



REGULATIONS 2017
CURRICULUM AND SYLLABI

B.TECH.
COMPUTER SCIENCE AND ENGINEERING
WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND
INTERNET OF THINGS
(IN ASSOCIATION WITH IBM)

VISION AND MISSION OF THE INSTITUTION

VISION

B.S. Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in Engineering, Science, Technology and Management and to play a vital role in the socio-Economic progress of the Country.

MISSION

- To blossom into an internationally renowned Institution
- To empower the youth through quality education and to provide professional leadership
- To achieve excellence in all its endeavors to face global challenges
- To provide excellent teaching and research ambience
- To network with global institutions of excellence, Business, Industry and Research Organizations
- To contribute to the knowledge base through scientific enquiry, Applied research and Innovation

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION AND MISSION

VISION

The vision of the Department of Computer Science and engineering is to impart quality education, inculcate professionalism and enhance the problem solving skills of the students in the domain of Computer Science and Engineering with a focus to make them industry ready, involve in possible areas of research, to pursue and have continual professional growth.

MISSION

- To equip the students with strong fundamental concepts, analytical capability, programming and problem solving skills.
- To create an academic environment conducive for higher learning through faculty training, self-learning, sound academic practices and research endeavors.
- To provide opportunities in order to promote organizational and leadership skills in students through various co-curricular and extra – curricular activities
- To make the students industry ready and to enhance their employability through training and internships.
- To improve department industry collaboration through interaction including participation in professional society activities, guest lecturers and industrial visit.

PROGRAMME EDUCATIONAL OBJECTIVES

- To introduce the fundamentals of science and engineering concepts essential for a computer engineer
- To inculcate the knowledge of mathematical foundations and algorithmic principles for effective problem solving
- To provide knowledge in computer science, modeling & design of computer based systems
- To impart knowledge to analyze, design, test and implement software required for various applications
- To hone personality skills, trigger social commitment and inculcate societal responsibilities.

PROGRAMME OUTCOMES

PO1: Analyse and build models applying the knowledge of mathematics, statistics, electronic, electrical and computer science discipline and solve the problem.

PO2: Identify the sources of information for data collection, design and conduct the experiments and interpret the result.

PO3: Think out-of-the box and solve the real time problems using their creativity in designing human friendly software systems.

PO4: Comprehend computer engineering concepts of the new research developments and apply them to develop relevant software and hardware products.

PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: Apply the computing knowledge to solve the socially relevant problems.

PO7: Understand the impact of engineering solutions in global, economic, environmental, societal context and apply it in exploring the new developments, research trends and involve them in research.

PO8: Develop professional integrity by understanding and appreciating professional, legal, ethical, cyber security and related issues and act with responsibility.

PO9: Communicate, collaborate and work as a team by involving in the group projects of multi-disciplinary nature.

PO10: To prepare documents as per the standards and present effectively to improve software documentation skills.

PO11: Apply the hardware and software project management techniques to estimate the time and human resources required to complete computer engineering projects.

PO12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes

PSO1: Understand, analyze and develop essential proficiency in the areas related to algorithms, system software, multimedia, web design, big data analytics, networking and apply the knowledge to solve practical problems.

PSO2: Apply standard practices and strategies in hardware and software project development using open-ended programming environments for successful career and entrepreneurship.

REGULATIONS - 2017
B.TECH. DEGREE PROGRAMMES

1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

- i) **"Programme"** means B.Tech. Degree Programme.
- ii) **"Branch"** means specialization or discipline of B.Tech. Degree Programme like Civil Engineering, Mechanical Engineering, etc.,
- iii) **"Course"** means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics, Computer Practice, etc.,
- iv) **"Institution"** means B.S.Abdur Rahman Crescent Institute of Science and Technology.
- v) **"Dean (Academic Affairs)"** means the Dean (Academic Affairs) of B.S.Abdur Rahman Crescent Institute of Science and Technology.
- vi) **"Dean (Student Affairs)"** means the Dean (Students Affairs) of B.S.Abdur Rahman Crescent Institute of Science and Technology.
- vii) **"Controller of Examinations"** means the Controller of Examination of B.S.Abdur Rahman Crescent Institute of Science and Technology who is responsible for conduct of examinations and declaration of results.

2.0 ADMISSION

2.1a) Candidates for admission to the first semester of the eight-semester B.Tech. degree programme shall be required to have passed the Higher Secondary Examination of the (10+2) curriculum (Academic stream) prescribed by the appropriate authority or any other examination of any university or authority accepted by the Institution as equivalent thereto.

2.1b) Candidates for admission to the third semester of the eight-semester B.Tech. programme under lateral entry scheme shall be required to have passed the Diploma examination in Engineering / Technology of the Department of Technical Education, Government of Tamil Nadu or any other examination of any other authority accepted by the Institution as equivalent thereto.

2.2 Notwithstanding the qualifying examination the candidate might have passed, the candidate shall also write an entrance examination prescribed by the Institution for admission. The entrance examination shall test the proficiency of the candidate in Mathematics, Physics and

Chemistry on the standards prescribed for Ten plus Two academic stream.

2.3 The eligibility criteria such as marks, number of attempts and physical fitness shall be as prescribed by the Institution from time to time.

3.0 BRANCHES OF STUDY

3.1 Regulations are applicable to the following B.Tech. degree programmes in various branches of Engineering and Technology, each distributed over eight semesters with two semesters per academic year.

B.TECH. DEGREE PROGRAMMES:

1. Aeronautical Engineering
2. Automobile Engineering
3. Civil Engineering
4. Computer Science and Engineering
5. Electrical and Electronics Engineering
6. Electronics and Communication Engineering
7. Electronics and Instrumentation Engineering
8. Information Technology
9. Manufacturing Engineering
10. Mechanical Engineering

12. Biotechnology
13. Cancer Biotechnology
14. Food Biotechnology

4.0 STRUCTURE OF THE PROGRAMME

4.1 Every Programme will have a curriculum with syllabi consisting of theory and practical courses such as,

- i) Basic Sciences (BS)
- ii) Humanities & Social Sciences (HS)
- iii) Management Sciences (MS)
- iv) Engineering Sciences Fundamentals (ESF)
- v) Engineering Core Courses (EC)

vi) Professional Electives (PE)

vii) General Electives (GE)

viii) Workshop practice, laboratory work, industrial training, seminar presentation, project work, etc.

4.2 Each course is normally assigned certain number of credits :

- one credit per lecture period per week
- one credit per tutorial period per week
- one credit for two to three periods and two credits for four periods of laboratory or practical sessions
- one credit for two periods of seminar / project work per week
- one credit for two weeks of industrial training.

4.3 Each semester curriculum shall normally have a blend of lecture courses, laboratory courses and laboratory integrated theory courses of total not exceeding 26 credits.

4.4 For the award of the degree, a student has to earn a minimum total credits specified in the curriculum of the relevant branch of study. The minimum credits to be earned will be between 174 and 180, depending on the program.

4.5 The medium of instruction, examinations and project report shall be in English, except for courses in languages other than English.

5.0 DURATION OF THE PROGRAMME

5.1 A student is ordinarily expected to complete the B.Tech. programme in eight semesters (six semesters in the case of lateral entry scheme), but in any case not more than 14 continuous semesters reckoned from the date of first admission (12 semesters in the case of lateral entry student).

5.2 Each semester shall consist of a minimum of 90 working days.

5.3 Semester end examination will normally follow within a week after the last working day of the semester.

6.0 CLASS ADVISOR AND FACULTY ADVISOR

6.1 CLASS ADVISOR

A faculty member will be nominated by the HOD as Class Advisor for the class throughout the period of study except first year.

The Class Advisor shall be responsible for maintaining the academic, curricular and co-curricular records of students of the class throughout their period of study.

However, for the first and second semester, the class advisors (First year class advisors) will be nominated by the first year coordinator.

6.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling, the Head of the Department of the students will attach a maximum of 20 students to a faculty member of the department who shall function as faculty advisor for the students throughout their period of study. Such faculty advisor shall guide the students in taking up the elective courses for registration and enrolment in every semester and also offer advice to the students on academic and related personal matters.

7.0 COURSE COMMITTEE

7.1 Each common theory course offered to more than one group of students shall have a —Course Committee comprising all the teachers teaching the common course with one of them nominated as course coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The Course Committee shall meet as often as possible and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the Course Committee may also prepare a common question paper for the test(s).

8.0 CLASS COMMITTEE

A class committee comprising faculty members handling the classes, student representatives and a senior faculty member not handling the courses as chairman will be constituted branch-wise and semester-wise

8.1 The composition of class committees for first and second semester will be as follows:

- i) The first year coordinator shall be the chairman of the class committee
- ii) Faculty members of all individual courses of first / second semester
- iii) Six student representatives (male and female) of each class nominated by the first year coordinator
- iv) The class advisor and faculty advisors of the class.

8.2 The composition of the class committee for each branch from 3rd to 8th semester will be as follows:

- i) One senior faculty member preferably not handling courses for the concerned semester, appointed as chairman by the Head of the Department
- ii) Faculty members of all courses of the semester
- iii) Six student representatives (male and female) of each class nominated by the Head of the Department in consultation with the relevant faculty advisors
- iv) All faculty advisors and the class advisors.
- v) Head of the Department

8.3 The class committee shall meet at least four times during the semester. The first meeting will be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment will be decided for the first and second assessment. The second meeting will be held within a week after the date of first assessment report, to review the students' performance and for follow up action. The third meeting will be held within a week after the second assessment report, to review the students' performance and for follow up action.

8.4 During these three meetings the student members representing the entire class, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process.

8.5 The fourth meeting of the class committee, excluding the student members, shall meet within 5 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator.

9.0 REGISTRATION AND ENROLMENT

9.1 Except for the first semester, every student shall register for the ensuing semester during a specified week before the semester end examination of the ongoing semester. Every student shall submit a completed registration form indicating the list of courses intended to be enrolled during the ensuing semester. Late registration with the approval of the Dean (Academic Affairs) along with a late fee will be permitted up to the last working day of the current

semester.

9.2 From the second year onwards, all students shall pay the prescribed fees for the year on a specific day at the beginning of the semester confirming the registered courses. Late enrolment along with a late fee will be permitted up to two weeks from the date of commencement of classes. If a student does not enroll, his/her name will be removed from rolls.

9.3 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

9.4 A student should have registered for all preceding semesters before registering for a particular semester.

10.0 COURSE CHANGE / WITHDRAWAL

10.1 CHANGE OF A COURSE

A student can change an enrolled course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

10.2 WITHDRAWAL FROM A COURSE

A student can withdraw from an enrolled course at any time before the first assessment for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

11.0 TEMPORARY BREAK OF STUDY FROM PROGRAMME

A student may be permitted by the Dean (Academic Affairs) to avail temporary break of study from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. A student can avail the break of study before the start of first assessment of the ongoing semester. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 5.1). If any student is debarred for want of attendance or suspended due to any act of indiscipline, it will not be considered as break of study. A student who has availed break of study has to rejoin in the same semester only.

12.0 CREDIT LIMIT FOR ENROLMENT & MOVEMENT TO HIGHER SEMESTER

12.1 A student can enroll for a maximum of 32 credits during a semester including Redo /Pre do

Courses

12.2 The minimum earned credit required to move to the higher semester shall be

- Not less than 20 credits, to move to the 3rd semester
- Not less than 40 credits, (20 for lateral entry) to move to the 5th semester
- Not less than 60 credits, (40 for lateral entry) to move to the 7th semester

13.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

13.1 Every theory course shall have a total of three assessments during a semester as given below:

Assessment No.	Course Coverage in Weeks	Duration	Weightage of Marks
Assessment 1	1 to 6	1.5 hours	25%
Assessment 2	7 to 12	1.5 hours	25%
Semester End Exam	Full course	3 hours	50%

13.2 Appearing for semester end theory examination for each course is mandatory and a student should secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

13.3 Every practical course will have 60% weightage for continuous assessments and 40% for semester end examination. However a student should have secured a minimum of 50% marks in the semester end practical examination.

13.4 For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory component and 25% for practical component. Grading shall be done for this consolidated mark. Assessment of theory component shall have a total of three assessments with two continuous assessments carrying 25% weightage each and semester end examination carrying 50% weightage. The student shall secure a separate minimum of 40% in the semester end theory examination. The evaluation of practical component shall be through continuous assessment.

13.5 The components of continuous assessment for theory/practical/laboratory integrated theory courses shall be finalized in the first class committee meeting.

13.6 In the case of Industrial training, the student shall submit a report, which will be evaluated along with an oral examination by a committee of faculty members, constituted by the Head of the Department. A progress report from the industry will also be taken into account for evaluation. The weightage for report shall be 60% and 40% for Viva Voce examination.

13.7 In the case of project work, a committee of faculty members constituted by the Head of the Department will carry out three periodic reviews. Based on the project report submitted by the student(s), an oral examination (viva-voce) will be conducted as the semester end examination, for which one external examiner, approved by the Controller of Examinations, will be included. The weightage for periodic review will be 50%. Of the remaining 50%, 20% will be for the project report and 30% for the Viva Voce examination.

13.8 Assessment of seminars and comprehension will be carried out by a committee of faculty members constituted by the Head of the Department.

13.9 For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance will be used for grading along with the marks scored in the arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination and the internal assessment marks secured during the course of study shall be ignored.

In case of laboratory integrated theory courses, after one regular and one arrear appearance, the internal mark of theory component is invalid and full weightage shall be assigned to the marks scored in the semester end examination for theory component. There shall be no arrear or improvement examination for lab component.

14.0 SUBSTITUTE EXAMINATIONS

14.1 A student who has missed, for genuine reasons, a maximum of one of the two continuous assessments of a course may be permitted to write a substitute examination paying the prescribed substitute examination fees. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc. by a committee constituted by the Dean of School for that purpose. However there is no Substitute Examination for Semester End examination.

14.2 A student who misses any continuous assessment test in a course shall apply for substitute exam in the prescribed form to the Head of the Department / Dean of School within a week

from the date of missed assessment test. However the Substitute Examination will be conducted after the last working day of the semester and before Semester End Examination.

15.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

- 15.1** A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds or representing the Institution in approved events etc.) to become eligible to appear for the semester-end examination in that course, failing which the student shall be awarded —III grade in that course. The cases in which the student is awarded —III grade, shall register and repeat the course when it is offered next.
- 15.2** The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in that course to the Class Advisor. The Class Advisor will consolidate and furnish the list of students who have earned less than 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department/ Dean of School. Thereupon, the Dean (Academic Affairs) shall announce the names of such students prevented from writing the semester end examination in each course.
- 15.3** A student who has obtained ‘_I’ grade in all the courses in a semester is not permitted to move to next higher semester. Such student shall repeat all the courses of the semester in the subsequent academic year.
- 15.4** A student should register to re-do a core course wherein —III or —WII grade is awarded. If the student is awarded, —III or —WII grade in an elective course either the same elective course may be repeated or a new elective course may be taken with the approval of Head of the Department / Dean of School.
- 15.5** A student who is awarded —UII grade in a course will have the option to either write the semester end arrear examination at the end of the subsequent semesters, or to redo the course in the evening when the course is offered by the department. Marks scored in the continuous assessment during the redo classes shall be considered for grading along with the marks scored in the semester-end (redo) examination. If any student obtained —UII grade in the redo course, the marks scored in the continuous assessment test (redo) for that course will be considered as internal mark for further appearance of arrear examination.

15.6 If a student with —Ull grade, who prefers to redo any particular course, fails to earn the minimum 75% attendance while doing that course, then he / she will not be permitted to write the semester end examination and his / her earlier —Ull grade and continuous assessment marks shall continue.

16.0 REDO COURSES

16.1 A student can register for a maximum of two redo courses per semester in the evening after regular college hours, if such courses are offered by the concerned department. Students may also opt to redo the courses offered during regular semesters.

16.2 The Head of the Department with the approval of Dean Academic Affairs may arrange for the conduct of a few courses during the evening, depending on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

16.3 The number of contact hours and the assessment procedure for any redo course will be the same as those during regular semesters except that there is no provision for any substitute examination and withdrawal from an evening redo course.

17.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

17.1 All assessments of a course will be made on absolute marks basis. However, the Class Committee without the student members shall meet within 5 days after the semester-end examination and analyze the performance of students in all assessments of a course and award letter grades. The letter grades and the corresponding grade points are as follows:

Letter Grade	Grade Points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	0
I	0
AB	0

"W" denotes withdrawal from the course.

"I" denotes inadequate attendance and hence prevention from semester- end examination

“U” denotes unsuccessful performance in the course.

“AB” denotes absence for the semester-end examination.

17.2 A student who earns a minimum of five grade points (‘E’ grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student for improvement of grade.

17.3 The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department/Dean of Schools and it shall be declared by the Controller of Examinations.

17.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester-end theory examination answer scripts of one or more courses, on payment of prescribed fee, through proper application to Controller of Examination. Subsequently the Head of the Department/ Dean of School offered the course shall constitute a revaluation committee consisting of Chairman of the Class Committee as Convener, the faculty member of the course and a senior member of faculty knowledgeable in that course. The committee shall meet within a week to revalue the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

17.5 After results are declared, grade sheets shall be issued to each student, which will contain the following details. The list of courses enrolled during the semester including redo courses, if any, and the grade scored, the Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards. GPA is the ratio of the sum of the products of the number of credits of courses registered and the grade points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester.

If C_i is the number of credits assigned for the i^{th} course and GPI is the Grade Point in the i^{th} course

$$GPA = \frac{\sum_{i=1}^n (C_i)(GPI)}{\sum_{i=1}^n C_i}$$

Where n = number of courses

The Cumulative Grade Point Average CGPA shall be calculated in a similar manner,

considering all the courses enrolled from first semester.

"I" and "W" grades will be excluded for calculating GPA .

"U", "I", "AB" and "W" grades will be excluded for calculating CGPA.

The formula for the conversion of CGPA to equivalent percentage of marks shall be as follows:

Percentage Equivalent of Marks = CGPA X 10

17.6 After successful completion of the programme, the Degree will be awarded with the following classifications based on CGPA.

Classification	CGPA
First Class with Distinction	8.50 and above and passing all the courses in first appearance and completing the programme within the Prescribed period of 8 semester for normal entry and 6 semesters for lateral entry
First Class	6.50 and above and completing the programme within a maximum of 10 semester for normal entry and 8 semesters for lateral entry
Second Class	Others

However, to be eligible for First Class with Distinction, a student should not have obtained U or I grade in any course during his/her study and should have completed the U.G. programme within a minimum period (except break of study). To be eligible for First Class, a student should have passed the examination in all the courses within the specified minimum number of semesters reckoned from his/her commencement of study. For this purpose, the authorized break of study will not be counted. The students who do not satisfy the above two conditions will be classified as second class. For the purpose of classification, the CGPA will be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

18.0 ELECTIVE CHOICE:

18.1 Apart from the various elective courses listed in the curriculum for each branch of specialization, the student can choose a maximum of two electives from any other specialization under any department, during the entire period of study, with the approval of the Head of the parent department and the Head of the other department offering the course.

18.2 ONLINE / SELF STUDY COURSES

Students are permitted to undergo department approved online/ self-study courses not exceeding a total of six credits with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean Academic Affairs during his/ her period of study. In case of credits earned through online mode ratified by the respective Board of Studies, the credits may be transferred following the due approval procedures. The students shall undergo self-study courses on their own with the mentoring of a member of the faculty. The online/ self-study courses can be considered in lieu of elective courses.

19.0 SUPPLEMENTARY EXAMINATION

Final Year students can apply for supplementary examination for a maximum of two courses thus providing an opportunity to complete their degree programme. Likewise students with less credits can also apply for supplementary examination for a maximum of two courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within three weeks of the declaration of results.

20.0 PERSONALITY AND CHARACTER DEVELOPMENT

20.1 All students shall enroll, on admission, in any of the personality and character development programmes, NCC / NSS / NSO / YRC / Rotaract and undergo practical training.

- **National Cadet Corps (NCC)** will have to undergo specified number of parades.
- **National Service Scheme (NSS)** will have social service activities in and around Chennai.
- **National Sports Organization (NSO)** will have sports, games, drills and physical exercises.
- **Youth Red Cross (YRC)** will have social service activities in and around Chennai.
- **Rotaract** will have social service activities in and around Chennai.

21.0 DISCIPLINE

21.1 Every student is required to observe disciplined and decorous behavior both inside and

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outside the campus and not to indulge in any activity which will tend to affect the prestige of the Institution.

21.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HOD / Dean will be referred to a Discipline and Welfare Committee nominated by the Vice-Chancellor, for taking appropriate action.

22.0 ELIGIBILITY FOR THE AWARD OF DEGREE

22.1 A student shall be declared to be eligible for the award of B.Tech. degree provided the student has:

- i) successfully completed all the required courses specified in the programme curriculum and earned the number of credits prescribed for the specialization, within a maximum period of 14 semester (12 semesters for lateral entry) from the date of admission, including break of study
- ii) no dues to the Institution, Library, Hostels
- iii) no disciplinary action pending against him/her.

22.2 The award of the degree must have been approved by the Institution.

23.0 POWER TO MODIFY

Notwithstanding all that has been stated above, the Academic Council has the right to modify the above regulations from time to time.

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

Vandalur, Chennai – 600048

**B.TECH. COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL
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Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 1181	Differential Calculus and Geometry	3	1	0	4
2.	HS	ENC 1181/ ISC 1181/ LNC 1181/ LNC 1182 / LNC 1183	English / Arabic / Mandarin / German / Japanese	3	0	0	3
3.	BS	PHC 1181	Physics	3	0	2	4
4.	BS	CHC 1181	Chemistry	3	0	2	4
5.	ESF	GEC 1101	Engineering Graphics	2	0	2	3
6.	ESF	GEC 1102	Engineering Design	2	0	0	2
7.	ESF	GEC 1103	Basic Engineering Practices Laboratory	0	0	2	1
8.	EC	CSC 1121	Software Foundation Programming Using C	1	0	2	2

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SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 1281	Advanced Calculus	3	1	0	4
2.	BS	-	Physics Elective	2	0	2	3
3.	BS	-	Chemistry Elective	2	0	2	3
4.	ESF	GEC 1211	Basic Engineering Mechanics	3	1	0	4

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5.	BS	GEC 1212	Environmental Studies	2	0	0	2
6.	EC	CSC 1211	Digital System	3	0	2	4
7.	EC	CSC 1212	Python Programming	2	0	0	2
8.	EC	CSC 1221	Software Foundation (Advanced) Course with C++ Programming	1	0	2	2

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SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 2181	Partial Differential Equations and Transforms	3	1	0	4
2.	HS	-	Humanities Elective I	2	0	0	2
3.	HS	ENC 2181	Oral Communication	0	0	2	1
4.	EC	CSC 2101	Data Structures	3	1	0	4
5.	EC	CSC 2102	Computer Networks	3	0	2	4
6.	EC	CSC 2103	Software Engineering	3	0	0	3
7.	EC	CSC 2105	Data structures Lab	0	0	2	1
8.	EC	CSC 2121	Essentials of Object Oriented Programming using Java	3	0	0	3
9.	EC	CSC 2122	Industry session: Analytics in Enterprises	0	0	2	1

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SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	-	Mathematics Elective I	3	1	0	4
2.	HS	-	Humanities Elective II	2	0	0	2

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3.	HS	ENC 2282	Written Communication	0	0	2	1
4.	EC	CSC 2211	Computer architecture and microprocessor	3	0	0	3
5.	EC	CSC 2212	Analysis of Algorithms	3	1	0	4
6.	EC	CSC 2213	Network Security and Cryptography	3	0	0	3
7.	EC	CSC 2216	Security Lab	0	0	2	1
8.	EC	CSC 2221	Information management Basics with DB2	2	0	0	2
9.	EC	CSC 2222	Information management Basics with DB2 Lab	0	0	2	1
10.	EC	CSC 2223	Business analytics and Cognos Insight	3	0	0	3

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SEMESTER V

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	MS	MSC 3181 MSC 3182	CEO and Leadership Training / Social Entrepreneurship	3	0	0	3
2.	GE	-	General Elective I	3	0	0	3
3.	HS	ENC 3181	Communication & soft skill - I	0	0	2	1
4.	EC	CSC 3101	Operating Systems	3	0	0	3
5.	EC	CSC 3102	Web Development using JAVA	3	0	0	3
6.	EC	CSC 3103	Artificial Intelligence and Machine Learning	3	0	0	3
7.	EC	CSC 3104	Web Development Lab	0	0	2	1
8.	EC	CSC 3122	Business Intelligence	3	0	0	3
9.	EC	CSC 3123	IBM Design Thinking, Agile Software Development And Devops	3	0	0	3

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SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	EF	MSC 3181 MSC 3182	CEO and Leadership Training / Social Entrepreneurship	3	0	0	3
2.	BS	-	Mathematics Elective II	2	0	0	2
3.	HS	ENC 3281	Communication and soft skill - II	0	0	2	1
4.	EC	CSC 3212	Distributed Computing	3	0	0	3
5.	EC	CSC 3213	Graph Theory and Application	3	1	0	4
6.	EC	CSC 3214	Big Data Analytics Tools Lab	0	0	2	1
7	EC	CSC 3221	Foundation course in Big data Analytics	3	0	0	3
8	EC	CSC 3222	Industry session	0	0	2	1
9	EC	CSC 3223	Enterprise Mobile Application Development & Deployment using IBM Worklight	3	0	0	3
10	EC	CSC 3225	Cognitive Analytics	3	0	0	3

24**SEMESTER VII**

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	GE	-	General Elective II	3	0	0	3
2.	EC	CSC 4101	Software project management	3	0	0	3
3.	EC	CSC 4102	Compiler Design	3	0	0	3
4.	EC	CSC 4104	Compiler Lab	0	0	2	1
5.	EC	CSC 4105	Internship				1

B.Tech.	Computer Science and Engineering with specialization in Artificial Intelligence and Internet Of Things	Regulations 2017
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6.	PE		Program Elective					3*
7.	EC	CSC 4121	Applications Development & Deployment Using IBM BlueMix	3	0	2	4	
8.	EC	CSC 4122	Advance course Programming in Big data	3	0	0	3	
9.	EC	CSC 4123	Advance course Programming in Internet of things	3	0	0	3	

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SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	EC	CSC 4211	Project Work	0	0	24	12	12

Total credits – 177

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

ELECTIVE LIST

SEMESTER VII

Programme Elective

(3)

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CSC X143	Deep Learning	2	0	2	3
2.	PE	CSC X144	Intrusion Detection and Prevention	3	0	0	3
3.	PE	CSC X145	Security Law and Compliance	2	0	0	2
4.	PE	CSC X146	Software Design patterns	1	0	0	1
5.	PE	CSC X147	Writing skills for engineering leaders	1	0	0	1

B.Tech.	Computer Science and Engineering with specialization in Artificial Intelligence and Internet Of Things			Regulations 2017			
6.	PE	CSC X148	Software Reliability	2	0	0	2
7.	PE	CSC X149	AAIP – Animation with Portfolio Development	2	0	2	3
8.	PE	CSC X150	Advanced SAS: Macros & SQL	2	0	0	2
9.	PE	CSC X151	Advanced Programming in Data Science with Python	3	0	0	3

*** - Student has to take either 3 Credit or 2+1 Credits**

Physics Elective Courses
(To be offered in II Semester)

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

Chemistry Elective Courses
(To be offered in II Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	CHCX01	Analytical Instrumentation	2	0	2	3
2.	CHCX02	Corrosion and its Control	2	0	2	3
3.	CHCX03	Electrical Materials and Batteries	2	0	2	3
4.	CHCX04	Engineering Materials	2	0	2	3
5.	CHCX05	Fuels and Combustion	2	0	2	3

6.	CHCX06	Fundamentals of Physical Chemistry	2	0	2	3
7.	CHCX07	Green Technology	2	0	2	3
8.	CHCX08	Organic Chemistry of Biomolecules	2	0	2	3
9.	CHCX09	Polymer Science and Technology	2	0	2	3

Maths Elective Courses
(To be offered in IV Semester)

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

Maths Elective Courses
(To be offered in VI Semester)

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

Humanities Elective I
(to be offered in III Semester)

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

Humanities Elective II
(to be offered in IV Semester)

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

General Elective
Group I Courses
(To be offered in V semester)

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

**Group II Courses
(To be offered in VII semester)**

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

SEMESTER I

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

OBJECTIVES:

The aims of this course are to

- Introduce eigen values and eigenvectors of matrix algebra.
- Make the student knowledgeable in the area of Three Dimensional Analytical Geometry.
- Demonstrate the application of Differential Calculus.
- Familiarize the student with the functions of several variables.
- Develop the use of ODE solvable techniques necessary for engineering applications.
- Motivate the students with some basic engineering application problems in ODE.

MODULE I	MATRICES	8+2
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Characteristic Equation- Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem (without proof) – Orthogonal matrices – orthogonal transformations of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

MODULE II	THREE DIMENSIONAL ANALYTICAL GEOMETRY	7+3
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Direction cosines and ratios – angle between two lines – equations of a plane – equations of a straight line, coplanar lines - shortest distance between skew lines - sphere – tangent plane – plane section of a sphere – orthogonal spheres.

MODULE III	DIFFERENTIAL GEOMETRY	7+3
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Curvature – Cartesian and polar coordinates – centre and radius of curvature – circle of curvature – involutes and evolutes – envelopes.

MODULE IV	DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES	8+2
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Functions of two variables – partial derivatives – total differential – Implicit Functions – Jacobian - Taylor's series expansion – Optima of two variables – Lagrange's multiplier method.

MODULE V	ORDINARY DIFFERENTIAL EQUATIONS	8+2
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Linear equations of second order with constant and variable coefficients – Simultaneous first order linear equations with constant coefficients – homogeneous equations of Euler's type – method of undetermined coefficients, method of variation of parameters

MODULE VI APPLICATIONS OF ORDINARY DIFFERENTIAL 7+3
EQUATIONS

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

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

- After completing the course, student will be able to:
- Understand the matrix techniques and compute eigenvalues and eigenvectors of a given matrix.
- Do the problems based on the three dimensional analytic geometry.
- Apply differential calculus in engineering problems.
- Differentiate more than one variable and their applications.
- Solve the differential equations with constant coefficient and variable coefficient.
- Form and solve differential equations.

ENC 1181	ENGLISH	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I **8**

L: Listening for general information

S : Self Introduction, Introducing one another.

R: Predicting the content

W: Paragraph Writing

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

MODULE II **8**

L: Listening for specific information (from dialogues)

S:Exchanging opinion.

R: Skimming technical Passages

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

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

MODULE III **7**

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

S: Making Presentations using visuals.

R : Scanning short texts for gist of information

W: Letter of Invitation, Expository Writing

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

MODULE IV**7**

L: Understanding prepared presentation techniques through videos
S: Short Presentations.
R: Reading for coherence and cohesion
W: Letter seeking permission for Industrial Visit
Language Focus: S-V agreement, Euphemism

MODULE V**8**

L : Understanding Non- Verbal Communications while listening to narration of incidents.
S: Narrating an experience
R: Inferential Reading
W: Process Description – Transcoding a Flow chart.
Language Focus: Interchange of Active & passive voice, Impersonal Passive voice.

MODULE VI**7**

L: Learning Story telling techniques (stories & visuals) through audio files
S: Discussion in groups
R: Reading for critical appreciation
W: Developing an idea, Slogan writing, Interpreting a Bar Chart.
Language Focus: If clause and phrasal verbs.

TOTAL HOURS :45**REFERENCES:**

1. Carol Rosenblun perry(2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.
2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in Communication Skills. Cambridge Univesity Press, India.
3. Kala, Abdul & Arun Tiwari (2004) . Wings of Fire : An Autobiography(Simplified and Abridged by Mukul Chowdhri). Hyderabad Univeristy Press.
4. Sen, Leena. (2004) Communication Skills. Prentice Hall, New Delhi.
5. Matt Firth, Chris Sowton et.al. (2012). Academic English: An Integrated Skills Course for EAP. Cambridge University Press, Cambridge.

OUTCOMES:

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

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

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

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

LNC1181	MANDARIN	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I **8**

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

MODULE II **8**

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

MODULE III **7**

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

MODULE IV **7**

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

MODULE V **8**

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

MODULE VI **7**

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

TOTAL HOURS :45

TEXT BOOKS:

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

OUTCOMES:

On completion of the course, students will be able to

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

LNC1182	GERMAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I **8**

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

MODULE II **8**

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

MODULE III **7**

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

MODULE IV **7**

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

MODULE V **8**

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

MODULE VI **7**

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

TOTAL HOURS :45

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

On completion of the course, students will be able to

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

LNC1183	JAPANESE	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I **7**

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

MODULE II **8**

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

MODULE III **7**

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

MODULE IV **8**

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

MODULE V **7**

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

MODULE VI **8**

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

TOTAL HOURS :45**REFERENCES:**

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

OUTCOMES:

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

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

PHC 1181**PHYSICS****L T P C****3 0 2 4****OBJECTIVES:**

To make students conversant with the

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

MODULE I CRYSTAL PHYSICS**8**

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

MODULE II ULTRASONICS AND THERMAL PHYSICS**8**

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

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

MODULE III APPLIED OPTICS**8**

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

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

MODULE IV FIBRE OPTICS 7

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

MODULE V QUANTUM MECHANICS 7

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

MODULE VI RENEWABLE ENERGY SOURCES 7

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

PRACTICALS

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

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES :

1. Gaur R.K. and Gupta S.L., "Engineering Physics", 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2013.
2. Palanisamy P.K., Physics for Engineers, Vol1 & Vol2, 2nd Edition, Scitech Publications, 2003.
3. Serway R.A. and Jewett, J.W. "Physics for Scientists and Engineers with Modern Physics". Brooks/cole Publishing Co., 2010.
4. Tipler P.A. and Mosca, G.P., "Physics for Scientists and Engineers with Modern Physics", W.H. Freeman, 2007.
5. Markert J.T., Ohanian. H. and Ohanian, M. "Physics for Engineers and Scientists". W.W. Norton & Co. 2007.
6. Godfrey Boyle, "Renewable Energy: Power for sustainable future", 2nd Edition, Oxford University Press, UK, 2009.

OUTCOMES:

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

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

CHC1181**CHEMISTRY****L T P C****3 0 2 4****OBJECTIVES:**

The students should be conversant with

- The basic problems like hardness, alkalinity, dissolved oxygen associated with the water used for domestic and industrial purpose and treatment process involved.
- The synthesis, properties and applications of nanomaterials.
- The importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean and their limitations.
- The basic analytical techniques like uv-visible, ft-ir, nmr, aas, aes, circular dichroism and xrd etc.
- Photochemistry concepts related to physical processes and chemical reactions induced by photon absorption and their applications.
- Basic principles of electrochemistry, cell construction and evaluation and to understand general methodologies for construction & design of electrochemical cell

MODULE I WATER TECHNOLOGY**9**

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

MODULE II NANOCHEMISTRY**6**

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

MODULE III ENERGY SOURCES**8**

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

MODULE IV PHOTOCHEMISTRY**7**

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

MODULE V ANALYTICAL TECHNIQUES**7**

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

MODULE VI ELECTROCHEMISTRY**8**

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

PRACTICALS

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

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

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

OUTCOMES:

The students will be able to

- Solve problems related to hardness, alkalinity, dissolved oxygen associated with the water and describe the treatment processes.
- Classify nanomaterials and apply the nanochemistry approach to synthesize the nanomaterials.
- Explain the principle and enumerate the advantages and disadvantages of various renewable energy sources.
- State the principle and illustrate the instrumentation of various analytical techniques.
- Apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- Construct a electrochemical cell and describe the various types of electrodes and Determine the fluoride content.

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

OBJECTIVES:

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

MODULE I BASICS AND ENGINEERING CURVES 10

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

Conic sections: ellipse, parabola, hyperbola.

Special curves: cycloid, epicycloid, hypocycloid and involutes.

MODULE II ORTHOGRAPHIC PROJECTION 8

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

MODULE III PROJECTION OF STRAIGHT LINES AND PLANES 10

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

Projection of plane lamina in first quadrant and its traces

MODULE IV PROJECTION OF SOLIDS 10

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

MODULE V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12

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

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

MODULE VI PICTORIAL PROJECTIONS 10

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

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

L – 30; P – 30; TOTAL HOURS – 60

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

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

OBJECTIVES:

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

MODULE I DESIGN AS A CENTRAL ACTIVITY IN 08
ENGINEERING

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

MODULE II NEED ANALYSIS AND CONCEPT DEVELOPMENT 07

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

MODULE III CASE STUDIES IN ENGINEERING DESIGN 08

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

MODULE IV INNOVATION AND DESIGN 07

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

TOTAL HOURS – 30

REFERENCES:

1. Clive L. Dym and David C. Brown, "Engineering Design: Representation and Reasoning", 2nd Edition, Cambridge University Press, New Delhi, 2011.
2. Daniel G. Dorner, G. E. Gorman and Philip J. Calvert, "Information Needs Analysis: Principles and practice in information organizations", Published by Faced Publishing, London. 2015.
3. Cliff Matthews, "Case Studies in Engineering Design", John Wiley & Sons Pvt. Ltd, New York, 1998.
4. Bengt-Arne Vedin, "The Design-Inspired Innovation Workbook", World Scientific, 2011.
5. Navi Radjou, Jaideep Prabhu and Simone Ahuja, "Jugaad Innovation", Published by Random House India, 2012.

OUTCOMES:

The students will be able to

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

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

OBJECTIVES:

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

CIVIL ENGINEERING PRACTICE

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

MECHANICAL ENGINEERING PRACTICE

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

ELECTRICAL ENGINEERING PRACTICE

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

ELECTRONICS ENGINEERING PRACTICE

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

TOTAL HOURS – 30

OUTCOMES:

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

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

CSC 1121	SOFTWARE FOUNDATION PROGRAMMING USING C	L	T	P	C
		1	0	2	2

OBJECTIVES :

- To teach the audience relating to console based application development.
- To provide conceptual and foundational knowledge of the Fundamentals of technologies in the context of software and programming.
- To focus on history and the current topics of IT Industry including various components and practices followed with major focus on Software
- To give training on C Concepts.
- To introduce background of LINUX environment.
- To learn the features of PHP.

MODULE I INTRODUCTION TO C PROGRAMMING 10

Brief History of Computing Art and Science of Programming Introduction to C Programming -Background of C, Getting Started with C, Constructs, Loops & Arrays, Functions, Pointers, User Defined Types, Binary I/O With Structures, Appendix, Reference Tables.

MODULE II INTRODUCTION TO OPEN STANDARDS ,LINUX & PHP 05

Open Standard: Open Standards Model, Industries needing standards, The Impact of Standards, Open Source Software, Open Source, Open Source Technology, the OPEN Proposition.

Linux: Background of Linux, Why is Linux so popular, what can you do with Linux, Linux Distributions, Linux Technology Center, Future of Linux. PHP: PHP – Key Driver of LAMP Stack, Getting Started with PHP, Unified ODBC.

PHP Data Objects, PHP Deployment Platform, What is Zend Core, Features and Benefits, Zend and IBM, What is Ruby, What is Rails.

L – 15; P-30; TOTAL HOURS - 45

LIST OF EXPERIMENTS:

Session 1: Basics - simple example programs

Session 2: Data Types and Constants; Variables, Identifier and Declarations; Operators and Expressions

Session 3: Arrays, More about Declarations (Incl. Initialization), Functions

Session 4: Assignment, Increment and Decrement Operators; Character I/O; Strings

Session 5: C Preprocessor

Session 6: Pointers, Strings

Session 7: Array/Pointer Equivalence, Memory Allocation, More About Strings

REFERENCES:

1. Paul J. Deitel, Deitel & Associates, "C How to Program", 8th Edition, Pearson, Education, ISBN No: 0134227026, 2015.
2. Gary Mitnick, "Linux: Linux Terminal Including Basic Functionalities and CLI", CreateSpace Independent Publishing Platform, ISBN No : 1539940454,2016.
3. David Sklar," Learning PHP: A Gentle introduction to the Web most popular language",O'Reilly Publications, ISBN No: 1491933585,2016.

OUTCOMES :

Students who complete this course will be able to

- Explain conceptual and practical knowledge of the fundamentals of technologies in the context of building enterprise web based application.
- Sow a seed for a conceptual understanding of software and computing practices of current generation.
- Develop simple real time applications using the programming constructs and algorithms.
- Provide hands on experience with open source technologies.
- Write programs on the current problem scenario and make use of latest technology to solve the problem.
- Describe the basics of Linux and PHP concepts.

SEMESTER II

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

OBJECTIVES:

The aims of this course are to

- Train the students in solving problems using multiple integration.
- Provide knowledge in using special functions to find out the area and volume of a region.
- Acquire knowledge in tangent and normal vectors.
- Gain knowledge in finding the areas of a curve and surface using vector integration.
- Learn about the analytic functions and their properties along with bilinear transformation.
- Know complex integration using cauchy's theorems.

MODULE I MULTIPLE INTEGRATION AND ITS APPLICATIONS 8+2

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

MODULE II TRANSFORMATION OF COORDINATES AND SPECIAL FUNCTIONS 7+3

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

MODULE III VECTOR DIFFERENTIATION 7+3

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

MODULE IV VECTOR INTEGRATION 8+2

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

OUTCOMES:

After completing the course, student will be able to

- Compute the area and volume using multiple integrals.
- Apply special functions to solve integration problems.
- Apply differentiation in scalar and vector fields.
- Find area and volume of a region using vector integration.
- Verify analyticity, conformity and bilinearity of complex functions.
- Evaluate complex integrals.

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

OBJECTIVES:

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

MODULE I VECTOR APPROACH TO MECHANICS 07

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

MODULE II EQUILIBRIUM OF PARTICLE 06

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

MODULE III EQUILIBRIUM OF RIGID BODY 06

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

MODULE IV PROPERTIES OF SURFACES 08

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

MODULE V FRICTION 08

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

MODULE VI LAWS OF MOTION 10

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

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

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

OUTCOMES:

On completion of this course students should be able

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

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

OBJECTIVES:

The student will be conversant with the

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

MODULE I NATURAL RESOURCES 8

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

MODULE II ECOSYSTEM AND BIODIVERSITY 8

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

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

MODULE III ENVIRONMENTAL POLLUTION AND NATURAL DISASTER 8

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

MODULE IV HUMAN POPULATION, HEALTH AND SOCIAL ISSUES 6

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

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

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

Case studies related to current situation

TOTAL HOURS – 30

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

The student will be able to

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

CSC 1211**DIGITAL SYSTEM**

L	T	P	C
3	0	2	4

OBJECTIVES :

- Expose Boolean algebra, Boolean functions and realization of functions with basic gates.
- To design combinational and sequential circuits.
- To implement the K-map method for logical operation.
- To use the concepts of state and state transition for analysis and design of sequential circuits.
- Use the functionality of flip-flops for analysis and design of sequential circuits
- To learn Hardware Design language programming for Digital Systems.

MODULE I**BOOLEAN ALGEBRA AND LOGIC GATES****07**

Review of Binary Number Systems - Binary Arithmetic - Binary Codes - Boolean Algebra and Theorems -.Boolean functions- Canonical and Standard forms - Logic operations- Digital Logic Gates.

MODULE II**GATE-LEVEL MINIMIZATION****08**

The K-Map method-Two variable-Three variable-Four Variable -Product of sums simplification - Don't care conditions- NAND and NOR implementation - Other two level implementation – Exclusive OR function - Hardware Description Language .

MODULE III**COMBINATIONAL LOGIC****08**

Combinational circuits - Analysis and Design procedures -Adder, Subtractor, - Decimal adder – Binary Multiplier - Magnitude Comparators -Encoder -Decoder -, Multiplexer - Demultiplexer - HDL models of combinational circuits.

MODULE IV**SYNCHRONOUS SEQUENTIAL LOGIC****08**

Sequential Circuits - Latches and Flip Flops - Analysis of clocked sequential circuits- - Synthesizable HDL models of Sequential circuits – State Table, State Reduction Diagram and State Assignment – Design Procedure.

MODULE V REGISTERS, COUNTERS, MEMORIES 06

Registers-Shift Registers -Ripple Counters - Synchronous Counters-Other Counters-HDL for Registers and Counters – Memory - Programmable Logic Array- Programmable Array Logic- Sequential Programmable Devices.

MODULE VI DESIGN AT THE REGISTER TRANSFER LEVEL 08

Introduction-Register Transfer Level Notation-Register transfer level in HDL-ASMs-Sequential Binary multiplier-Control Logic-HDL description of Binary Multiplier-Design with Multiplexers.

L-45 ; P-30 TOTAL HOURS-75

REFERENCES :

1. M. Morris Mano and Michael D.Ciletti, "Digital Design with an introduction to the Verilog HDL", Pearson Education, Fifth Edition, ISBN-13: 978-0-13-277420-8, 2012.
2. Charles H.Roth, Jr., Kinney," Fundamentals of Logic Design", Brooks Publications, Seventh Edition, ISBN-13 :978 -1-133-62848-4,2013.
3. Donald D.Givone, "Digital Principles and Design", Tata McGraw-Hill, Third Edition, ISBN 0072525037, 2003.

OUTCOMES :

Students who complete this course will be able to

- Define different number systems, binary addition and subtraction, 2's complement representation and its operations.
- Demonstrate the use of Karnaugh map and perform an algorithmic reduction of logic functions.
- Define the following combinational circuits: buses, encoders/decoders, (de)multiplexers, exclusive-ORs, comparators, arithmetic-logic units; and to build simple applications.
- Evaluate the concepts of state and state transition for analysis and design of sequential circuits.
- Design and develop simple projects Using flip flops after state machine analysis.
- Expose the basics of Hardware Design language to design digital circuits.

CSC 1212**PYTHON PROGRAMMING**

L	T	P	C
2	0	0	2

OBJECTIVES :

- To Learn simple data types, and expressions.
- To learn the control structures of Python programming.
- To know the scope of the variables used in functions.
- To Write large programs in Python, with modules.
- To learn objects, classes, and other object-oriented features
- To study the different types of inheritance concepts.

MODULE I INTRODUCTION TO PYTHON 10

Basic Elements of Python – Object, Expression and Numeric Types – Variables and Assignments – Data types - Input statements – Input Statements – Branching Programs – Looping Programs.

MODULE II FUNCTIONS AND STRUCTURES 10

Functions and Scoping – Function Definitions – Keyword Arguments and Default values – Scoping – Specifications – Recursion –Global Variables – Modules – Tuples – Lists – Dictionaries.

MODULE III CLASSES AND OBJECTS 10

Abstract Data Types – Classes – Inheritance – Multiple level of Inheritance – Substitution Principles – Encapsulation and Information Hiding.

L-30;**TOTAL HOURS - 30****REFERENCES :**

1. John V. Guttag, "Introduction to Computation and Programming Using Python: With Application to Understanding Data", 2nd Edition, MIT Press, ISBN: 978-0262529624, 2016.
2. Bill Lubanovic, "Introducing Python: Modern Computing in Simple Package", O'Reilly Media, 1st Edition , ISBN: 9781449359362, 2014.
3. Pratik Desai , "Python Programming for Arduino", 1st edition, Packt publishing, ISBN:9781783285938, 2015.

OUTCOMES :

Students who complete this course will be able to

- Identify the elements of python and the different types of data.
- Write loops and decision statements in Python.
- Explore Python code structure, including the use of functions.
- Implement lists, tuples, and dictionaries in Python programs.
- Design object-oriented programs with Python classes.
- Use class inheritance in Python for reusability.

CSC 1221	SOFTWARE FOUNDATION (ADVANCED)	L	T	P	C
	COURSE WITH C++ PROGRAMMING	1	0	2	2

OBJECTIVES:

- To grasp the difference between object oriented programming and procedural programming.
- To learn the basic concepts of object oriented programming.
- To program using more advanced C++ features.
- To build C++ classes using appropriate encapsulation and design principles.
- To apply object oriented programming and non - object oriented techniques to solve bigger computing problems.
- To develop good programming and problem solving skills.

MODULE I INTRODUCTION 6

Introduction to C++ - C Vs C++ - Basic concepts of OOPS - History & Features of C++ - C++ Program - Variable declaration - Data Types. C++ Keywords - Operators - Control Statement - Loop Statement - Break , Continue & Goto Statement - C++ Functions - Call by value , amp; reference - Recursion - C++ Storage -Classes - C++ Arrays - Array to Function - Multidimensional Arrays.

MODULE II OBJECT ORIENTED PROGRAMMING CONCEPTS 9

C++ Object Class - Constructor - Destructor - C++ this Pointer - C++ static – Structure - Enumeration - Friend Function Inheritance - Aggregation - Polymorphism - Overloading - Overriding. C++ Virtual Function - Abstraction - Interfaces - Data Abstraction - Namespaces - Strings -. C++ Exceptions - Exception Handling - try/catch. C++ User-Defined - C++ File & Stream.

LIST OF EXPERIMENTS: 30

1. To print the Fibonacci series without using recursion and using recursion.
2. To generate the prime number between 10 and 100.
3. To check the palindrome number.
4. To print the factorial of each number for a given input number. (eg : Input 5 , Output as 1,2,6,24,120,720)

5. To print a Armstrong number between 100 to 500.
6. To print sum of the digits.
7. To reverse the given number.
8. To swap the two numbers without using third variable.
9. To print the multiplication of 2 matrices.
10. To convert the decimal number to binary.
11. To print the alphabet triangle.
12. To print the number triangle.
13. To generate the Fibonacci triangle.
14. To convert the number in characters.

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Eleanor Joyce, "C Plus Plus Essentials", CreateSpace Independent Publishing Platform, First Edition, ISBN: 9781540385956, 2016.
2. Bjarne Stroustrup, "Programming: Principles and Practice Using C++" Pearson Education, 2nd Edition, ISBN-13: 978-0321-99278-99, 2014.
3. Harry.H.Chaudary," The C++ Programming Language:: Brain Wash Style", CreateSpace Publishing , First Edition , ISBN 13:978-1500329976, 2014.

OUTCOMES:

Students who complete this course will be able to

- Distinguish the concepts of object oriented programming and procedural oriented language.
- Recognize the concepts of object oriented programming.
- Analyze the working of the programming constructs, functions, and I/O.
- Identify the various concepts like inheritance, overloading, exception handling.
- Implement programs involving various OOPs concepts.
- Apply the OOPs concepts for solving different real world problems.

SEMESTER III**CSC 2101****DATA STRUCTURES**

L	T	P	C
3	1	0	4

OBJECTIVES :

- To assess how the choice of data structures impacts the performance of programs
- To design and implementation of various basic and advanced data structures
- To expose the different types of searching and sorting algorithms.
- To employ the different data structures to find the solutions for specific problems.
- To improve the logical ability
- To develop application using data structures.

MODULE I OVERVIEW , ARRAYS, RECORDS AND POINTERS**08**

Introduction – Basic Terminology- Data Structures – Algorithms – Linear Arrays – Representation of linear arrays in Memory – Traversing linear arrays – Insertion and deletion – Sorting – Searching – Multidimensional arrays – Pointers - Records

MODULE II LINKED LIST**08**

Linked list – Representation of linked list in Memory – Traversing a Linked List – Searching a Linked List – Memory allocation – Insertion into a Linked list – Deletion from a Linked List – Header Linked Lists – Two- ways Lists

MODULE III STACKS, QUEUES AND RECURSION**07**

Stacks – Array Representation of Stacks-Linked Representation of Stacks – Arithmetic Expressions – Quick sort , an application of stacks – Recursion – Towers of Hanoi – Implementation of Recursive procedures by Stacks – Queues – Linked representation of Queues – Dequeues – Priority Queues

MODULE IV TREES**08**

Binary Trees – Representing Binary Trees in Memory – Traversing Binary Trees – Traversal algorithm using Stacks – Header nodes ; Threads – Binary Search Trees searching and inserting in Binary Search Trees –Deleting in a Binary Search Trees - AVL Search Trees – Insertion in an AVL Search Trees – Deletion in an AVL Search Trees – m-way search trees – B trees – Heap; Heap sort – Path Length; Huffman's Algorithms – General Trees

MODULE V GRAPHS AND THEIR APPLICATIONS**07**

Graph Theory Terminology – Sequential Representation of Graphs – Warshall's Algorithm –Linked Representation of a Graph – Operations on a Graph – Traversing a Graph – Posets ; Topological Sorting

MODULE VI SORTING AND SEARCHING**07**

Sorting – Insertion Sort – Selection Sort – Merging – Merge Sort – Radix Sort – Searching and Data modification – Hashing

L-45 ; T-15 TOTAL HOURS-60**REFERENCES :**

1. Seymour Lipschutz, "Data Structures", McGraw Hill Education, Revised First edition, ISBN-10: 1259029964, ISBN-13: 978-1259029967, 2014
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", CareerMonk Publications, Fifth Edition, ISBN-10: 819324527X, ISBN-13: 978-8193245279, 2016.
3. Reema Thareja, "Data Structures Using C", Oxford Publisher, Second Edition, ISBN-10: 0198099304, ISBN-13: 978-0198099307, 2014
4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education; Second edition, ISBN-10: 9332535841, ISBN-13: 978-9332535848, 2014.

OUTCOMES:

Students who complete this course will be able to

- Examine a given problem and recommend suitable data structure.
- Implement operations on arrays, linked lists, stacks and queues.
- Design, implement, test, and debug programs using a variety of data structures including binary and general tree structures, search trees, heaps, graphs, and B-trees.
- Compare between different data structures and pick an appropriate data structure for a design situation.
- Employ Algorithm for solving problems like sorting, searching, insertion and deletion of data.
- Apply concepts learned in various domains like DBMS, compiler construction etc.

CSC 2102	COMPUTER NETWORKS	L	T	P	C
		3	0	2	4

OBJECTIVES :

- To study the networked system organization and architecture, current practices and recent trends
- To lay the foundation on emerging network and data communication technologies and their potential impact
- To provide knowledge on socket programming using TCP and UDP.
- To explore the modern network architectures from a design and performance perspective.
- To understand and design the mobile and wireless network protocols.
- To identify various network parameters to increase QoS for multimedia networks.

MODULE I INTRODUCTION TO COMPUTER NETWORKS 07

Need for Networking - Service Description -Connectionless and Connection-oriented Services - Circuit and Packet Switching - Physical Media - Wireless Links and Characteristics - Queuing Delay and Packet Loss - Internet Protocol stack - OSI Reference Model - Service Models.

MODULE II APPLICATION LAYER 07

Principles of Network Applications - The Web and HTTP - FTP - Electronic Mail - SMTP - DNS - Peer-to-Peer Applications.

MODULE III TRANSPORT LAYER 08

Transport Layer Services - Multiplexing and Demultiplexing - UDP – Principles of Reliable Data Transfer - Connection-oriented Transport: TCP – Principles of Congestion Control - TCP congestion control mechanism – Socket Programming with TCP and UDP - Implementation of transport layer protocols using open source network simulators.

MODULE IV NETWORK LAYER AND LINK LAYER 09

Forwarding and Routing - Network Service Models - Virtual Circuit and Datagram Networks - Router - Internet Protocol (IP) - Routing algorithms - Implementation of network layer protocols using open source network simulators - Layer Services - Error Detection and Correction Techniques - Multiple Access Protocols - Switched Local Area Networks - Link Virtualization - Data Center Networking.

MODULE V WIRELESS AND MOBILE NETWORKS 07

Wireless Links and Network Characteristics - WiFi: 802.11 Wireless LAN - Cellular Internet Access - Mobility Management: Principles - Mobile IP - Wireless and Mobility: Impact on Higher-Layer Protocols - Implementation of mobile routing protocols using open source network simulators.

MODULE VI MULTIMEDIA NETWORKING**07**

Multimedia Networking Applications - Voice-over-IP - Protocols for Real-Time Interactive Applications - Network Support for Multimedia.

L – 45; P-30; TOTAL HOURS-75**REFERENCES :**

1. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 7th Edition, Pearson Education, ISBN: 9780133594140, 2017.
2. Larry Peterson and Bruce S Davis "Computer Networks: A System Approach" Elsevier, 5th Edition, ISBN: 978-0123850591, 2012.
3. Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols, and Architecture" 6th Edition, PHI, ISBN: 9780136085300, 2014.
4. Behrouz A. Forouzan, "Data Communications and Networking", McGraw-Hill Education, 5th Edition , illustrated, ISBN : 9780073376226, 2012.

OUTCOMES:

Students who complete this course will be able to

- Compare and contrast the OSI reference model and TCP/IP model.
- Examine the various application layer protocols and propose the solutions based on the need.
- Review the protocols, network interfaces, and performance issues in local area networks and wide area networks.
- Identify different congestion control techniques and critique upon them.
- Design and implement the routing and transport protocols for Wireless and Mobile networks.
- Analyze and interpret the effect of QoS Parameters in the multimedia networks.

CSC 2103**SOFTWARE ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES :

- To introduce the process involved in developing software.
- To guide the importance of requirements gathering.
- To represent the requirements collected using the various design models
- To provide knowledge in developing a software in a systematic method with quality.
- To explore the various testing methodologies.
- To understand how to improve performance of a software product.

MODULE I SOFTWARE PROCESS 07

Nature of Software – Software Engineering - Software Process – Models – Generic Process Model – Process Assessment - Prescriptive Process Model – Specialized Process Models – Unified Process – Personal and Team Process Models – Process Technology – Product and Process – Agile Model.

MODULE II REQUIREMENTS GATHERING 08

Requirements Engineering – Understanding Requirements – Requirements Modeling – Scenarios, Information and Analysis Classes, Flow, Behavior, Patterns and Web Apps.

MODULE III DESIGN 09

Introduction – Design Process – Design Concepts – Design Model – Software Architecture –Component Based Development: Introduction – User Interface Design – Pattern Based Design – WebApp Design.

MODULE IV QUALITY MANAGEMENT 07

Software Quality – Achieving Software Quality – Review Techniques – SQA Goals and Metrics – Software Reliability.

MODULE V SOFTWARE TESTING 07

Software Testing – Strategic Approach – Issues – Test Strategies – Validation Testing – System Testing – Debugging – Testing Fundamentals: Path Testing, White Box and Black Box, Control Structure – Testing Applications.

MODULE VI MAINTENANCE 07

Software Maintenance – Supportability – Reengineering – Software Reengineering – Reverse Engineering – Restructuring – Forward Engineering – Risk Management.

L – 45; TOTAL HOURS-45

REFERENCES :

1. Roger S. Pressman, "Software Engineering – A Practitioners Approach", Mc Graw Hill, Eighth Edition, ISBN -13: 9789339212087, 2014.
2. Ian Sommerville, "Software Engineering", Addison-Wesley, 9th Edition, ISBN-13: 978-0137035151, 2010.
3. Jibitesh Mishra, Ashok Mohanty, "Software Engineering", Pearson Education, ISBN 978-81-317-5869-4, 2012.

OUTCOMES :

Students who complete this course will be able to

- Choose the appropriate process model for the software application to be developed.
- Collect requirements based on the type of the application and its need.
- Design frameworks for the application to be developed.
- Ensure that the software satisfies the quality standards.
- Apply the appropriate testing strategies to the developed products.
- Modify and improve the deployed product based on user needs and performance results.

CSC 2105**DATA STRUCTURES LAB**

L	T	P	C
0	0	2	1

OBJECTIVES :

- To make familiar with the data structure concepts.
- To design real time problems and find the way to implement the solution.
- To implement the Stack and Queue ADT.
- To traverse the tree and graph data structures.
- To implement searching and sorting techniques.
- To demonstrate the shortest path algorithm.

SOFTWARE REQUIRED : C/C++/JAVA

Design problems and implement solutions for the following concepts:

1. Basic data structure concepts
2. Linked list
3. Stack ADT and Queue ADT
4. Priority Queue
5. Sorting and Searching
6. Tree traversal
7. Tree Structure - Binary tree, AVL tree
8. Graph traversal
9. Huffman Algorithm
10. Shortest path algorithm

P-15;**TOTAL HOURS-15****OUTCOMES :**

Students who complete this course will be able to

- Identify the data structure to provide a solution for the given problem.
- use object oriented concepts to solve the complex problems.
- apply Stack and Queue ADT.
- develop and implement the algorithm for the application.
- analyze the problem and identify the appropriate solution for it.
- implement linear and non-linear data structure concepts through programming.

CSC 2121	ESSENTIALS OF OBJECT ORIENTED PROGRAMMING USING JAVA	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To introduce the concept of web applications and platforms.
- To understand the concept of Classes and Methods.
- To explore the inheritance and interface concepts.
- To impart the importance of exception handling in a code.
- To learn the roles of swings and applets in user interface.
- To introduce the markup language to design web pages along with Servlet concepts.

MODULE I INTRODUCTION 07

History of Java – Java Architecture -- JVM – JRE – JVM –Java Development Environment -- Data types –Variables – Arrays – Operators – Control Statements – Looping Statements –Type Conversion -- Simple Java Program -- Object Oriented Programming Concepts – Objects – Classes – Methods.

MODULE II CONSTRUCTORS, OVERLOADING, INHERITANCE 08

Constructors – Constructors – Default Constructor – Parameterized Constructors – Constructor with Default Argument — Overloading – Overriding – Inheritance – Single Inheritance – Hybrid Inheritance – Multilevel Inheritance – Hierarchical Inheritance – Access Specifier.

MODULE III PACKAGES, INTERFACE & ABSTRACTION 09

Packages – Defining – Creating – Importing and Accessing Packages –Keywords – This – Super – Final –Interface – Implementing Interface – Class vs Interface – Abstraction – Implementing Abstraction -- Abstraction vs Interface.

MODULE IV STRINGS, EXCEPTION HANDLING 07

Introduction – Design Process – Design Concepts – Design Model – Software Architecture –Component Based Development: Introduction – User Interface Design – Pattern Based Design – WebApp Design.

MODULE V APPLETS, SWINGS, THREAD 07

Multi-threading -- Lifecycle – Creating threads –Thread Priorities – Synchronizing Threads – Multitasking – Multithreading vs Multitasking – Thread Priorities – Thread Groups –Events – Event Listeners –Event Handling – Mouse Event – Keyboard Event – Applets—Life Cycle –Introduction to Swings – Buttons – Labels –Scrollbar –Radio Button -- Layout Manager Types – Border – Grid –Flow --Card and Grid Bag.

MODULE VI HTML, JSP, SERVLET, SQL, JDBC CONNECTIVITY 07

Introduction to HTML – Tags – Forms – Post – Get –Introduction to JSP –Scripting Elements –Custom Tags – Directive Elements – Model View Controller in JSP -- Introduction to SQL – DDL – DML Commands --Introduction to Servlet – Life Cycle – Request – Response –Filters -- JDBC Connectivity – Validations -- Sample Web Application Project.

L – 45; TOTAL HOURS – 45

REFERENCES :

1. J.Nino and F.A. Hosch , “An Introduction to programming and OO design using Java”, John Wiley & Sons, 3rd Edition, ISBN: 8126523530, 2009.
2. Timothy Budd, “An Introduction to Object Oriented Programming”, Pearson Education, 3rd Edition, ISBN: ISBN-10: 0201760312, 2008.
3. Y. Daniel Liang, “Introduction to Java Programming”, Pearson Education, 10th Edition, ISBN-10: 0133761312, 2017.
4. Richard A. Johnson, “An introduction to Java Programming and Object Oriented Application Development, - Thomson Course Technology, 3rd Edition, ISBN: 9780619217464, 2007.
5. Herbet Schildt, “Java Complete Reference”, McGraw Hill Professional, 9th Edition, ISBN: 978-0071808552, 2014.
6. Balaguruswamy, “Programming with Java – A Primer”, Tata McGraw Hill, 3rd Edition, ISBN: 9789351343219, 2014,

OUTCOMES :

Students who complete this course will be able to

- Write a flexible code that would run on any platform.
- Incorporate the various inheritance methodologies according to the problem.
- Include the various packages based on the need of an application.
- Handle run time errors caused by exceptions.
- Apply the applet and swing concepts in web page design.
- Integrate the web with enterprise backend systems using servlet concepts.

SEMESTER IV

CSC 2211	COMPUTER ARCHITECTURE AND MICRO PROCESSOR	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To conceptualize the basics of organizational and architectural issues of a digital computer
- To develop an in-depth understanding of the operation of Central processing unit and ILP.
- Impart the knowledge about Control unit and the ideas about parallel organization.
- Provide the essentials of the processors and Develop assembly level programs using 8085.
- To understand fundamental architecture of 16 bit and 32 bit microprocessors.
- To offer a necessary ideas on microcontroller.

MODULE I BASIC STRUCTURE OF COMPUTERS 07

Basics – Computer evolution and performance – Computer functions and interconnections – Computer Arithmetic - The Arithmetic and Logic Unit - Integer Representation - Integer Arithmetic - Floating-Point Representation - Floating-Point Arithmetic.

MODULE II PROCESSOR STRUCTURE AND FUNCTION 08

Processor Structure and Function - Processor Organization - Register Organization - Instruction Cycle - Instruction Pipelining - The x86 Processor Family.

MODULE III CONTROL UNIT 07

Control Unit Operation - Micro-operations - Control of the Processor - Hardwired Implementation - Micro programmed Control - Basic Concepts - Microinstruction Sequencing -Microinstruction Execution.

MODULE IV MEMORY AND I/O 08

Cache Memory - Computer Memory System Overview - Cache Memory Principles - Elements of Cache Design - Internal Memory - External Memory - Input/Output - External Devices - I/O Modules - Programmed I/O - Interrupt-Driven I/O - Direct Memory Access.

MODULE V 8085 ARCHITECTURE 07

Microprocessor based systems hardware and interfacing – Programming 8085 – Interfacing peripherals – PPI (8255).

MODULE VI 8086 ARCHITECTURE 08

Basics of 8086 – Instruction set of 8086 – Assembler Directives –Interrupt systems – Classification – Interrupts of 8086 – PIC (8259).

L – 45; TOTAL HOURS-45

REFERENCES :

1. William Stallings, "Computer Organization and Architecture - Designing for Performance", 10th Edition, Pearson Education, ISBN-13: 978013410613, 2015.
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer organization", 5th Edition, McGraw Hill, ISBN 13:9781259005275, 2002.
3. John Kennessy and David Patterson, "Computer Architecture", 5th edition, ISBN: 9780123838728, 2011.
4. Ramesh Goankar, "Microprocessor architecture, programming and applications with 8085", 6th edition, Penram International Publishing, ISBN: 978-8187972884, 2013.
5. Mathur Sunil, "Microprocessor 8086: Architecture, Programming and Interfacing", PHI, ISBN: 9788120340879, 2012.
6. Kenneth J Ayala," The 8051 micro controller", 3rd edition, Cengage Learning, ISBN: 9781401861582, 2010.

OUTCOMES :

Students who complete this course will be able to

- Clarify the essentials of the working of the computing units and trace the operation.
- Demonstrate the working of central processing unit.
- Illustrate the computer architectures and design issues and tradeoffs.
- Bring out the design of microprocessors / microcontrollers-based systems.
- Write an assembly language code to program a microprocessor system.
- Elucidate the microcontroller basics and showcase its applications.

CSC 2212	ANALYSIS OF ALGORITHMS	L	T	P	C
		3	1	0	4

OBJECTIVES :

- To learn the asymptotic performance of algorithms.
- To synthesize efficient algorithms in common engineering design situations.
- To familiar with good principles of algorithm design.
- To understand different algorithmic design strategies.
- To know the limitations of Algorithm Power.
- To define the classes P and NP and explain the significance of NP-completeness.

MODULE I FUNDAMENTALS OF ANALYSIS OF ALGORITHM 08

Algorithm - Fundamentals of Algorithmic Problem Solving – Important Problem Types - Fundamental Data Structures – Analysis Framework –Asymptotic Notations and Basic Efficiency Classes –Mathematical Analysis of Recursive and Non-Recursive Algorithms- Empirical Analysis of Algorithm-Algorithm Visualization.

MODULE II BRUTE FORCE AND DECREASE AND CONQUER 08

Selection Sort and Bubble Sort – Sequential Search and Brute Force String matching – Closest pair and Convex Hull Problems by Brute Force – Exhaustive Search – Depth First Search and Breadth First Search – Insertion Sort – Topological Sorting – Algorithms for Generating Combinatorial Objects – Decrease by a Constant Factor Algorithms – Variable Size Decrease Algorithms.

MODULE III DIVIDE AND CONQUER AND TRANSFORM AND CONQUER 08

Merge Sort – Quick Sort - Binary Tree Traversals and Related Properties – Multiplication of Large Integers and Strassen's Matrix Multiplication – The Closest Pair and Convex Hull Problems by Divide and Conquer – Presorting – Gaussian Elimination – Balanced Search Trees – Heaps and Heap Sort – Horner's Rule and Binary Exponentiation – Problem Reduction.

MODULE IV DYNAMIC PROGRAMMING AND COMPUTATIONAL COMPLEXITY 07

Sorting by Counting – Input Enhancement in String Matching – Hashing – B-Trees – Knapsack Problems and Memory Functions – Optimal Binary Search Trees – Warshall's and Floyd's Algorithm.

MODULE V GREEDY TECHNIQUE AND ITERATIVE IMPROVEMENT 07

Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm – Huffman Trees and Codes – The Simplex Method – The Maximum Flow Problem – Maximum Matching in Bipartite

Graphs.

MODULE VI COPING WITH THE LIMITATIONS OF ALGORITHM POWER**07**

Lower Bound Arguments – Decision Trees – P, NP and NP Complete Problems – Challenges of Numerical Algorithms – Backtracking – Branch and Bound – Approximation Algorithms for NP Hard Problems – Algorithms for Solving Non Linear Equations.

L-45 ; T-15; TOTAL HOURS-60**REFERENCES :**

1. Anany Levitin, "The Design and Analysis of Algorithms", Pearson Education Limited, Third Edition, ISBN 10:0-273-76411-X, ISBN 13:978-0-273-76411-3, 2012.
2. Rajesh K. Shukla, "Analysis and Design of Algorithms", Wiley India Private Limited, ISBN : 978-81-265-5477-5, ISBN:978-81-265-8214-3, 2015.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, Third Edition, ISBN: 978-0-262-03384-8, ISBN: 978-0-262-53305-8, 2009.
4. Sahni Horowitz, "Fundamentals of Computer Algorithms, University Press, ISBN-10:8173716129, ISBN-13:978-8173716126, 2008.

OUTCOMES:

Students who complete this course will be able to

- Analyze best case, average case and worst-case running times of algorithms using asymptotic analysis.
- Apply design principles and concepts to algorithm design.
- Identify and analyze criteria and specifications appropriate to new problems, and choose the appropriate algorithmic design technique for their solution.
- Have the mathematical foundation in analysis of algorithms.
- Develop new data structures by augmenting existing data structures and design algorithms that employ data structures.
- Design algorithms using the Divide-and-Conquer, Dynamic Programming strategy and recite algorithms that employ this strategy.

CSC 2213	NETWORK SECURITY AND CRYPTOGRAPHY	L	T	P	C
		3	0	0	3

OBJECTIVES :

- Provide deeper understanding into cryptography, its application to network security, threats/vulnerabilities to networks and countermeasures.
- Cram the various approaches to Encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes.
- Acquainted with Digital Signature Standard and provide solutions for their issues.
- Familiar with cryptographic techniques for secure (confidential) communication of two parties over an insecure (public) channel
- Introduce the remote User Authentication Principle, symmetric and asymmetric encryption
- Focuses on the practical applications that have been implemented and are in use to provide email and web security.

MODULE I INTRODUCTION TO COMPUTER AND NETWORK SECURITY 07

Computer and Network Security concepts – The OSI Security Architecture – Security attacks – Security Services – Security Mechanisms – Fundamental Security Design Principles – Attack surfaces and Attack Trees – Introduction to Number Theory – Divisibility and the Division Algorithm – The Euclidean Algorithm – Modular Arithmetic Prime Numbers – Fermat's and Euler's Theorem – The Chinese Remainder Theorem

MODULE II SYMMETRIC CIPHERS 07

Classical Encryption Techniques – Symmetric Cipher Model – Substitution Techniques – Transposition Techniques – Rotor Machines – Steganography – Block Ciphers and Data Encryption Standard – Traditional Block Cipher Structure – The Data Encryption Standard – DES Example – Strength of DES – Block Cipher Design Principles-Advanced Encryption Standard – Block Cipher Operation – Multiple Encryption and Triple DES – Electronic Code book – Cipher Block Chaining Mode – Cipher Feedback Mode 0 Output Feedback Mode – Counter Mode

MODULE III ASYMMETRIC CIPHERS 07

Public- Key Cryptography and RSA – Principles of Public Key Cryptosystem – RSA Algorithm – Diffie-Hellman Key Exchange – Elliptic Curve Arithmetic – Elliptic Curve Cryptography – Pseudo Random Generation

MODULE IV CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS 08

Cryptographic Hash Functions – Applications of Cryptographic Hash functions – Simple Hash Functions – Requirements and Security – Hash Functions Based on Cipher Block Chaining – Secure Hash Algorithm (SHA) – Message Authentication Codes – Message Authentication Requirements – Message Authentication Functions – Security of MACs-HMAC – MACs Based on Block Ciphers : DAA and CMAC – Digital Signatures –

Elgamal, Schnorr , NIST, Elliptic, RSA-PSS Digital Signature.

MODULE V MUTUAL TRUST 07

Key Management and distribution – Symmetric Key Distribution using Symmetric Distribution – Public Key infrastructure – User authentication – Remote User Authentication Principle – Kerberos – Remote User Authentication using symmetric and Asymmetric Encryption

MODULE VI NETWORK AND INTERNET SECURITY 09

Network Access Control and Cloud Security – Transport Kevel Security – Wireless Network Security – Electronic Mail Security - IP Security

L-45 ; TOTAL HOURS-45

REFERENCES :

1. Williams Stallings, "Cryptography and Network Security: Principles and Practice ", Pearson Education, 7th Edition, ISBN: 10:1-292-15858-1, 2016.
2. Manuel Mogollon, "Cryptography and Security Services: Mechanisms and Applications ", Cybertech Publishing, 1st Edition, ISBN-13: 978-1599048376, 2008.
3. Mike Speciner, Radia Perlman , "Network Security: Private Communications in a Public World", , Pearson Education, 2nd Edition, ISBN: 0-13-046019-2, 2002.
4. Christof Paar; Bart Preneel; Jan Pelzl, "Understanding Cryptography : a Textbook for Students and Practitioners", Springer, e-ISBN: 978-3-642-04101-3, 2014

OUTCOMES :

Students who complete this course will be able to

- Impart knowledge on Encryption techniques, Design Principles and Modes of Operation.
- Design a security solution for a given application
- Devise the Key Management techniques and Number Theory.
- Create an understanding of Authentication functions the manner in which Message Authentication Codes and Hash Functions works.
- Examine the issues and structure of Authentication Service and Electronic Mail Security
- Provide familiarity in Intrusion detection and Firewall Design Principles.

CSC 2216**SECURITY LAB****L T P C**
0 0 2 1**OBJECTIVES :**

- To study and implement simple security algorithm
- To understand the concept of public key encryption, its implementation and real time applications
- To know the symmetric algorithms, and its real time applications
- To identify the various applications of cryptography and security issues practically
- To analyze the different security parameters by installing the security tool kits
- To familiar with S/MIME for e-mail communication

SOFTWARE REQUIRED : C/C++/JAVA

1. Implement the Substitution and Transposition Techniques
2. Implement DES
3. Implement RSA and Diffie Hellman Algorithm
4. Implement MD5 and SHA
5. Implement Digital Signature Standard
6. Install JCRYPT tool (or any other equivalent). Demonstrate Symmetric and Asymmetric cryptographic algorithm, hash and digital signatures
7. Demonstrate Intrusion Detection System (IDS) using any tool using SNORT (or any other equivalent)
8. Demonstrate secure data storage, secure data transmission and create Digital Signatures GnuPG(or any other equivalent)
9. Configure SSH (Secure Shell) and send/receive a file on this connection to verify the correctness of this system using the configured parameters.
10. Install Rootkits and study the variety of options
11. Generate password hashes with OpenSSL.
12. Configuring S/MIME for e-mail communication

13. Using IPTABLES on Linux and setting the filtering rules
14. Understanding the buffer overflow and format string attacks
15. Setup a Honey pot and monitor the honey pot on network using KF Sensor (or any other equivalent)
16. Configure a firewall to block the following for 5 minutes and verify the correctness of this system using the configured parameters: (a) Two neighborhood IP addresses on your LAN (b) All ICMP requests (c) All TCP SYN Packets

P-15; TOTAL HOURS-15

OUTCOMES :

Students who complete this course will be able to

- Implement Symmetric and asymmetric algorithms
- Install the different security toolkits and analyze various parameters
- Demonstrate Intrusion Detection System and Digital signatures using tool kits
- Generate password hashes with security toolkits
- Monitor flow of information in the network and look for vulnerability
- Configure the firewall to block the system and verify the correctness of the system

REFERENCES :

1. Jan L.Harrington, "Relational Database Design and Implementation", Elsevier publishing, Fourth Edition, ISBN: 978-012 8043998, 2016.
2. Yan Li, "Handbook of Research on Innovative Database Query Processing Techniques", Idea Group, 1st Edition , ISBN: 9781466687677, 2015.
3. Saeed k.Rahimi, Frank S.Haug , "Distributed Database Management Systems: A Practical Approach", John Wiley publishing, 1st edition, ISBN:9780470407455, 2015.

OUTCOMES :

Students who complete this course will be able to

- Apply the fundamental concepts of a relational database management system.
- Illustrate the design strategies, query processing techniques and algorithms for advanced databases.
- Explore the perception of RDBMS & Query Languages.
- Analyze the concepts of data Modeling and design of relational database.
- Write complex queries to solve the real world problems.
- Assess the database techniques for designing intelligent information retrieval system for any application.

CSC 2222	INFORMATION MANAGEMENT BASICS WITH DB2 LAB	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To provide the basic understanding of database installation.
- To create, update and query the data in the databases.
- To access and manipulate data using data models.
- To familiarize advanced import, export and load utilities.
- To give basics of information management concepts.
- To establish database connectivity and perform the imported data.

List of exercises:

1. Install Data Base and Planning.
2. Implement Data Models.
3. Implement Fundamental Information Management Concepts.
4. Demonstrate on Relational Data base design concepts.
5. Demonstrate on Import, Export and Load utilities.
6. Demonstrate on db2move Utility.
7. Case studies on Importance of Information Management in Modern Enterprises.

P-15;**TOTAL HOURS- 15****OUTCOMES :**

Students who complete this course will be able to

- Illustrate the basic concept of database installation.
- Implement the concept of RDBMS& Query Languages.
- Demonstrate the concepts of Data Modeling and Design of Relational Database.
- Design and develop programs in relational database.
- Analyze Information Management in Modern Enterprises.
- Build applications using DB2.

CSC 2223	BUSINESS ANALYTICS AND COGNOS INSIGHT	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explore the concept and regular terminologies of Business Analytics.
- To provide the knowledge in importing and restructuring data in workspace.
- To focus on the basics Of Data Visualizations in Cognos Insight
- To identify the benefits of Sharing Workspace in connected Analytics Environment.
- To explore the various Charts in IBM Cognos Insight.
- To show the various data sets in business analytics and usage of data in IBM Cognos Insight Workspace.

MODULE I INTRODUCTION TO IBM COGNOS INSIGHT 07

Business Analytics: Descriptive, Predictive, Prescriptive Analytics- Importance of using Business Analytics in modern Enterprises -What is IBM Cognos Insight -Why to use IBM Cognos Insight-Exploring IBM Cognos Insight.

MODULE II IMPORTING & RESTRUCTURING DATA INTO COGNOS INSIGHT 08

Working with Data sets in Cognos Insight-Understanding Data Dimensions, Measures and Cube-Importing and Analyzing Data from various sources- Restructuring Data in a Workspace.

MODULE III DATA VISUALIZATIONS IN COGNOS INSIGHT 07

Objectives of Data Visualizations-Working with Effective Chart Types-Importance of Data Visualizations in Modern Business.

MODULE IV CONSTRUCTING A WORKSPACE IN COGNOS INSIGHT & FORMATTING & ENTERING DATA IN IT 08

Understanding Workspace in IBM Cognos Insight and how to work on the same by importing various data sets; Various Data Types to work with in Analytics; Usage of Numeric & Alphanumeric Data in IBM Cognos Insight Workspace.

MODULE V SHARING A COGNOS INSIGHT WORKSPACE 07

Objectives of Sharing Workspace in IBM Cognos Insight-Publishing of Workspace in IBM Cognos Insight-Importance of Sharing Workspace in connected Analytics Environment.

MODULE VI CASE STUDY 08

Navigate and Explore Data in IBM Cognos Insight - Guided Import of Data from a File and Spreadsheet- Exploring Charts in IBM Cognos Insight- Design a compelling Workspace- Publishing Workspace- Exporting Data to Microsoft Excel-Printing Data End to End Workshop using IBM Cognos Insight.

L – 45; TOTAL HOURS – 45**REFERENCES :**

1. Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R. Anderson, "Essentials of Business Analytics", Cengage Learning, 2nd Edition, ISBN-13: 978-1-305-62773-4, 2016.
2. Khalid Mehmood Awan, "IBM Cognos BI v10.2 Administration Essentials", Packt Publishing Ltd, First Edition, ISBN 978-1-78217-178-2, 2014.
3. Dan Volitich, Gerard Ruppert, "IBM Cognos Business Intelligence 10: The Official Guide", Mc Graw Hill, Eighth Edition, ISBN -13: 978007177593, 2012.

OUTCOMES :

Students who complete this course will be able to

- Analyze the Business Analytics in modern Enterprises.
- Summarize the Importance of Data Visualizations in Cognos Insight.
- Apply the personal analytics tool IBM Cognos Insight to analyze data from a variety of sources.
- Assess the sharing the Workspace in IBM Cognos Insight.
- Compare the various data types to work with in Business analytics and usage of data in IBM Cognos Insight Workspace.
- Develop the applications using Excel and Cognos TM1 Web.

SEMESTER V

CSC 3101	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To know the objectives, functions and architecture of operating systems.
- To understand process management concepts.
- To study the functions of process concurrency and synchronization .
- To provide knowledge about how the memory management is done with the help of operating systems.
- To learn the techniques for managing the I/O devices.
- To illustrate techniques for managing the files.

MODULE I OVERVIEW OF OPERATING SYSTEMS 08

Operating Systems Objectives and Functions - Evolution of the Operating systems - Operating System Structures.

MODULE II PROCESS MANAGEMENT & SCHEDULING 08

Process Life cycle - Process control - Threads - Multi Threads - Scheduling criteria - Types of scheduling - Scheduling Algorithms.

MODULE III PROCESS SYNCHRONIZATION 07

Concurrent process - Principles of Concurrency - IPC - Semaphores – Deadlock - Deadlock Prevention, Avoidance, Detection and recovery.

MODULE IV MEMORY MANAGEMENT 07

Introduction - Partitions - Paging - Segmentation - Segmentation and paging - Need for virtual memory management - Demand Paging - Page fault and page replacement policies.

MODULE V I/O MANAGEMENT 07

Organization of I/O functions - Evolution of I/O Functions - Logical Structure of I/O functions - I/O Buffering and Blocking

MODULE VI DISK SCHEDULING 08

Disk I/O - Disk Scheduling algorithms - File Management: Principles - File management Techniques - File directories - File System Architecture - File allocation.

L – 45; TOTAL HOURS-45**REFERENCES :**

1. Abraham Silberschatz, Peter B galvin , Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley & Sons Inc, 2013, ISBN:978-1-118- 06333-0.
2. Deitel H M, "Operating Systems", 3rd Edition, Pearson education India, New Delhi, ISBN : 978-0-536-21215-3, 2007.
3. Dhamdhare D M, "Operating Systems", 1st reprint, Tata McGraw Hill, New Delhi, 2006, ISBN 978–0–07–295769–3.

OUTCOMES :

Students who complete this course will be able to

- State the functioning of operating systems.
- Compare the performance of various process scheduling algorithms.
- Evaluate the implementation of processes and problems related to process synchronization.
- Analyze resources like memory , I/O devices can be managed.
- Discuss the features of various file management techniques.
- Interpret the mechanisms adopted for disk scheduling algorithms

CSC 3102	WEB DEVELOPMENT USING JAVA	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To understand the importance of the web as a medium of communication.
- To learn the language of the web: XHTML and CSS.
- To become familiar with graphic design principles that relate to web design.
- To know the principles of creating an effective web page.
- To develop skills in analyzing the usability of a web site.
- To become familiar with popular search engine.

MODULE I INTRODUCTION 08

Declaring Variables - Programming in Java - Operator and control structures- Functions - Packages and Interfaces - Exception Handling. Java I/O streaming - Filter and pipe streams - Byte Code interpretation - Threading -Swing - Internet and web Trends.

MODULE II XHTML & CSS 07

XHTML Introduction- Body and Text basics- List basics – Text Formatting-Hyperlink-CSS Overview- Configuring Color with embedded style sheet - Configuring Text-Centering XHTML elements with CSS.

MODULE III WEB DESIGN 08

Website Organization & Navigation – Design Principles- Web Page Design – Page layout Design Techniques – Text Design – Graphics Design.

MODULE IV WEBSITE DEVELOPMENT 08

Server side programming - Servlets - Java Server Pages - JDBC - Development Process- Domain name overview – Web Hosting – Choosing Virtual Host.

MODULE V WEB MULTIMEDIA & INTERACTIVITY 07

Helper Applications – Multimedia file types – Using Sound on a Web Page – Using Video on Web Page – podcasting overview – Adobe flash in web page- Java in web page.

MODULE VI WEB PROMOTION 07

Search Engine Overview – Popular Search Engine – Components of Search Engine – Designing pages for Web promotion – Social Media Organization – Case Study: Car loan, Interior Design.

L-45; TOTAL HOURS-45

REFERENCES :

1. Herbert Schildt,"JAVA: The Complete Reference", McGraw Hill Education Pvt Ltd, 9th Edition, ISBN: 9780071808569, 2014.
2. Terry Felke, Morris,"Web Development and Design Foundations with HTML5", Pearson Publication, Eighth Edition, ISBN: 9780134323589, 2016.
3. Sandeep Kumar Patel,"Developing Responsive Web Applications with AJAX and jQuery", Packt publishing, 1st edition, ISBN: 978-1-78328-637-9, 2014.
4. AchyutGodbole, AtulKahate, "Web Technologies: TCP/IP, Web/Java Programming, and Cloud Computing", McGraw Hill Education Pvt Ltd, Third edition, ISBN: 978129062681, 2013.
5. Alex Belotserkovskiy, Stephen Kaufman, Nikhil Sachdeva, "Building Web Services with Microsoft Azure", Packt publishing, first edition, ISBN: 978-1-78439-8, 2015.
6. Jennifer T. Campbell, "Web Design: Introductory", Shelly Cashman Series, 5th Edition, ISBN: 978-1285170626, 2017.

OUTCOMES :

Students who complete this course will be able to

- Use fundamental skills to maintain web server services required to host a website.
- Design and develop basic web pages using XHTML and CSS.
- Select and apply markup languages for processing, identifying, and presenting of information in web pages.
- Apply scripting languages and web services to transfer data and add interactive components to web pages.
- Create and manipulate web media objects using editing software.
- Design websites using appropriate security principles, focusing specifically on the vulnerabilities inherent in common web implementations.

MODULE V MACHINE LEARNING MODELS 8

Statistical learning framework model – unsupervised learning – PAC learning – a more general learning model – uniform convergence for learnability – non uniform learnability – structural risk minimization – run time of learning.

MODULE VI ADVANCED LEARNING MODELS 5

Online learning – realizable and unrealizable case – clustering – generative models – Feature selection and generation – feature selection – feature manipulation and normalization – feature learning.

L - 45; TOTAL HOURS-45

REFERENCES :

1. Nils J. Nilsson, "Principles of Artificial Intelligence", 1 st Edition, Morgan Kauffman publishers, ISBN: 1483295869 2014.

Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, ISBN 9780262028189, 2014.

Shai Shalev - Shwartz, Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, ISBN 9781107057135, 2014.

OUTCOMES :

Students who complete this course will be able to

- Identify the production systems and the search strategies.
- Acquire knowledge on the representation and reasoning techniques.
- Have an exposure on machine learning problems and applications.
- Examine the learning applications for machine learning
- Examine the installation of machine learning tools and its packages.
- Address the types of learning based on machine learning tools.

CSC 3104**WEB DEVELOPMENT LAB**

L	T	P	C
0	0	2	1

OBJECTIVES :

- To develop a web application using java technologies.
- To discover the language of the web: XHTML and CSS.
- To become familiar with graphic design principles that relate to web design.
- To know the principles of creating an effective web page.
- To expand skills in analyzing the usability of a web site.
- To become familiar with web application and development careers.

SOFTWARE REQUIRED :

Basic tools : Java JDK 1.6 and above ,AJAX ,MySQL ,Dream Weaver, Apache Server

LIST OF EXPERIMENTS:

1. Applications form for B.E/B.TECH Admission using Java.
2. Study of Layout Controls.
3. Color Palette Applications.
4. Webpage Design using Image Mapping.
5. Webpage Design Using Style sheet.
6. Designing and Validating Bio-Data using HTML Script.
7. JDBC Connectivity.
8. Invoking HTML forms by Servlets.
9. Servlet with JDBC Connectivity.
10. Employee Payroll System using Java Servlet

P-15; TOTAL HOURS-15**OUTCOMES :**

Students who complete this course will be able to

- Define modern protocols and systems used on the Web such as HTML.
- Apply client-server internet approaches to web design and implementation.
- Design and implement interactive web sites.
- Apply scripting languages and web services to transfer data and add interactive

components to web pages

- Justify and explain particular internet application concepts, relevant alternatives and decision recommendations, including design considerations for internet security.
- Conceptualize and plan an internet-based business that applies appropriate business models and web technologies.

CSC 3122**BUSINESS INTELLIGENCE**

L	T	P	C
3	0	0	3

OBJECTIVES :

- To learn modeling, provisioning, and visualization for cross sectional data.
- To explore the features of Cognos BI, reusable metadata, report issue and crosstab reports.
- To elaborate organization's operations and performance.
- To learn Cognos BI administration and Security in Cognos BI.
- To introduce the concept and terminologies of Business Intelligence.
- To study dimensionally-modeled relational data source in report studio.

MODULE I OVERVIEW OF IBM COGNOS BI 08

IBM Cognos 10 Family - BI Enterprise Components - BI Architecture (high level) - BI Security- BI Groups and Roles- Framework Manager UI - View the top-level objects and reports - Package as a report author.

MODULE II DATA STRUCTURE 08

Data Sources and Model Types- Differentiate Data Entities- Relational Models- Operational vs Reporting- Operational Databases- Example of an Operational and Reporting Database Query- Create a Star Schema from an Operational Model- Operational Data -Reporting Data- Fact Table - Dimension Tables-Define Relationships - Identify Issues with a Star Schema-Cardinality- Relationships- Cardinality Optional vs Mandatory Cardinality- Data Traps-Chasm Trap- Transitive Relationship- Fan Trap - Connection Trap- OLAP Data Structures- OLAP-MOLAP vs ROLAP- Identify Data Access Strategies- Create a Baseline Project.

MODULE III FRAMEWORK MANAGER 08

Gather Requirements - Modeling Recommendations Overview- Analyze BI and Data Requirements- Interview and View Samples- Identify Required Business Areas-Creating a Baseline Project - Framework Manager - How does Framework Manager Connect to IBM Cognos BI-FM Query Modes-FM Model Types-FM Project- FM Metadata Elements- Create, view and publish a package.

MODULE IV REPORTS 08

Introduction to the Reporting Application - Report Studio- Explore the Environment- Explorer Bar and Report Templates- Generate the Report-Create List Reports - Group Data-Format List Column- Include List Headers and Footers-Focus Reports using Filters- Create Filters- Filter Your Data with Advanced Detail Filters-Create Crosstab Reports - Create a Crosstab Report- Add Measure to Crosstab Reports-Format Crosstab Reports.

MODULE V GRAPHICAL REPORT**06**

Data Graphically - Chart Report- Charts Containing Peer and Nested Items-Reuse Custom Chart Palettes-Data driven Baselines and Markers to Charts-Focus Reports using Prompts - Parameters and Prompts- Create a Parameter Item on the Report-Build a Prompt Page- Prompt Item to a Report- Extend the Model to add Staff Location Metadata-Rearrange the diagram.

MODULE VI DATA SOURCE**07**

Extend Reports using Calculations - Derive Additional Information from the Data Source-Run-time Date/Time Functions to Report - String Functions -Customize Reports with Conditional Formatting- Change Displays Based on Conditions-Steps for Conditional Formatting-Drill Through from One Report to Another - Navigate to Related Data in IBM Cognos BI-Set Up Drill-Report- Values Passed to Target Parameters- Create a Report using Relational Data- Relational Data Tree-List Object-Introduction to BI Administration-BI Administration Workflow, Portal and Configuration-Create a Report from a Dimensionally-modeled Relational Data Source.

L – 45; TOTAL HOURS – 45**REFERENCES :**

1. Richard Tran, Sachchidanand Singh, Poonam Chitale, Tushar Patil,"IBM Cognos Business Intelligence Version 10.2.0", IBM Corporation, International Technical Support Organization, SG24-8174,2014.
2. Administration and Security Guide, Chapter 32: Managing Index Search.
3. Jay Joseph, "Oracle Business Intelligence (Obi) Foundation Suite 11g Essentials", CreateSpace Independent Publishing Platform, ISBN 9781523453047, 2016.
4. Brian Larson, "Delivering Business Intelligence with Microsoft SQL Server 2016", McGraw Hill Professional, ISBN 9781259641497, 2016.
5. Norm Warren, Mariano Neto, Stacia Misner, Ivan Sanders, Scott A. Helmers,"Business Intelligence in Microsoft SharePoint 2013", Pearson Education, ISBN 9780735675872, 2013.

OUTCOMES :

Students who complete this course will be able to

- Analyze the data from various data sources
- Illustrate the major frameworks of computerized decision support: decision support systems (DSS), data analytics and business intelligence (BI).
- Describe the foundations, capabilities of DSS and data analytics and BI.

- Demonstrate the impact of business reporting, information visualization, and dashboards.
- Describe the architecture of data source.
- Analyze the report from dimensionally-modeled relational data source.

CSC 3123**IBM DESIGN THINKING, AGILE SOFTWARE
DEVELOPMENT AND DEVOPS**

L	T	P	C
3	0	0	3

OBJECTIVES :

- To understand the principles of Design Thinking, a creative solution-based approach to problem solving.
- To learn about Agile methodology as a practice to promote continuous iteration of development and testing throughout SDLC.
- To learn the basics about development cycles, IT Operations & faster innovation.
- To learn about Continuous Integration (CI) and Continuous Delivery (CD) for quicker & continuous software release/delivery.
- To learn the advanced process of software engineering for faster problem resolution & team collaboration.
- To give knowledge of how DevOps could help reduce complexity in developing and deploying code.

MODULE I IBM DESIGN THINKING 09

Introduction to Design Thinking – Importance of Design Thinking – History of Design Thinking – IBM Design Thinking Framework Design Thinking Methods, Empathize, Design, Ideate, Prototype, Test- Customer Example.

MODULE II INTRODUCTION TO AGILE 06

Software Development Methodology – Waterfall model – V –model – History of Agile – Agile principles – Agile Vs Waterfall – Agile Methodology Overview.

MODULE III AGILE FRAME WORK 06

Agile frameworks – Extreme programming - Rational Unified Process (RUP) - Test Driven Development (TDD) – Feature Drive Development (FDD) - Scrum - Kanban Methodology – Agile and Devops.

MODULE IV AGILE SOFTWARE DEVELOPMENT 08

Software Development using Extreme Programming – Roles & Rules - Software Development using Scrum Framework – Scrum team – Sprints – Sprints planning – Metrics – Scrum tools - Case Studies.

MODULE V DEVOPS FUNDAMENTALS 08

Introduction to DevOps – DevOps vs Agile – DevOps Principles and Life Cycle – Introduction to CI / CD & DevOps Tools– Version Control – Build Automation – Configuration Management – Containerization – Continuous Deployment – Continuous Integration – Continuous Testing – Continuous Monitoring.

MODULE VI ADVANCED DEVOPS AND DEVOPS ON CLOUD 08

DevOps Use Case and Setup – Solving Problems with DevOps – Introduction to advanced DevOps Concepts – Introduction to IBM Cloud – DevOps on IBM Cloud.

L – 45; TOTAL HOURS – 45

REFERENCES :

1. Kallori Vikram, "Introduction to DevOps" , 1st Edition, Kallori Vikram Publication, 2016.
2. Jaokim Verona, "Practical DevOps", 2nd Edition, Packt. Publication, 2018.
3. Stephen Fleming, Pravin, "DevOps Handbook: Introduction of DevOps Resource Management", 1st Edition, Createspace Independent Pub. , 2010.
4. Len Bass, Ingo Weber, Liming Zhu, G., "DevOps: A Software Architect's Perspective", 1st Edition, Addison-Wesley Professional, 2015.

OUTCOMES :

Students who complete this course will be able to

- Apply design thinking concepts to give solution for the problems identified.
- Implement agile software methodology for faster development of quality softwares.
- Describe how to unify processes and improve collaboration between development and operations.
- Implement Automated Installations and Deployments.
- Identify tools and practices for implementing CI, testing, and continuous deployment.
- Work with tools/technologies - Git, Maven, Puppet, Junit, Jenkins, Docker & Nagios.

SEMESTER VI**CSC 3212****DISTRIBUTED COMPUTING**

L	T	P	C
3	0	0	3

OBJECTIVES :

- To identify the fundamental principles to design basic distributed systems.
- To describe about the various distributed computing paradigms for Client-Server communication based on the application.
- To analyze the key issues related to communication across a distributed infrastructure and across multiple heterogeneous resources.
- Illustrate the principles of naming and coordinating distributed systems and evaluate the effectiveness and shortcomings of this solution.
- To interpret how various identify and apply design principles when consistency and replication is addressed in architecture.
- To recognize and analyze the failure detection algorithms for fault tolerance and how recovery from failure can be carried out.

MODULE I DISTRIBUTED COMPUTING ARCHITECTURE 08

Design goals-Types of distributed system-Architecture styles-Middleware organization-System architecture.

MODULE II PROCESSES 08

Threads-Virtualization-Clients-Servers-design issues-object servers-Code migration-Migration in heterogeneous systems.

MODULE III COMMUNICATIONS 08

Layered protocols-Types of communication-Remote procedure call-Message oriented communication-Multicast communication.

MODULE IV NAMING AND CO-ORDINATION 07

Flat naming-Structured Naming-Attribute-based naming-Clock synchronization-Logical clocks-Mutual Exclusion-Election Algorithms-Distributed event matching-Gossip based coordination.

MODULE V CONSISTENCY AND REPLICATION 07

Introduction-Data-Centric consistency models- Client-Centric consistency models-Replica management-Consistency protocols-Caching and replication in web.

MODULE VI FAULT TOLERANCE AND SECURITY 07

Failure Models-Process resilience-Reliable client-server communication-Reliable group communication-Distributed commit-Recovery-Security threats-Cryptography-Secure

channel-Access control-Secure Naming-Security Management.

L – 45; TOTAL HOURS-45

REFERENCES :

1. Andrew S Tanenbaum, Maarten van Steen, "Distributed Systems – Principles and Paradigms", 2nd Edition, Pearson Education, ISBN=1543057381, 2017.
2. Pradeep K. Sinha, "Distributed Operating Systems - Concepts, Systems and Applications", 3rd Edition, Prentice Hall India, New Delhi, ISBN=8120313801, 2008
3. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", 3rd Edition, Pearson Education, ISBN=0321263545, 2009
4. A.D. Kshemkalyani, M. Singhal, "Distributed Computing: Principles, Algorithms and Systems", Paperback Edition, Cambridge University Press, ISBN=1139470310, 2011.

OUTCOMES :

Students who complete this course will be able to

- Recognize the design principles underlying the functioning of distributed systems.
- Design a distributed system and migrate process when required.
- Apply various communication algorithms and techniques to distributed system environment.
- Build distributed system environment using various naming strategies and coordination techniques based on application.
- Improve the performance and reliability of distributed programs analyzing various security factors.
- Describe and distinguish synchronization and concurrency control for a parallel or distributed computing system.

CSC 3213	GRAPH THEORY AND APPLICATION	L	T	P	C
		3	1	0	4

OBJECTIVES :

- To introduce the students to graphs and their properties.
- To introduce graph applications as models of networks
- To improve the ability to use recursive definitions and solve recurrence relations.
- To deal with non-polynomial time graph problems.
- To impart knowledge on applying graph algorithms in the domain of Computer Science.
- To apply concept of graph theory to represent and use in communication networks.

MODULE I INTRODUCTION TO GRAPHS 08

Fundamentals of Graph Theory - Families of Graphs and Digraphs - History of Graph Theory – Graph Representation

MODULE II GRAPH THEORY 07

Graph Isomorphism - Recursively Constructed Graphs - Structural Graph Theory - Directed Graphs - Basic Digraph Models and Properties - Directed Acyclic Graphs – Tournaments.

MODULE III CONNECTIVITY AND REVERSIBILITY 08

Connectivity: Properties and Structure - Eulerian Graphs - Chinese Postman Problems - Hamiltonian Graphs - Traveling Salesman Problems - High Connectivity – Bounded Connectivity.

MODULE IV COLORINGS 08

Graph Coloring - Independence and Cliques - Factors and Factorization - Applications to Timetabling - Graphs in Computer Science – Searching - Dynamic Graph Algorithms - Algorithms on Recursively Constructed Graphs - Fuzzy Graphs.

MODULE V GRAPHS IN COMPUTER SCIENCE 08

Searching - Dynamic Graph Algorithms - Dynamic Problems on Undirected Graphs - Dynamic Problems on Directed Graphs - Drawings of Graphs - Types of Graphs and Drawings - Combinatorics of Some Geometric Graphs - Properties of Drawings and Bounds - Complexity of Graph Drawing Problems.

MODULE VI NETWORKS AND FLOWS 06

Maximum Flows - The Basic Maximum Flow Problem - Minimum Cuts and Duality - Max-Flow Min-Cut Theorem - Algorithms for Maximum Flow - Variants and Extensions of Maximum Flow - Minimum Cost Flows - The Basic Model and Definitions - Residual Networks - Optimality Conditions - The Dual Problem -

Algorithms for Minimum Cost Flow - Extensions to Minimum Cost Flow - Matchings and Assignments.

L – 45; T-15; TOTAL HOURS-60

REFERENCES :

1. “Handbook of Graph Theory”, Ping Zhang, Jay Yellen, Jonathan L. Gross, Chapman and Hall/CRC, 2nd Edition, ISBN: 9781439880197, 2015.
2. “Advanced Graph Theory and Combinatorics, Michel, John Wiley & Sons, ISBN: 9781848216167, 2016.
3. “Algorithmic Graph Theory and Perfect Graphs”, Martin Charles Golumbic, North Holland, 2nd Edition, ISBN: 9780444515308, 2004.

OUTCOMES :

Students who complete this course will be able to

- Formulate problems in terms of graphs.
- Solve graph theoretic problems and apply algorithms taught in the course.
- Use generating functions to solve a variety of combinatorial problems.
- Identify the biconnected components in a graph or a circuit.
- Apply principles and concepts of graph theory in practical situations
- Apply concepts of graph theory in Computer networks.

CSC 3214**BIG DATA ANALYTICS TOOLS LAB**

L	T	P	C
0	0	2	1

OBJECTIVES :

- To provide the basic understanding of Hadoop eco system
- To create a Hadoop working environment
- To execute simple programs in Hadoop.
- To write Python programs for solving problems by MapReduce.
- To give basics of Spark programming principles.
- To establish database connectivity and perform analytics on the imported data.

List of exercises:

1. Hadoop Installation.
2. Simple program execution on Hadoop.
3. Python basic programming.
4. MapReduce problem using Python.
5. Simple programs using Spark.
6. Database connectivity and query evaluation using HBase and Hive.
7. Case studies on data analytics using real world Data with suitable Big data open source tools and presentation with effective visualization of analytics.

P-15; TOTAL HOURS -15**OUTCOMES :**

Students who complete this course will be able to

- Establish the Hadoop working environment.
- Test working of simple programs on Hadoop.
- Develop programs in Python for performing data analytics.
- Analyze and MapReduce a given problem and solve it in Hadoop.
- Design and develop programs in Spark.
- Carry out data analytics on big data collected from real time scenarios.

CSC 3221	FOUNDATION COURSE IN BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To introduce the fundamentals of concepts and principles regarding data handling
- To provide knowledge the problems in the area of data storage, data handling and data analysis
- To understand and implement the advanced features of DBMS, RDBMS.
- To perform data analysis using HADOOP.
- To explore knowledge in solve problems using Map Reduce Technique
- To provide fundamental training for key areas of Big Data.

MODULE I DATA GENERATION FUNDAMENTALS 08

Data - Data generation - Data Storage and Management Within a System and In Corporate Level Technologies and Departments In Real World Where Huge Amount of Data is Produced - Necessity for Maintaining Data - Generating Insights Over Data.

MODULE II IMPLEMENTATION OF BIG DATA 08

Big Data - Where is Big Data Implemented - Technologies where Big Data is Implemented - IoT - Machine learning - Cloud computing - Deep Learning - Artificial Intelligence.

MODULE III WAY OF IMPLEMENTING THE BIG DATA 08

How it is Implemented - Concepts in DBMS (Database Management System) – RDBMS (Relational Database Management System) - Hadoop - Comparing Hadoop and Big Insights.

MODULE IV ENTERPRISE TOOL OF HADOOP 08

Hadoop - The Enterprise Tool for Data Handling - IBM info Sphere Big Insights – Comparison Between Hadoop and Big Insights – Overview of File Systems.

MODULE V FILE SYSTEMS & HDFS 06

File systems – Types of File Systems - FPO – GPFS – DFS - HDFS – Hadoop Distributed File System – Map Reduce – Implementation of Map Reduce.

MODULE VI APPLICATIONS 07

Generating Data into Workbook - Big Sheets Using Unstructured Data - Run an Application to for a Workbook - Web Crawler Application - Adding Charts - Adding Big Sheets - Creating and Managing Data Using Big SQL - Big SQL Integration - Analyzing Social Media and Structured Data - Working With Hadoop.

L – 45; TOTAL HOURS – 45

REFERENCES :

- 1 Mike Ebbers ,Renata Ghislotti de Souza, Marcelo Correia Lima, Peter McCullagh, Michael Nobles ,Dustin VanStee ,Brandon Waters,"Implementing IBM InfoSphere BigInsights on IBM System x" ,Second Edition, ISBN 0738437557, 2013.
- 2 Paul Zikopoulos, Chris Eaton," Understanding and working with Big Data using Hadoop and IBM Info Sphere",ISBN 0071790543,2011.
- 3 Jy Liebowitz, "Big Data and Business analytics",CRC press, Third Edition, ISBN 1466672730, 2013.
- 4 Boris Iublinky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, First Edition, ISBN 9788126551071, 2015.
- 5 Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, "Mining of Massive Datasets", Cambridge University Press, Second Edition ISBN 1107077230, 2014.

OUTCOMES :

Students who complete this course will be able to

- Identify new trending and faster developing technology being adopted by many companies.
- Gain Knowledge on different area where Big Data is applied.
- Apply new algorithms for collecting Big Data from various sources.
- Demonstrate the various applications in HADOOP.
- Apply algorithms that uses Map Reduce technique for solving Big Data problems
- Implement software and tools required to manage and analyze data.

CSC 3223	ENTERPRISE MOBILE APPLICATION DEVELOPMENT AND DEPLOYMENT USING IBM WORKLIGHT	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To study the basic terminologies in IBM worklight.
- To build rich, cross-platform applications using standard technology.
- To determine mobile application development and delivery.
- To identify the complete end-to-end mobile device management.
- To illustrate the connectivity to back-end systems and cloud-based services that is optimized for mobile devices.
- To provide the advanced application management for updates push and version control.

MODULE I	INTRODUCTION TO IBM WORKLIGHT	06
	Introduction to IBM MobileFirst Foundation , Overview of MobileFirst Studio, Developing and testing the user Interface .	
MODULE II	MOBILE SMARTER PROCESS OVERVIEW	08
	IBM MobileFirst Client-side development: Core API's – IBM MobileFirst client-side Development: Local storage API's – Working with UI Frameworks.	
MODULE III	IMPLEMENTATION DETAILS	08
	Apache Cordova – Integration Adapters – Native and Web page Integration – Using MobileFirst native API's.	
MODULE IV	ENTERPRISE MOBILE SECURITY WITH IBM WORKLIGHT	08
	Adapters - Security – Location Services – Notification Mechanisms .	
MODULE V	DEPLOYMENT	08
	Deploying an application from development to production – Team development and Application Center.	
MODULE VI	APPLICATION	07
	Starter Application , JSON store – Encrypted Cache – UI Frameworks: Cordova – Native Page development and Linking , Development & Deployment of Adapters - Log in Application – GPS enabled application.	

L – 45; TOTAL HOURS – 45

REFERENCES :

1. Andreas Dannhauer, Ming Zhe Huang, Paul Idstein, Todd Kaplinger, Hossam Katory, Christian Kirsch, Kearan McPherson, Leonardo Olivera, Susan Hanson "Extending Your Business To Mobile Device With IBM Worklight" , RedBooks, ISBN-10: 0738438448, 2015.
2. Scott Andrews Juarez Barbosa Junior Virginijus Kaminas Jia Lei Ma Dale Sue Ping Madlin Seide, "Securing Your Mobile Business with IBM Worklight", IBM Redbooks, ISBN 073843888X, 2013.
3. Muhammad Saifuddin, Talha Haroon , "IBM Worklight Mobile Application Development Essentials", Packt Publishing Limited, ISBN 9781782177609 , 2014

OUTCOMES :

Students who complete this course will be able to

- Develop the user interface for IBM worklight
- Test the user interface environment for IBM worklight.
- Implement mobile app using apache coredova
- Deploy the mobile application
- Build mobile applications using IBM MobileFirst Platform
- Deploy with platform specific application on android and iOS

CSC 3225**COGNITIVE ANALYTICS**

L	T	P	C
3	0	0	3

OBJECTIVES :

- To introduce the cognitive technology involved in IBM Watson.
- To guide the importance of planning various services to address the problems.
- To represent the smart data discovery for structured data sources.
- To provide knowledge in various cognitive services.
- To explore the various Watson analytics based on application.
- To understand how to solve complex problems using Cognitive analytics.

MODULE I INTRODUCTION TO IBM WATSON ANALYTICS 08

Introduction to Watson Analytics – Content Analytics architecture-Scenario Analysis – Accessibility features.

MODULE II UPLOADING DATA 08

Identifying use cases-Data context-Sample Data Assets on IBM Watson Analytics.

MODULE III ASKING QUESTIONS AND DISCOVERING INSIGHTS 08

Content Analytics data model-Discovering Insights in IBM Watson Analytics

MODULE IV CREATING A DISPLAY TO SHARE WITH OTHERS 08

Cycle of analysis-Analysis and Insights in IBM Watson Analytics – creating a Watson Analytics Prediction-Display in Watson Analytics

MODULE V SOCIAL MEDIA 06

Adding and Exploring Tweets – Analyzing Social Media Topics and Trends

MODULE VI CASE STUDY 07

Human Resources Training on Watson Analytics- Discovering Insights in Watson Analytics using HR Training - Display in Watson Analytics- Social Media in Watson Analytics.

L – 45; TOTAL HOURS – 45

REFERENCES :

1. James D.Miller, "Learning IBM Watson Analytics", PACKT Publishing, ISBN -13: 9781785880773, 2016.
2. Danish Contractor, Aaditya Telang, "Applications of Cognitive Computing Systems and IBM Watson", Springer, 8th Edition, ISBN-13: 9789811064173, 2017.
3. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive Computing and Big Data Analytics", Wiley Publishing, ISBN -13:9781118896624, 2015.

OUTCOMES :

Students who complete this course will be able to

- Analytics applies some of those cognitive capabilities along with other advanced analytical capabilities like predictive analytics to analyze and visualize your data
- Collect requirements based on the type of the application and its need.
- Design cognitive frameworks for the application to be developed.
- Ensure guidance to shape data, find discoveries and put it to together in a dashboard to share.
- Apply the natural language traits and predictive algorithms to understand data and find insights that are not visible to the user.
- Modify and improve unbiased understanding of one's data.

SEMESTER VII

CSC 4101	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES :

- Learn the basic of software project management and the project planning.
- Evaluate and assess the projects and to find the cost of the project using cost benefit evaluation techniques.
- To highlight different techniques for software cost estimation and activity planning.
- It also helps identify the risks involved in the project and the appropriate strategies for minimizing potential risks.
- Conduct project planning activities that accurately forecast project costs, timelines, and quality. Implement processes for successful resource, communication and change management.
- Manage the selection and initiation of individual projects and of portfolios of projects in the enterprise.

MODULE I INTRODUCTION 08

Software projects versus other types of project - Contract management and technical project management- Plans, methods and methodologies -categorizing software projects -Stakeholders - The business case - Requirement specification - Management control - Step Wise project planning.

MODULE II PROJECT EVALUATION 07

Strategic assessment - Technical assessment - Cost–benefit analysis - Cash flow forecasting - Cost–benefit evaluation techniques - Risk evaluation.

MODULE III SOFTWARE PROJECT APPROACH 07

Choosing technologies - Technical plan contents list - The waterfall model - The V-process model - The spiral model - Software prototyping - Incremental delivery - Dynamic Systems Development Method - Extreme programming..

MODULE IV EFFORT ESTIMATION AND ACTIVITY PLANNING 08

Problems with over- and under-estimates -Software effort estimation techniques - Albrecht function point analysis - A procedural code-oriented approach - COCOMO: a parametric model - The objectives of activity planning -Project schedules and activities - Network planning models - The forward pass - The backward pass - Identifying the critical path and activities.

MODULE V RISK MANAGEMENT AND MONITORING 08

Introduction - The nature of risk - Types of risk - Managing risk - Hazard identification - Hazard analysis - Risk planning and control- Evaluating risks to the schedule- Creating

the framework - Collecting the data - Visualizing progress - Cost monitoring - Earned value - Prioritizing monitoring -Getting the project back to target - Change control- Types of contract - Stages in contract placement - Typical terms of a contract - Contract management – Acceptance.

MODULE VI ORGANIZING TEAMS AND SOFTWARE QUALITY 07

Understanding behavior- Organizational behavior-- Selecting the right person for the job - Instruction in the best methods -The Oldham–Hackman job characteristics model - Decision making - Leadership -Organizational structures - software quality in project planning -Practical software quality measures- Product versus process quality - Quality plans.

L – 45; TOTAL HOURS-45

REFERENCES :

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi,. ISBN= 9780077122799,2012
2. Robert K.Wysocki “Effective Software Project Management” –Wiley Publication. ISBN=1118089243,2011
3. Walker Royce: “Software Project Management”- Addison-Wesley, 1998. ISBN=0321734025,1998
4. Gopalswamy Ramesh, “Managing Global Software Projects” – McGraw Hill Education (India),. ISBN=1259007111,2013

OUTCOMES :

Students who complete this course will be able to

- Practice Project Management principles while developing a software.
- Demonstrate effective project execution and control techniques that result in successful projects.
- Conduct project closure activities and obtain formal project acceptance.
- Demonstrate a strong working knowledge of ethics and professional responsibility.
- Demonstrate effective organizational leadership and change skills for managing projects, project teams, and stakeholders.
- Critical-thinking and analytical decision-making capabilities to investigate complex business problems to propose project-based solutions.

CSC 4102**COMPILER DESIGN**

L	T	P	C
3	0	0	3

OBJECTIVES :

- To outline the history and algorithms for compiler construction.
- To introduce high-level programming language implementation.
- To provide fundamental principles of compiler design.
- To have an in-depth knowledge of inner process of compiler.
- To understand the workings of and add to a language processor for each of the modern paradigms.
- To give knowledge on writing programs using compiler construction tools.

MODULE I INTRODUCTION 07

Introduction – A simple traditional modular compiler/interpreter – Structure of compiler – Compiler architecture – Properties of good compiler- History of Compiler Construction – Grammar- Closure algorithm.

MODULE II LEXICAL ANALYSIS 08

Reading the program text – Regular expressions and regular descriptions – Creating lexical analysis by hand and by automatically – Transition table compression – Error handling in lexical analyzers – Lexical identification of tokens – Macro processing and file inclusion.

MODULE III SYNTAX ANALYSIS 09

Two classes of parsing methods – Error detection and error recovery – Creating top down parser manually and automatically – LL(1) parsing – Creating bottom up parser automatically – SLR (1) parsing – LR(1) parsing – LALR (1) parsing – Recovering grammars from legacy code.

MODULE IV SEMANTIC ANALYSIS AND INTERMEDIATE CODE 06

Types and types checking – Storage management – Syntax directed translation – Intermediate code - Assemblers, Disassemblers, Linkers and Loaders.

MODULE V CODE GENERATION 08

Optimization techniques – Local Optimization and Basic blocks – Control and data flow - Code generation – Target machines – Register allocation – Stack management – Automatic Code generation construction.

MODULE VI COMPILER CONSTRUCTION TOOLS 07

Implementation issues – Cross compilation – Implementation languages – Compiler construction tools – Structure – Simple programs.

L – 45; TOTAL HOURS-45**REFERENCES :**

1. Des Watson, "A Practical Approach to Compiler Construction", Springer, 2nd Edition, ISBN: 3319527894, 9783319527895, 2017
2. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Criel J.H. Jacobs, Koen Langendoen, "Modern Compiler design", Springer Science & Business Media, 2012, 2nd Edition, ISBN : 1461446996, 9781461446996,2012.

OUTCOMES :

Students who complete this course will be able to

- Describe the fundamental steps for designing a compiler.
- Generate tokens for any programming syntax.
- Construct syntax tree and parse the input.
- Implement a translator for a programming language.
- Optimize the code using the techniques provided.
- Use compiler construction tools such as LEX/FLEX and YACC/BISON.

CSC 4104**COMPILER LAB**

L	T	P	C
0	0	2	1

OBJECTIVES :

- To expose the working of various phases of compiler.
- To introduce various compiler construction tools.
- To illustrate tools to design lexical analyzer and produce a parser for a given grammar.
- To implement various methods for converting three address code to assembly level program.
- To introduce concept of code optimization of three address code for different programming statements.
- To generate assembly code for the input program.

SOFTWARE REQUIRED :

Basic tools :C/C++/JAVA, LEX/FLEX, YACC/BISON
Compiler construction tools based on the selection of projects.

List of exercises:

1. Design a lexical analyzer for a given High Level Language. Ignore redundant space, tabs and new lines.
2. Study of compiler construction tools.
3. Implement a lexical analyzer.
4. Design and implement Top-Down parsing techniques and Bottom up parsing techniques.
5. Implement a scientific calculator.
6. Generate abstract syntax tree and intermediate code for the given language.
7. Implement code optimization phase of the compiler.

P-15; TOTAL HOURS – 15**OUTCOMES :**

Students who complete this course will be able to

- Illustrate the working of compiler.
- Design lexical analyzer and generate tokens.

- Parse the string for the given grammar.
- Develop and implement the mathematical operations.
- Construct syntax tree and intermediate code.
- Implement various phases of compiler through construction tools.

CSC 4121	APPLICATIONS DEVELOPMENT & DEPLOYMENT USING IBM BLUEMIX	L	T	P	C
		3	0	2	4

OBJECTIVES :

- To integrate applications and speed deployment of new cloud services.
- To improve application performance and availability.
- To provide a catalog of open source, IBM and third-party APIs Services allow a developer to form an application.
- To execute the application by adding new runtime instances.
- To focus on the Bluemix services for application development to infrastructure deployment and monitoring.
- To expose de-risk and separate concerns of application development.

MODULE I INTRODUCTION TO CLOUD COMPUTING 08

Cloud computing – factors contributing to the growth of cloud – cloud service models – infrastructure as service architecture – Platform as a service – Software as a service – Cloud computing: Benefits for developers.

MODULE II DEEP DIVE INTO BLUEMIX 08

Evolution of BlueMix – Importance of BlueMix – BlueMix UI Tour – BlueMix Catalog Overview - Creating an IBM Bluemix account – web application development through Bluemix.

MODULE III BLUEMIX ARCHITECTURE 08

BlueMix Architecture – Cloud Foundry Architecture – BlueMix application Deployment Stages – Cloud Foundry command line Interface – web app deployment using cloud foundry.

MODULE IV BLUEMIX SERVICES 08

Partner Cloud Services in BlueMix – Registering a Service in BlueMix – Various BlueMix services – VCAP_services - Integration DB PAAS service – Auto scaling application.

MODULE V BLUEMIX CLOUDANT 06

Overview of Cloudant – Watson Chat BOT - Watson Language Translator - Cloudant - IOT - Mobile Application.

MODULE VI BLUEMIX DEVOPS SERVICES 07

Overview of Devops – BlueMix Devops tool Chain – Devops tool integration – Bluemix live sync features – Setting up IBM Bluemix Devops services project - Connect a Git

client to IBM Bluemix Devops project - Successful Build and deploy result.

L – 45; P -30; TOTAL HOURS – 75

REFERENCES :

1. Ahmed Azraq, Hala A. Aziz, Mohamed El-Khouly, Sally Fikry, Ahmed S. Hassan, Ben Smith, “Essentials of Cloud Application Development on IBM Bluemix” , IBM Redbooks, 2017.
2. Ahmed Azraq, Hala A. Aziz, Mohamed El-Khouly, Sally Fikry, Ahmed S. Hassan, Ben Smith, “Developing Node.js Applications on IBM Bluemix” , IBM Redbooks, 2017.
3. Jordan T Moore, Mamoun A Hirzalla, Richard Osowski, Srinivas Chowdhury, Vasfi Gucer, “IBM Bluemix Architecture Series: Web Application Hosting on Java Liberty”, IBM Redbooks, 2015.
4. Vasfi Gucer, Shishir Narain, “Creating Applications in Bluemix Using the Microservices Approach”, IBM Redbooks, 2015.
5. Leigh Williamson, Roland Barcia, Omkar Chandgadkar, Ashish Mathur, Soma Ray, Darrell Schrag, Roger Snook, Jianjun Zhang, “Enterprise Class Mobile Application Development: A Complete Lifecycle Approach for Producing Mobile Apps”, IBM Press, 2015.

OUTCOMES :

Students who complete this course will be able to

- Create an integrated development experience with third-party and open technologies.
- Interface the Bluemix user interface for account creation.
- Have a deeper knowledge on PaaS and IaaS tools.
- Identify the services for developing integrated services in cloud.
- Use Devops tool for application development in Bluemix services.
- Connect private services to the public Bluemix services available from IBM

CSC 4122	ADVANCE COURSE PROGRAMMING IN BIG DATA	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To introduce the process involved in Big Data Programming
- To lead the importance of basic requirements on Hadoop distribution - IBM InfosphereBigInsights
- To represent the requirements collected using the various methods in R
- To provide knowledge in developing a Apache Pig in a systematic method with quality.
- To explore the various functions in Pig scripting.
- To understand how to improve the use cases of big data.

MODULE I INTRODUCTION TO PROGRAMMING IN BIG INSIGHTS 08

Overview on Big Data and Hadoop – IBM InfosphereBigInsights – Getting to know BigInsights Components.

MODULE II INTRODUCTION TO BIG SQL 08

Introduction to BigSQL Architecture –Terminologies – Working with BigSQL – Data types – Statistics.

MODULE III INTRODUCTION TO R 08

Getting started with R – Working with R – Objects and Expressions – Vectors, Matrices, Lists and Data Frames – Overview on BigR.

MODULE IV OVERVIEW ON APACHE PIG 08

Pig invocation methods – Data structures used in Pig – Input and Output Operators.

MODULE V PIG SCRIPTING 06

Overview of Pig Scripting – Hands-on with Pig scripting – Evaluation functions – Pig Explain.

MODULE VI BIG DATA SCENARIO 07

Applications – Use Cases of Big Data – R Visualizations– Real time scenario in Big Data.

L – 45; TOTAL HOURS – 45

REFERENCES :

1. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", Packt Publishing, First Edition, ISBN: 978-1-78216-328-2, 2013.
2. Christian Klose and S.B. Klose, "Beyond big data: Biginsights in small data with R", Think Publishing, First Edition, ISBN-13: 978-0137035151, 2016.
3. Balaswamy Vaddeman, "Beginning Apache Pig", Apress, First Edition, ISBN 978-1-4842-2337-6, 2016.

OUTCOMES :

Students who complete this course will be able to

- Choose the appropriate big data programming for the hadoop ecosystem.
- Acquire the knowledge on IBM big Data Hadoop Distribution such as IBM InfoshpereBigInsights.
- Design frameworks for the hadoop with BigSQL
- Ensure the R language and apply for the Pig in big data.
- Analyze the appropriate Pig scripting for the big data applications.
- Propose solutions for the analytics and big data problems.

CSC 4123	ADVANCE COURSE PROGRAMMING IN INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To introduce basic elements of IoT and Raspberry Pi setup.
- To focus on JavaScript with open source server framework.
- To learn MQTT Server installation on desktop, gain familiarity with MQTT protocol
- To describe the need for developing applications on BlueMix environment.
- To explore basic IoT solutions using open source low cost devices such as Raspberry Pi.
- To familiarize real time examples and case studies on BlueMix.

MODULE I INTRODUCTION TO INTERNET OF THINGS 08

Introduction to IoT – Sensors – Actuators – Processing Elements – Set Up the Raspberry Pi – Linux Refresher

MODULE II JAVASCRIPT AND NODE.JS 08

JavaScript – A Refresher – Introduction to Node.js – Installation on a Raspberry Pi – Setting up Node.js environment – Playing with the REPL Terminal – Programming in Node.js environment & make Raspberry Pi Blink.

MODULE III COMMUNICATION PROTOCOLS 08

Concepts of Protocols – MQ Telemetry - MQTT Server installation on desktop – MQTT protocol – Node-RED – Wire Various Devices and API's Together – Node-RED installation – RED UI and its elements – basic flows with Function Node – creating Node-RED flows.

MODULE IV IOT WITH BLUEMIX 07

Introduction to BlueMix – Capabilities and Exceptional Use to create IoT Applications – IoT Apps using BlueMix – Bluemix IoT Services and its UI/Navigation.

MODULE V IOT IN NODE RED 07

Node-RED application on Bluemix – IoT devices and gateway registration process – Develop Node-RED application – deploy the Node-RED application outlined in the section on Overview – sensors in Node-RED environment with Raspberry Pi.

MODULE VI CASE STUDIES 07

BlueMix with IoT in real Life – Real Life Examples and Case studies- Fagor Industrial – Sensitel – Mahindra & Mahindra: transforming product innovation – The Poseidon Project: Making the most of the world's water resources through smarter irrigation.

L – 45; TOTAL HOURS – 45**REFERENCES :**

1. Ahmed Azraq, Mohamed Ewies, Ahmed E. Marzouk, Developing Node.js Applications on IBM Bluemix, IBM Redbooks, IBM Redbooks, ISBN: 0738442151, 9780738442150, 2017.
2. Derek Molloy, Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux, John Wiley & Sons, ISBN: 1119188687, 978111918868, 2016.
3. Sreelatha Sankaranarayanan, Learning IBM Bluemix, Packt Publishing Ltd, ISBN: 178588199X, 9781785881992, 2016.
4. Robert Stackowiak, Art Licht, Venu Mantha, Louis Nagode, Big Data and The Internet of Things: Enterprise Information Architecture for A New Age, Apress, ISBN: 1484209869, 9781484209868, 2015.

OUTCOMES :

Students who complete this course will be able to

- Analyze the basic concepts of IoT and understand Raspberry-Pi environment.
- Apply the basics of node.js environment and implement simple concepts
- Use open-source visual application development environment Node-RED on both the device and the cloud.
- Create an IoT applications using BlueMix.
- Access the Node-Red, BlueMix platforms using APIs and explore the different connectivity options for various devices, gateways and applications.
- Apply the BlueMix and IOT concepts in real time examples.

SEMESTER VII**Programme Elective****CSC X143****DEEP LEARNING**

L	T	P	C
2	0	2	3

OBJECTIVES :

- To learn the machine learning basics
- To estimate the deep learning networks
- To describe the deep networks.
- To expose the students to sequence modeling
- To appraise the recent advances in deep learning.
- To summarize the practical methodology and applications of deep learning.

MODULE I MACHINE LEARNING BASICS FOR DEEP LEARNING 08

Learning Algorithms - Capacity, Overfitting and Underfitting -Hyper parameters and Validation Sets - Estimators, Bias and Variance - Maximum Likelihood Estimation - Bayesian Statistics - Stochastic Gradient Descent - Building a Machine Learning Algorithm - Challenges Motivating Deep Learning.

MODULE II DEEP LEARNING NETWORKS 07

Introduction – Historical context of Deep Learning – Classes of Deep Learning Network – Deep Networks for Unsupervised learning – Deep Networks for Supervised learning – Hybrid Deep Networks.

MODULE III DEEP NETWORKS: MODERN PRACTICES 08

Deep Feedforward Networks - Architecture Design - Back-Propagation and Other Differentiation Algorithms - Regularization for Deep Learning - Regularization and Under- Constrained Problems - Optimization for Training Deep Models - Optimization Strategies and Meta-Algorithms – Convolutional Network.

MODULE IV SEQUENCE MODELING: RECURRENT AND RECURSIVE NETS 08

Unfolding Computational Graphs - Recurrent Neural Networks - Deep Recurrent Networks - The Challenge of Long-Term Dependencies - Echo State Networks - The Long Short-Term Memory and Other Gated RNNs - Optimization for Long-Term Dependencies.

MODULE V PRACTICAL METHODOLOGY AND APPLICATION 07

Performance Metrics - Default Baseline Models - Selecting Hyperparameters - Debugging Strategies - Example: Multi-Digit Number Recognition – Applications -

Computer Vision, Speech Recognition and Natural Language Processing – Other Applications.

MODULE VI RESNET 07

Review of Deep Learning-Problems in Deep Learning- Deep Learning Architecture -
Deep Residual Learning-Application of ResNet-Case Study.

L – 30; P – 30; TOTAL HOURS-60

REFERENCES :

1. Li Deng and Dong Yu, “Deep Learning Methods and Applications”, Now Publisher, 1st Edition, ISBN: 1932-8346, 2014.
2. Josh Patterson, Adam Gibson, “Deep Learning”, O'Reilly Media, 1st Edition, ISBN: 978-1491914250, 2017.
3. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning (Adaptive Computation and Machine Learning Series)”, MIT Press, 1st Edition, ISBN: 978-0262035613, 2017.
4. Tom M. Mitchell, Machine Learning, McGraw Hill Education, 1stEdition, ISBN: 978-1259096952, 2013.
5. LaureneFausett, “Fundamentals of Neural Networks: Architectures, Algorithms and Applications”, Pearson, 1st Edition, ISBN- 978-8131700532, 2004.

OUTCOMES :

Students who complete this course will be able to

- Illustrate the machine language applications in deep learning
- Identify the various deep learning algorithms and its application
- Evaluate the role of sequence modeling
- Compare the various deep learning network algorithms
- Apply the deep learning algorithms to solve real time problems.
- Acquire skills in handling situations involving application of deep learning

CSC X144	INTRUSION DETECTION & PREVENTION	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To study the fundamental concepts in Intrusion detection
- To discuss about the various Intrusion detection networks.
- To expose to the advanced detection Methods
- To gain knowledge on Intrusion prevention system
- To train how to choose the appropriate algorithm for designing intrusion detection networks.
- To expose the students to various detection approaches.

MODULE I	INTRODUCTION	05
	Cyber intrusion – Malware- Intrusion detection system – Intrusion detection networks–co-operation technologies and algorithms.	
MODULE II	DESIGN OF AN INTRUSION DETECTION NETWORKS	08
	Network Architecture design – Collaboration framework – Trust management – Robustness against common treats – simulations and experimental results.	
MODULE III	WIRELESS INTRUSION DETECTION SYSTEMS	08
	Architecture – Data Collection – Intrusion Detection- Detection Methods - Correlation techniques –Evaluation	
MODULE IV	INTRUSION DETECTION AND PREVENTION SYSTEMS	08
	Host-based Intrusion Detection System – Network-Based Intrusion Detection System (IDS) / Intrusion Prevention System (IPS)- Signature-Based Detection-IDS/IPS System Architecture and Framework-Responses by IDPS to the Intrusions	
MODULE V	DETECTION APPROACHES	08
	Anomaly Detection – Data Collection for Host-Based IDSs – Theoretical Foundation of Detection – Intrusion Response-. Examples of Commercial and Open Source IDSs	
MODULE VI	OTHER TYPES OF IDN DESIGN	08
	Intrusion detection rules and alerts– knowledge based Intrusion detection networks – Bayesian learning and dynamic algorithm – collaborative malware detection network – decision model – evaluations.	
		L-45; TOTAL HOURS – 45

REFERENCES :

1. Carol Fung and Raouf Boutaba, "Intrusion Detection Networks: A Key to Collaborative Security", CRC Press, Taylor and Francis Group, 1st Edition, ISBN: 978-1466564121, 2014.
2. Gorbani A.A, Lu w Tavallae M "Network Intrusion Detection and Prevention-concepts and techniques", Springer International Publishing, 1st Edition, ISBN: 9780387887708, 2010.
3. Al-Sakib Khan Pathan, "The State of the Art in Intrusion Prevention and Detection", CRC Press, Taylor and Francis Group, 1st Edition, ISBN: 978-1-4822-0351-6, 2014.
4. Umesh Hodeghatta Rao and Umesha Nayak, "The Infosec Handbook: An introduction to Information Security", APress, 1st Edition, ISBN: 978-1430263821, 2014.

OUTCOMES :

Students who complete this course will be able to

- Apply the architecture design of various Intrusion detection networks to solve real time applications
- Design, conduct simulations and provide experimental results of detection algorithms
- Identify the needs of Intrusion detection networks
- Adopt advanced detection Methods for solving research problems
- Comprehend the quality attributes of intrusion detection and prevention algorithms.
- Compare the functioning of various detection approaches.

OUTCOMES :

Students who complete this course will be able to

- Evaluate technologies, such as digital signatures, to comply with the law and serve as evidence.
- Appreciate current and imminent legislation pertinent to ICT governance, risk management and compliance.
- Make decisions about the law of data security and investigations.
- Identify the Interrelationship between the various elements of information security management and its role in protecting organizations.
- Demonstrate work in compliance with established standards and relevant legislation in the protection, security and investigation fields.
- Assign and evaluate delegated duties and responsibilities in compliance with organizational policies and procedures.

CSC X146**SOFTWARE DESIGN PATTERNS**

L	T	P	C
1	0	0	1

OBJECTIVES :

- To explain what specific object oriented design problem the pattern solves.
- To provide a specific context for each pattern in which it can be applied.
- To draw a high level class diagram in UML for each pattern.
- To list the consequences of applying each pattern to the overall software quality of a system.
- To study the different types of patterns.
- To implement this pattern to a real world problem.

MODULE I**OVERVIEW****06**

Essential Elements of design patterns- Catalog of design patterns- Common themes in structural patterns- How to select and use a design pattern-How design pattern solve design problems

MODULE II**CATEGORIES OF DESIGN PATTERNS****09**

Creational patterns - Structure patterns- Behavior patterns- Anti-patterns

L-15; TOTAL HOURS – 15**REFERENCES :**

1. Erich Gamma, Richard Helm, Ralph Johnson & John Vlissides, "Design Patterns: elements of Reusable Object Oriented Software", Pearson Education, 2nd Edition, ISBN: 9789332555402, 2015.
2. Eric Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra, "Head First Design Patterns: A Brain-Friendly Guide", Shroff Publishers & Distributors Pvt. Ltd., 10th Edition, ISBN: 9789352132775,2014.
3. Kerievsky, "Refactoring to Patterns", Pearson Education, 1st Edition, ISBN: 9780321213358, 2004.

OUTCOMES :

Students who complete this course will be able to

- Recognize the architecture, creating it and moving from one to any, different structural patterns.
- Analyze the architecture and build the system from the components.
- Design creational and structural patterns.

- Demonstrate what tradeoffs need to be made when implementing a design pattern.
- Mix patterns with each other and understand the consequences of mixing patterns on the overall quality of a system.
- Know what design pattern to apply to a specific problem.

CSC X147	WRITING SKILLS FOR ENGINEERING LEADERS	L	T	P	C
		1	0	0	1

OBJECTIVES :

- To addresses the specific combination of thinking and writing skills needed to succeed in modern engineering.
- To describe how to avoid logical fallacies and use physical reasoning to catch mistakes in claims.
- To covers the essentials of technical grammar and style as well as the elements of mathematical exposition.
- To emphasizes the centrality of the target audience, and thus the need for clear and concise prose.
- To check for spelling, word choice, sentence structure, punctuation, paragraph and essay writing
- To learn the basics of English writing with its clear, concise concept explanations and useful, relevant corresponding exercise.

MODULE I WRITING BY DESIGN 07

Clearly understand the goal – Mindset for Technical writing – Avoid the worst thinking traps- Grammar and style.

MODULE II WRITING SKILLS 08

Basic Structure – The Paragraph – The Essay – Writing skills – Organizing ideas- Choosing quotations- Writing arguments and summaries – Revising and presenting work.

L-15; TOTAL HOURS – 15

REFERENCES :

1. Len Bass Edward J. Rothwell, Michael J. Cloud,” Engineering Writing by Design: Creating Formal Documents of Lasting Value”, CRC Press, ISBN: 9781482234329,2016.
2. Paige Wilson, Teresa Ferster Glazier,” The Least You Should Know About English: Writing Skills, Form C”, Cengage Learning, ISBN: 9781111830922,2013.

OUTCOMES :

Students who complete this course will be able to

- Demonstrates how effective writing can be achieved through engineering-based thinking.
- Locate the basic errors and mistakes for designing a document.

- Become expert in technical writing.
- Describe the writing skills formally.
- Become effective writers.
- Inbuilt confident on writing any technical document.

CSC X148**SOFTWARE RELIABILITY**

L	T	P	C
2	0	0	2

OBJECTIVES :

- To understand how to apply the principles of software reliability in a variety of context.
- To learn the techniques to find the reliability of software.
- To know the different models of software reliability.
- To study the various metrics used to measure the quality factors of software reliability
- To identify the responsibility of organization and staffing in achieving software reliability, and computer architecture and program correctness
- To explain the fault detection and correction approaches used in developing a quality software
- To illustrate the design principles for achieving higher reliable software system.

MODULE I**SOFTWARE RELIABILITY CONCEPTS****10**

Defining failure for the product, common measure for all associated systems, setting system failure intensity objectives, determining develop software failure intensity objectives, software reliability strategies, failures, faults and errors, availability, system and component reliabilities and failure intensities, predicting basic failure intensity.

MODULE II**SOFTWARE RELIABILITY MODELING SURVEY****10**

Introduction, Historical Perspective and Implementation, Exponential Failure Time Class of Models, Weibull and Gamma Failure Time Class of Models, Infinite Failure Category Models, Bayesian Models, Model Relationship, Software Reliability Prediction in Early Phases of the Life Cycle, software reliability growth modeling.

MODULE III**SOFTWARE METRICS FOR RELIABILITY ASSESSMENT****10**

Introduction, Static Program Complexity, Dynamic Program Complexity, Software Complexity and Software Quality, Software Reliability Modeling

L-30; TOTAL HOURS – 30**REFERENCES :**

1. Betsy Beyer, Chris Jones, "Site Reliability Engineering", O'Reilly Publishers, 1st Edition, ISBN: 9781491929124, 2016.
2. Shigeru Yamada "Software Reliability Modeling: Fundamentals and Applications", Springer publishers, ISBN: 9784431545644, 2014.
3. Michael R. Lyu, "Handbook of Software Reliability Engineering", Tata McGrawHill Publications, ISBN: 9780070394001, 2005.

OUTCOMES :

Students who complete this course will be able to

- Know the process and basic activities of software reliability engineering
- Apply methods for ensuring, evaluation and enhancing of software reliability
- Work better with other professionals at an organization to make decisions about the reliability of software.
- Implement different software reliability models and to evaluate the reliability of developed tool using different methods and tools.
- Apply the knowledge and select an appropriate software reliability model
- Perform an evaluation of software reliability and in case of necessity to enhance reliability.

CSC X149	AAIP – ANIMATION WITH PORTFOLIO DEVELOPMENT	L	T	P	C
		2	0	2	3

OBJECTIVES :

- To design a character for both 2D and 3D animation.
- To create new animations that may be needed to supplement existing body of work
- To develop a high quality student animation reel.
- To design and create a web-base location to host animation samples.
- To create a portfolio specific to a particular medium and purpose.
- To demonstrate skill in industry standard tools and techniques of 3D Animation.

MODULE I INTRODUCTION 10

How animation works – Flipping, Flicking and Rolling – Bouncing ball in 2D and 3D–
Principles of animation- How to design a 3D Character

MODULE II ANIMATION OF INANIMATED OBJECTS 10

Inanimate Objects: Weight, Solidity, Force- Animation of Solids: Bowling Ball, Soccer
Ball– Animation of Liquids: Drip, Splash – Animal walks.

MODULE III ANIMATIONS & REALISM 10

Design of Animation sequences – animation function – raster animation – key frame
systems – motion specification –morphing – tweening.

PRACTICAL

- 2D Digital Animation
- Basic Scripting & Interactivity
- 2D Animation Portfolio
- Claymation – A stop-motion animation technique
- 3D Basics – Modeling to Animation
- Modeling in 3D
- 3D Animation Portfolio
- Pixar RenderMan
- Crowd Simulation

- 3D Projection Mapping
- Augmented Reality
- 3D Modeling
- Texturing, Lighting & Rendering
- Paint Effects - Visor
- Portfolio Demo Reel

L-30; P-30; TOTAL HOURS-60

REFERENCES :

1. Steve Roberts, "Character animation fundamentals: Developing skills for 2D and 3D character Animation", Elsevier Ltd, ISBN:9780240522272,2012.
2. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, Kelvin Sung, and AK Peters, "Fundamental of Computer Graphics", CRC Press, Fourth edition, ISBN: 9781498785907, 2015.
3. Chris Webster,"Action Analysis for Animators", Focal Press; 1 edition,ISBN-13: 978-0240812182,2012
4. Sheila Graber, "Animation A Handy Guide",A&C Black Published , first edition, ISBN: 978140810283, 2009.

OUTCOMES :

Students who complete this course will be able to

- Create work in a variety of animation techniques including 3D animation, stop- motion and experimental methods.
- Collect and review body of personal animation samples
- Discuss learning experiences across disciplines in the University and establish connections to their own animation practices.
- Build and manipulate web media objects using editing software.
- Make animated sequences from the development of the original concept through design to final film or video production.
- Integrate the concepts, principles and theories involved in the physics of animation in all aspects of drawing.

CSC X150	Advanced SAS: Macros & SQL	L	T	P	C
		2	0	0	2

OBJECTIVES :

- To impart about basics of statistical analysis.
- To render the students to apply data analysis concepts.
- To expose the students to use macros and automate a process.
- To apply the SAS concepts in data management, applications development and data warehousing.
- To create macro programs to reduce the complexity of SAS
- To use SQL and SAS in effective database management.

MODULE I	DATA MANIPULATION AND THE SAS PROGRAMMING LANGUAGE	10
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Introduction to SAS- Reading Raw Data from External Files - Displaying Your Data- Using Advanced INPUT Techniques.

MODULE II	SAS MACRO LANGUAGE	10
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Introduction- Macro Variables-Built-In Macro Variables - LET Statement - Demonstrating a Simple Macro- Tokens -a Macro Variable as a Prefix –transfer of value between DATA Steps.

MODULE III	SAS STRUCTURED QUERY LANGUAGE	10
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Basics-Joining Two Tables (Merge) -Left, Right, and Full Joins-Concatenating Data Sets -Summary Functions -an ORDER Clause -Fuzzy Matching.

L-30; TOTAL HOURS – 30

REFERENCES :

1. Alan C. Elliott, Wayne A. Woodward "SAS Essentials: Mastering SAS for Data Analytics, 2nd Edition, ISBN: 978-1-119-04216-7, 2015
2. Ron Cody, "Learning SAS® by Example: A Programmer's Guide", Sas Inst Edition ISBN: 9781599941653, 1599941651, 2010

OUTCOMES :

Students who complete this course will be able to

- Develop new macro code to write more efficient SAS programs .
- Utilize the SQL procedure as an easy, flexible way to query and combine your data.
- Apply advanced SAS programming techniques such as creating samples and indexes, using lookup tables to match data, and modifying and tracking data set changes.
- Transcribe SAS programs to maximize efficiency.
- Create SAS variables and recode data values.
- Using advanced DATA step programming statements to improve efficiency.

CSC X151	ADVANCED PROGRAMMING FOR DATA SCIENCE WITH PYTHON	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To know the basics of Data science.
- To Learn different types of tools for data science.
- To Learn the advanced NumPy (Numerical Python) features.
- To provide computational environments for data scientists using Python.
- To expose the features of DataFrame for efficient storage and manipulation of labeled/columnar data in Python
- To know the capabilities for a flexible range of data visualizations in Python

MODULE I INTRODUCTION 07

Data Science – Python for Data Analysis – Essential Python Libraries – Installation and setup – Dataset Retrieval.

MODULE II IPYTHON 08

IPython: Beyond normal Python – Launching IPython Shell – Launching Jupiter Notebook – Exploring Modules with Tab completion – shortcuts – Ipython Magic Commands – Running External Code – In and Out Objects.

MODULE III NUMPY 08

Understanding Data Types in Python - The Basics of NumPy Arrays - Computation on NumPy Arrays: Universal Functions - Aggregations: Min, Max- Computation on Arrays: Broadcasting - Comparisons, Masks, and Boolean Logic - Fancy Indexing.

MODULE IV DATA MANIPULATION WITH PANDAS 08

Introducing Pandas Objects - Data Indexing and Selection - Operating on Data in Pandas - Handling Missing Data - Combining Datasets: Concat and Append - Combining Datasets: Merge and Join.

MODULE V VISUALIZATION WITH MATPLOTLIB 08

Simple Line Plots - Simple Scatter Plots - Visualizing Errors - Density and Contour Plots - Histograms, Binnings, and Density - Customizing Plot Legends - Customizing Colorbars - Text and Annotation.

MODULE VI APPLICATIONS**06**

Analyzing unstructured data with Text Mining – Python in Big Data -Real Time Applications - Case Study.

L – 45; TOTAL HOURS-45**REFERENCES :**

1. Jake VanderPlas, “Python Data Science Handbook: Essential Tools for Working with Data”, O’Reilly Media, 1st Edition, ISBN: 9781491912058, 2016.
2. Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython”, O’Reilly Media, 1st Edition, ISBN: B009NLMB8Q, 2012.
3. Joel Grus, “Data Science from Scratch: First Principles with Python”, O’Reilly Media, 1st Edition, ISBN: 9781491901427, 2015
4. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O’Reilly Media, 2013.

OUTCOMES :

Students who complete this course will be able to

- Use high-performance tools to load, clean, transform, merge, and reshape data.
- Apply data analysis tools in the pandas library.
- Demonstrate with Shell commands in Python.
- Apply the pandas groupby facility to slice, dice, and summarize datasets.
- Create scatter plots and static or interactive visualizations with matplotlib.
- Solve real world problems in web analytics, social sciences, finance, and economics.

Physics Elective Courses**(to be offered in II Semester)**

PHCX 01	FUNDAMENTALS OF ENGINEERING MATERIALS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To help students to acquire the properties and applications of conducting and semiconducting materials.
- To familiarize students with basic ideas about the properties of dielectric and magnetic materials and their applications.
- To familiarize students with basic knowledge of nanomaterials and its electrical, electronic, mechanical and magnetic properties.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I	CONDUCTING	AND	SEMICONDUCTING	7
	MATERIALS			

Conductors: properties, Fermi distribution function, Fermi energy in metals- density of states- conducting polymers-properties-applications, semiconductors: intrinsic and extrinsic semiconductors-carrier concentration, conductivity and energy band gap, semiconducting polymers- properties- applications.

MODULE II	DIELECTRIC MATERIALS	8
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Polarization- dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – Internal field - Clausius Mosotti relation - dielectric loss – dielectric breakdown – applications of dielectric materials (capacitors and transformers) – Pyroelectricity, Piezoelectricity, ferroelectricity and applications in Ferroelectric Random Access Memory (FeRAM) - multiferroic materials and its applications.

MODULE III	MAGNETIC MATERIALS	7
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Origin of magnetism-magnetic moment, susceptibility, permeability – Bohr magneton – Dia, Para and Ferro magnetism –Spontaneous magnetization- Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its application - Giant Magneto-resistance effect (GMR) - Magnetic resonance imaging(MRI).

MODULE IV NANOMATERIALS**8**

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - carbon nanotubes, graphene - nanocomposites – applications of nano materials.

PRACTICALS

1. Determination of energy band gap of a semiconductor.
2. Determination of resistivity of metals by four point probe method.
3. Determination of dielectric constant of dielectric material.
4. Determination of time constant of a capacitor using RC circuit.
5. Determination of paramagnetic susceptibility of given liquid.
6. Determination of hysteresis loss in a transformer using BH curve.
7. Analysis of size effect on the absorption spectrum of nanomaterials.

L – 30; P – 30; TOTAL HOURS – 60**REFERENCES:**

1. William D. Callister, “Material Science and Engineering”, Wiley Publications, 2006.
2. Raghavan, V., “Materials Science and Engineering”, 5th edition, Printice Hall of India Pvt Ltd. New Delhi, 2004.
3. Wahab. M.A, “Solid State Physics: Structure and Properties of Materials”, Narosa Publishing House Pvt. Ltd., New Delhi , 2nd Edition, 2010.
4. Pillai, S.O., “Solid State Physics”, New Age International, New Delhi, 2005.
5. Charles P. Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India), 2009.
6. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education (India) Private Limited, New York, 2012.

OUTCOMES:

On completion of this course, the student will be able to

- Apply the concepts of conducting and semiconducting materials for solid state devices.
- Comprehend the significance of properties of dielectric magnetic materials and derive these properties from synthesized materials.
- Differentiate between the properties of the nanomaterials compared to bulk materials.
- Complement the knowledge acquired in the theory class and correlate the Results for applications.

PRACTICALS:

1. Determination of mechanical equivalent of heat by Joule's calorimeter.
2. Relation between temperature of a body and time by plotting a cooling curve-Newton's law of cooling.
3. Determination of specific heat capacity of liquid by cooling.
4. Determination of thermal conductivity of a good conductor-Forbe's method.
5. Determination of thermal conductivity of a bad conductor-Lee's disc method.

L – 30; P – 30; TOTAL HOURS – 60**REFERENCES:**

1. Mathur. D.S, "Heat & Thermodynamics", S.Chand & Co., 2009.
2. Brijlal & Subramaniam, "Heat and Thermodynamics", S.Chand & Co, Delhi, 2010.
3. Gupta. A.B and Roy. H, "Thermal Physics", Books and Allied Ltd., 2002.
4. Sharma. J.K and Sarkar. K.K, "Thermodynamics and statistical Physics", Himalaya Publishing House, 1988.

OUTCOMES:

On completion of this course, the student will be able to

- Understand the concepts of heat and its properties.
- Comprehend the ideas governing the conduction and radiation processes.
- Apply the knowledge of laws of thermodynamics in thermodynamic systems.
- Perform heat based experiments and determine its various properties.

PHCX 03	INTRODUCTION TO NANOSCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To acquire basic knowledge about the nanomaterials and applications.
- To learn about the synthesis and imaging techniques of nanomaterials.
- To gain the basic concepts of fabrication techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I NANOMATERIALS AND APPLICATIONS 10

Properties of nanomaterials – size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties – quantum confinement – classification of nanomaterials – quantum well, quantum wire, quantum dot - nanoporous materials - zeolite, mesoporous materials, carbon nanotubes, grapheme - nanocomposites - applications (qualitative): Molecular electronics- nanoelectronics – nanophotonics - single electron transistor-drug delivery.

MODULE II SYNTHESIS AND IMAGING TECHNIQUES 12

Top-down and bottom up approaches – mechanical alloying and mechanical ball milling - sol-gel approach - hydrothermal method - precipitation method - spray pyrolysis - spin coating-self assembled monolayer (SAM) - Chemical vapour deposition method – Physical vapour deposition method: laser ablation method, sputtering method.

Optical microscopy – Phase contrast and interference microscopy – confocal microscopy - high resolution Scanning electron microscope (HRSEM) - high resolution Transmission electron microscope (HRTEM) - Atomic force microscope - Scanning Tunnelling microscope (STM).

MODULE III NANOFABRICATION 8

Photolithography - electron beam lithography - X-ray and Ion beam lithography - nanoimprint lithography - soft lithography - nanoelectromechanical systems (NEMS) - nanoindentation principles.

PRACTICALS :

1. Synthesis of nanomaterials by sol-gel method.
2. Synthesis of nanomaterials by hydrothermal method.
3. Synthesis of nanomaterials by solid state reaction method.
4. Synthesis of nanomaterials by chemical bath deposition method.
5. Synthesis of nanomaterials by co-precipitation method.
6. Synthesis of nano thin films by spray pyrolysis method.
7. Synthesis of nano thin films by pulsed laser deposition (PLD) method.
8. Analysis of size effect on the absorption spectrum of nanomaterials.
9. SEM characterization of nanomaterials.
10. AFM characterization of nano thin films.
11. Phase confirmation by XRD.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Charles P.Poole and Frank J. Owens, "Introduction to nanotechnology", Wiley (India), 2009.
2. Cao. G., "Nanostructures & Nanomaterials: Synthesis, Properties & Applications", Imperial College Press, 2004.
3. Gaddand. W., Brenner. D., Lysherski. S. and Infrate. G.J., "Handbook of NanoScience Engineering and Technology", CRC Press, 2002.
4. Pradeep. T., "Textbook of Nanoscience and Nanotechnology", McGraw Hill Education (India) Private Limited, New York, 2012.
5. Chris Mack, "Fundamental Principles of Optical Lithography: The Science of Microfabrication", John Wiley & Sons, 2008.
6. Bandyopadhyay A.K., "Nano Materials", New Age International Publishers, New Delhi, 2008.

OUTCOMES:

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

- Understand the importance and basic concepts of the nanomaterials.
- Comprehend the imaging techniques for nanomaterials.
- Illustrate the various nanofabrication techniques.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 04	LASERS AND THEIR APPLICATIONS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To recognize the fundamentals of laser and its characteristics.
- To comprehend and compare the different laser systems.
- To apply lasers in metrology and material processing.
- To understand the working of laser instrumentation.
- To correlate the experimental results for applications.

MODULE I LASER THEORY 8

Spontaneous and stimulated emission - Population inversion – Einstein's A & B coefficients - Threshold condition – super-radiance Laser – Three level and four level laser systems -conditions for CW and pulsed laser action. Q-Switching - experimental methods - cavity dumping - Mode locking - experimental methods - Spatial and Temporal coherence.

MODULE II DIFFERENT LASER SYSTEMS 8

Laser systems – General description - Laser structure - excitation mechanism - Different laser systems- He-Ne laser, Carbon-dioxide laser - Excimer laser – Free electron laser- Alexandrite laser - Ti-Sapphire laser – Semiconductor diode laser - Diode pumped solid state laser - Pulsed-CW dye laser- Fibre laser.

MODULE III METROLOGICAL AND MATERIAL PROCESSING APPLICATIONS 8

CW and Pulsed laser beam characteristics and its measurements - Beam focusing effects - spot size - Power and Energy density Measurements - Distance measurement - Interferometric techniques - LIDARS - different experimental arrangements - Pollution monitoring by remote sensing - Laser gyroscope - Laser welding, drilling, machining and cutting - Laser surface treatment - Laser vapour deposition – Biophotonic applications.

MODULE IV LASER INSTRUMENTATION 7

Laser for measurement of length, current and voltage – Laser Doppler Velocimetry - Holography and speckle in displacement and deformation measurements - Laser for communication with fiber optics as channel.

PRACTICALS:

1. Tuning of Dye Laser using DFDL Arrangement
2. Determination of Brewster Angle using He-Ne laser
3. Study of transversely Pumped Dye Lasers
4. Study of longitudinally Pumped Dye Lasers
5. Determination of power and wavelength using Distributed Feedback Dye Laser (DFDL)
6. Determination of fibre optic losses using semiconductor laser.
7. Bandgap determination of a semiconductor diode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. William T. Silfvast, "Laser Fundamentals", Cambridge University Press, 2009.
2. Ghatak. A. & Thyagarajan. K. "Optical Electronics", Cambridge University, 1994.
3. Laud.B.B., "Laser and Non-Linear Optics", Second Edition, New Age International (p) Limited Publishers, 2011.
4. Nambiar. K.R., "Lasers Principle, Types and Applications", New Age International (p) Ltd, 2004.
5. Wilson. J. & Hawkes. J.F.B., "Opto Electronics - An Introduction", Prentice Hall, 1992.
6. William M.Steen, "Laser Material Processing", Springer-Verlag, Berlin, Third Edn., 2005.

OUTCOMES:

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

- To complement the knowledge acquired in the theory class.
- To work with dye lasers for tunability of laser wavelength.
- To measure the loss of information involved in fibre optic communication.
- To correlate the results for application.

PHCX 05**MATERIALS SCIENCE****L T P C****2 0 2 3****OBJECTIVES:**

- To gain basic knowledge in conducting and semiconducting materials and their properties.
- To provide basic understanding of properties and applications of dielectric materials.
- To impart knowledge on magnetic and optical materials and their properties & applications.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I CONDUCTING AND SEMICONDUCTING 10
MATERIALS

Quantum free electron theory of metals and its importance - Energy distribution of electrons in metals - Fermi distribution function - Density of energy states and carrier concentration in metals - Fermi energy – Classification of solids into conductors, semiconductors and insulators on the basis of Band theory – Introduction to Elemental and Compound semiconductors - Carrier concentration derivation for Intrinsic semiconductors - Density of electrons in conduction band & Density of holes in valence band- intrinsic carrier concentration - Fermi energy & Variation of Fermi energy level with temperature - Mobility and electrical conductivity - Band gap determination.

MODULE II DIELECTRIC MATERIALS 7

Introduction to dielectric materials & basic definitions – Electronic, Ionic, Orientation & Space charge polarizations - Total polarization – Frequency and temperature dependence of polarization - Internal field in a dielectric material - Deduction of Clausius - Mosotti's relation - dielectric loss & loss tangent – Different types of dielectric breakdown – Applications of dielectric materials : Capacitors and Transformers.

MODULE III MAGNETIC MATERIALS**6**

Introduction to magnetic materials & origin of magnetic moment - Different types of magnetic materials and their properties - Ferromagnetism & Domain theory of ferromagnetism - Hysteresis, Soft and Hard magnetic materials - Antiferromagnetic materials - Ferrites and its applications – Applications of magnetic materials : Data storage.

MODULE IV OPTICAL MATERIALS**7**

Optical properties of semiconductors - Direct and Indirect bandgap semiconductors – Traps, recombination centre, color center and exciton – Luminescence : Fluorescence and Phosphorescence - Liquid crystal display : twisted nematic crystal display – Applications of Optical materials - Optical Sources : light emitting diode and laser diode - Photo detectors : PIN photodiode and Avalanche Photodiode - Pyroelectric devices - Electro optic effect : Kerr effect and Faraday effect.

PRACTICALS:

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of dielectric constant of a given non-polar liquid.
5. Determination of magnetic susceptibility of a given paramagnetic liquid using Quincke's method.
6. Determination of energy loss of a given transformer core using hysteresis method.
7. To study the I-V characteristics of a photodiode.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Palanisamy P.K., "Physics II", Material Science for ECE, Scitech Publications (India) Pvt. Ltd., 2006.
2. Kasap. S.O., "Principles of Electronic materials and devices", McGraw Hill Publishers, 3rd Edition, 2007.
3. Arumugam. M, "Physics II", Material Science for ECE, Anuradha Publishers, 5th Edition, 2005.
4. Sze. S.M., "Semiconductor Devices – Physics and Technology", John Wiley, 2nd Edition. 2002.
5. Raghavan. V, "Materials Science and Engineering", Prentice Hall of India, 5th Edition, 2004.

OUTCOMES:

On the completion of this course, the students will be able to

- Gain knowledge about fundamentals of conducting and semiconducting materials.
- Understand concepts and applications of Dielectric and Magnetic materials.
- Familiarize Optical materials and their applications in Engineering and Medical fields.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PHCX 06	NON-DESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To study the process and applications of ultrasonic inspection method.
- To understand the basic concepts of radiographic inspection method.
- To acquire the knowledge about the various surface Non-Destructive Testing (NDT) techniques.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I ULTRASONIC INSPECTION METHOD 10

Ultrasonic Testing - Principle of operations - types of sound waves - types of Transducers - transmission and pulse-echo method - straight beam and angle beam, instrumentation - calibration methods - ultrasonic testing technique- data representation, A Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight. Diffraction - thickness determination - advantages, disadvantages and applications.

MODULE II RADIOGRAPHIC INSPECTION METHOD 10

Radiographic testing – Principle - Interaction of X-ray with matter - X-ray radiography - method of generation-industrial radiography inspection techniques – Equipment - Exposure charts - Types of films – Fluoroscopy - Xero-Radiography – Limitations - Gamma radiography - Equipment, radiation sources - method of generation - film processing - interpretations of radiography - safety in industrial radiography.

MODULE III SURFACE NDT TECHNIQUES 10

Liquid Penetrant Testing – Principles, Characteristics and types of liquid penetrants – developers - advantages and disadvantages of various methods - Inspection Procedure and Interpretation of results. Applications of Liquid Penetrant testing.

Magnetic Particle Testing - Principle-magnetizing technique - procedure – Equipment - Interpretation and evaluation of test indications - applications and limitations - demagnetization.

PRACTICALS:

1. Inspection of welds using solvent removable visible dye penetrant.
2. Inspection of welds using solvent removable fluorescent dye penetrant.
3. Inspection on non magnetic materials by eddy current method.
4. Inspection on magnetic materials by eddy current method.
5. Inspection of welds by Eddy current Testing.
6. Inspection of welds by Magnetic Particle Testing - Dry method.
7. Inspection of welds by Magnetic Particle Testing - Wet method.
8. Ultrasonic flaw detector - Inspection of defects.
9. Demonstration of Radiographic inspection.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Baldev Raj., Jayakumar T., Thavasimuthu., "Practical Non-Destructive Testing", Narosa Publishing House, 2009.
2. Ravi Prakash., "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010.
3. ASM Metals Handbook of Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA, Volume-17, 2000.
4. Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition New Jersey, 2005.
5. Charles J., Hellier, "Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- Illustrate the ultrasonic inspection methods of NDT.
- Understand the basic concept of radiographic inspection method.
- Test the surfaces by the various surface NDT techniques.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

PRACTICALS:

1. Determination of viscosity of liquid by Poiseuille's method.
2. Determination of viscosity of liquid by Stoke's method.
3. Analysis of stress by photo elastic method.
4. Verification of Hooke's law by spring method.
5. Determination of Young's modulus of the cantilever beam.
6. Determination of rigidity modulus by static torsion method.
7. Visit to acoustically good auditorium and identifying the sound absorbing materials in the auditorium.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Mathur D.S., "Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Gaur R.K., Gupta S.L., "Engineering Physics", Dhanpat Rai Publishers, 2010.
3. Brijlal and Subramaniam., " Properties of Matter", Eurasia Publishing Co, New Delhi, 2002.
4. Smith C.J., " General Properties of Matter", Orient & Longman, 1960.
5. Kenneth G. Budinski and Michel K., Budinski, "Engineering Materials Properties and Selection", Pearson, Singapore, 2002.

OUTCOMES:

Upon completion of this course, the students will be able to

- Understand the basic concepts of the elasticity of materials.
- Comprehend the concepts of viscosity of liquid and measurement.
- Demonstrate the acoustical aspects of building and its importance in construction.
- Apply the fundamental concept of photo elasticity for the stress analysis of The object.

PHCX 08	PROPERTIES OF MATTER AND NONDESTRUCTIVE TESTING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To impart knowledge about the principles and properties of elasticity.
- To learn the laws governing the dynamic of rigid bodies.
- To acquire the knowledge of the various techniques of Non-Destructive Testing (NDT) of materials.
- To understand the principle and basic concept of low temperature applications.

MODULE I ELASTICITY 8

Stress and strain - Hooke's Law of elasticity - Elastic moduli - Stress-Strain Diagram - Poisson's Ratio - Relation between elastic constants - Work done in stretching and twisting a wire - Twisting couple on a cylinder- Expression for bending moment-Cantilever-Expression for depression - Uniform Bending and Non-uniform bending of beams (theory & experiment) - I form Girders (qualitative treatment) and applications.

MODULE II DYNAMICS OF RIGID BODIES 8

Rigid bodies - angular acceleration - Torque on a particle - angular momentum - law of conservation of angular momentum - moment of inertia and its significance -Theorem of parallel and perpendicular axis - moment of inertia of a thin uniform bar - moment of inertia of a rectangular lamina - moment of inertia of uniform circular disc - Moment of inertia of hollow and solid cylinders – flywheel (qualitative) - kinetic energy of rotating body – Routh rule.

MODULE III NDT TECHNIQUES 6

Ultrasonic Testing- types of Transducers-transmission and pulse-echo method- Radiographic testing- Principle-Interaction of X-ray with matter-X-ray radiography-method of generation-industrial radiography inspection techniques- Liquid Penetrant Testing- Inspection Procedure and Interpretation of results.

MODULE IV LOW TEMPERATURE PHYSICS**8**

Definition of Refrigeration and Air-Conditioning - Types of Refrigeration Systems- Applications- Comfort Air Conditioning, Industrial Refrigeration, Food processing and food chain - Cryogenic treatment - Low temperature properties of engineering materials: Mechanical properties, Thermal properties, Electrical properties.

PRACTICALS:

1. Verification of Hooke's law by spring method.
2. Determination of Young's modulus of the beam by bending method.
3. Inspection of welds using solvent removable visible dye penetrant.
4. Inspection of welds using solvent removable fluorescence dye penetrant.
5. Inspection of welds by Magnetic Particle Testing.
6. Determination of moment of inertia of the disc by torsion pendulum method.
7. Determination of moment of inertia of the disc by static torsion method.
8. Demonstration of working of flywheel.

L – 30; P – 30; TOTAL HOURS – 60**REFERENCES:**

1. Mathur D.S., "Elements of Properties of Matter", S.Chand & Co, Delhi, 2009.
2. Brijlal & Subramaniam, " Properties of Matter", Eurasia Publishing Co, Delhi, 2002.
3. Gaur R.K., Gupta S.L., "Engineering Physics" Dhanpat Rai Publishers, 2010.
4. Baldev Raj., Jayakumar T., Thavasimuthu M., "Practical Non-Destructive testing", Narosa Publishing House, 2009.
5. Brijlal & Subrahmanyam., "Heat and Thermodynamics" S.Chand & Company Ltd, 2002.
6. Paul E Mix., " Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition, New Jersey, 2005.
7. Charles J., Hellier., " Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.

OUTCOMES:

Upon completion of this course, the students will be able to

- Understand the basic of concept of elasticity of materials.
- Comprehend the basic concepts of motion of rigid bodies and its applications.
- Demonstrate the various ndt techniques and its importance.
- Know the low temperature systems and its applications.

MODULE IV OPTICAL DETECTORS**8**

Photo detectors - photodiodes - phototransistors - noise characteristics - PIN diode – Avalanche Photodiode (APD) characteristics - APD design of detector arrays – Charged Couple Device - Solar cells - Materials and design considerations, Thin film solar cells, amorphous silicon solar cells.

PRACTICALS:

1. Resistivity measurement of a semiconductor using four point probe method.
2. Determination of band gap of a semiconductor diode.
3. Determination of Hall coefficient of a given semiconductor material.
4. Determination of the wavelength of a given laser source using diffraction grating.
5. Determination of Planck's constant using LED.
6. To study the I-V characteristics of photodiode and phototransistor.
7. To study the characteristics of a solar cell.

L – 30; P – 30; TOTAL HOURS – 60**REFERENCES:**

1. Arumugam. M, "Physics II", Anuradha Publishers, 5th Edition, 2005.
2. Sze. S.M., "Semiconductor Devices – Physics and Technology", 2nd edn. John Wiley, 2002.
3. Wilson & J.F.B. Hawkes, "Optoelectronics – An Introduction", Prentice Hall, India, 1996.
4. Bhattacharya, "Semiconductor optoelectronic devices", Second Edn, Pearson Education, 2002.
5. Safa O. Kasap, "Optoelectronics & Photonics: Principles & Practices", Second Edn, Pearson Education, 2013.
6. Palanisamy P.K., "Semiconductor physics and optoelectronics" Scitech Publications, 2003.

OUTCOMES:

On completion of this course, the student will be able to

- Understand the principles of Physics behind semiconductor devices.
- Choose the correct semiconductors for electronic devices and display.
- Differentiate the working principle of LED and Diode Laser.
- Apply the knowledge of modulation of light for different types of optical modulators.
- Select suitable photodetectors for different types of applications.
- Complement the knowledge acquired in the theory class and correlate the results for applications.

Chemistry Elective Courses**(To be offered in II Semester)**

CHCX01	ANALYTICAL INSTRUMENTATION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with

- Principles, instrumentation and applications of different electro analytical techniques
- Different chromatographic techniques
- Principles, instrumentation and applications of various types of absorption and emission spectroscopy
- Different thermal analytical methods and their applications

MODULE I ELECTROANALYTICAL TECHNIQUES 7

Principle and applications: conductometric titrations – potentiometric titrations, ion-selective electrodes and pH-metry – coulometry – voltammetry - polarography, amperometric titrations.

MODULE II CHROMATOGRAPHY 8

Basic concepts of chromatography – paper chromatography – column chromatography – thin layer chromatography – gas chromatography – high performance liquid chromatography – gel permeation chromatography.

MODULE III SPECTROSCOPY 8

Absorption spectroscopy (principle, instrumentation and applications): Colorimetric analysis – UV-Visible spectroscopy – FTIR spectroscopy - Emission Spectroscopy (principle, instrumentation and applications): fluorescence, phosphorescence and chemiluminescence – Atomic absorption spectroscopy – flame emission spectroscopy.

MODULE IV THERMAL ANALYSIS 7

Principle, instrumentation and applications: Thermogravimetric analysis – Differential thermal analysis – Differential scanning calorimetry

PRACTICALS:

1. Conductometric titrations: acid-base and precipitation titrations
2. Potentiometric titrations
3. Determination of pH of the unknown solution
4. Estimation of alkali metals using flame emission spectroscopy
5. Estimation of metal ions of coloured solutions using colorimetric analysis
6. Separation of compounds using gas chromatography
7. Separation of compounds using high performance liquid chromatography
8. Analysis of the given sample and interpretation of the data using IR, UV-Visible spectroscopy
9. Demonstration of TGA/DTA and DSC and interpretation of data.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Skoog D.A., West D.M., Holler F.J. and Crouch S.R., Fundamentals of Analytical Chemistry, 8th Edition, Thomson Brooks/Cole Publication., Singapore, 2004.
2. Willard H.H., Merritt L.L., Dean J.A. and Settle F.A., Instrumental Methods of Analysis, 7th Edition, CBS Publication, New Delhi Reprint, 2004.
3. A.I. Vogel, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Prentice Hall, London, 2008.
4. Christian G.D., Analytical Chemistry, 6th Edition, John Wiley, Singapore, 2003.
5. Fifield F.W. and Kealey D., Principles and Practice of Analytical Chemistry, 5th Edition, Blackwell Publication, London, 2000.
6. Settle F. (Editor), Handbook of Instrumental Techniques for Analytical Chemistry, Pearson Education, Singapore, 2004.

OUTCOMES:

The student will be able to

- State the principle and applications of various electro-analytical techniques
- Identify the right separation method for a given sample using different chromatographic techniques
- Explain the principle, instrumentation & applications of various spectroscopic methods and also to interpret the data
- Elaborate the principle, instrumentation and applications of various thermal Analytical techniques and interpret the data.

CHCX02	CORROSION AND ITS CONTROL	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with the

- Basic concepts, principles and factors affecting corrosion
- Types and mechanism of corrosion
- Control measures of corrosion by material selection, proper design and by applying organic coatings
- Control of corrosion by applying inorganic coating

MODULE I BASIC CONCEPTS OF CORROSION 8

Corrosion – causes and impacts of corrosion – mechanism of corrosion: Dry corrosion- oxidation corrosion - corrosion by other gases – Pilling-Bedworth rule- Corrosion by hydrogen: hydrogen blistering, hydrogen embrittlement, decarburization and hydrogen attack – corrosion of silver and copper by sulphur compounds – liquid metal corrosion (embrittlement or cracking) – Wet corrosion : hydrogen evolution – presence and absence of oxygen and absorption of oxygen –difference between dry and wet corrosion-factors influencing corrosion-polarization-passivity-emf series and galvanic series- corrosion current -rate of corrosion.

MODULE II FORMS OF CORROSION 7

Forms of corrosion-conditions for electrochemical corrosion –galvanic corrosion – differential aeration corrosion: pitting, water line, wire fencing, crevice and filiform corrosion – stress corrosion – Intergranular corrosion- erosion corrosion – soil corrosion – microbiological corrosion- fretting corrosion- corrosion in composites.

MODULE III CORROSION CONTROL AND ORGANIC COATINGS 8

Corrosion control – selection of materials and designing- cathodic protection – sacrificial anode and impressed current cathodic protection – corrosion inhibitors: anodic, cathodic and vapour phase inhibitors.

Organic protective coatings – paints: constituents – functions – varnishes : types-constituents – functions – lacquers : constituents – functions –enamels-constituents – functions – special paints : fire retardant, water repellent, heat resistant, temperature indicating and luminous paints.

MODULE IV INORGANIC COATINGS**7**

Treatment of metal surface-inorganic coatings- classification- metallic coatings : anodic and cathodic coatings-hot dipping : galvanizing and tinning-electroplating—electroless plating – cementation (diffusion) : sherardizing, calorizing and chromizing – metal cladding-metal spraying – non metallic coatings (chemical conversion coatings) : phosphate, chromate, oxide coatings and anodizing – comparison of anodic and cathodic protection.

PRACTICALS:

1. Determination and comparison of rate of corrosion of metals in the presence of acid, base and neutral medium by weight loss method.
2. Determination of rate of corrosion of iron in the presence of various acids by weight loss method.
3. Determination of rate of corrosion of iron in the presence and absence of anodic Inhibitor by weight loss method.
4. Determination of rate of corrosion of iron in the presence and absence of cathodic Inhibitor by weight loss method.
5. Electroplating of base metal with copper.
6. Electrolessplating of base metal with copper
7. Chemical conversion coatings such as chromate and phosphate coatings.
8. Demonstration on the study of rate of corrosion by using cyclic voltametry.

L – 30; P – 30; TOTAL HOURS – 60**REFERENCES:**

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand & Company Ltd, New Delhi, 2014.
3. M.G. Fontana and N.G. Green, Corrosion Engineering, McGraw Hill Book Company, NewYork, 1984.
4. S. Banerjee, A.K. Tyagi, Functional Materials- Preparation, Processing and Applications, ELSEVIER Publications, London ; Waltham, MA : 2011

OUTCOMES:

Students will be able to

- Explain the mechanism, compare and enumerate the factors affecting corrosion
- Describe and identify the place and types for a given situation.
- Choose and elaborate the suitable organic coating method for a given real time situation.
- Apply a suitable metallic coating for a given situation

CHCX03	ELECTRICAL MATERIALS AND BATTERIES	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students should be conversant with

- Preparation, properties and applications of plastics used in electrical and electronic applications
- Properties and uses of electrical engineering materials
- Classification and description of different types of batteries.
- Classification and types of fuel cells

MODULE I	POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS	8
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Preparation, properties and applications: polyethylene, polypropylene, EPDM, Nylon-6,6, PVC, PTFE, polycarbonates, ABS, phenol formaldehyde, urea formaldehyde, epoxy resins – polymer blends and alloys.

MODULE II	ELECTRICAL ENGINEERING MATERIALS	7
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Conductors: Silver, Copper, Gold, Aluminum – Semiconductors: Germanium, Silicon, Gallium Arsenic – Insulating Materials: Rubbers, Mica, Plastics, Ceramics, Insulating papers – Magnetic Materials: ferromagnetic materials, paramagnetic materials, diamagnetic materials, antiferromagnetic materials, ferrites.

MODULE III	BATTERIES	7
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Electrochemical and electrolytic cell – batteries: types (primary, secondary and flow cell) – primary batteries: dry cells, alkaline batteries – secondary batteries: nickel-cadmium cell – lead acid storage cell, lithium battery: primary and secondary type – solar cell – dye sensitized solar cell.

MODULE IV FUEL CELLS**8**

Difference between batteries and fuel cells - chemistry of fuel cells - types of fuel cell (based on temperature and electrolyte) – principle, characteristic features, advantages, disadvantages and applications of polymer electrolyte membrane or proton exchange membrane fuel cell (PEMFC), direct methanol fuel cell (DMFC), alkaline fuel cell (AFC), phosphoric acid fuel cell (PAFC), molten carbonate fuel cell (MCFC) and solid oxide fuel cells (SOFC).

PRACTICALS:

1. Free radical polymerization of styrene.
2. Free radical polymerization of PMMA.
3. Preparation of phenol-formaldehyde.
4. Preparation of urea-formaldehyde.
5. Synthesis of epoxy resin.
6. Demonstration of mechanical properties of insulating materials using UTM
7. Demonstration of electrical properties of insulating materials
8. Construction of batteries using natural resources
9. Measurement of EMF for different batteries.

L – 30; P – 30; TOTAL HOURS – 60**REFERENCES:**

1. Jain P.C. and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2013.
2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
3. H.F. Mark and N. Gaylord, Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV Interscience, 2nd Ed. 1988.
4. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.
5. R.K. Rajput, A Textbook of Electrical Engineering Materials, Firewall Media, 2004
6. Vladimir S. Bagotsky, Fuel Cells: Problems and Solutions, 2nd Edition, John Wiley and Sons, 2012.
7. B. Viswanathan and M. Aulice Scibioh, Fuel Cells: Principles and Applications, Taylor and Francis Group, 2007.

OUTCOMES:

The student will be able to

- Summarize the preparation, properties and applications of plastics used in electrical and electronic applications
- Enumerate the properties and uses of electrical engineering materials
- Illustrate various types of batteries with the aid of a diagram
- Classify the fuel cells and elaborate the different types of fuel cells.

CHCX04**ENGINEERING MATERIALS****L T P C****2 0 2 3****OBJECTIVES:**

The students should be conversant with

- Properties and uses of different types of refractories and abrasives
- Adhesives, cements and lime, setting of cements and their chemical behaviors.
- Types, properties and uses of lubricants.
- Various types of composite materials.

MODULE I REFRACTORIES AND ABRASIVES**8**

Introduction refractory: - classification - based on chemical nature-characteristic and selection of good refractory - general manufacture of refractory- preparation properties and uses of: silica refractory - magnesite refractory - zirconia refractory, properties of refractories: refractoriness - refractoriness under load - thermal spalling - porosity and dimensional stability, Cermets - super refractory.

Abrasives : introduction - Moh's scale - natural abrasives: diamond – corundum – emery - garnet and quartz, synthetic abrasives: preparation properties and uses: carborundum (silicon carbide)– alundum - boron (norbide) carbide.

MODULE II ADHESIVES AND BINDING MATERIALS**7**

Introduction - classification of adhesives –advantage –limitation of adhesive bonding –development of adhesive- factors influencing adhesive action: chemical and physical, application techniques of adhesive – Lime: classification – manufacture - setting and hardening, Gypsum: -Manufacture and properties and uses - Cement : chemical composition- Manufacture – setting and hardening – concrete – weathering of cement and concrete and its prevention- special cements: high alumina cement - sorel cement - white portland cement – water proof cement.

MODULE III LUBRICANTS 7

Introduction –functions of lubricant- mechanism of lubrication - classification of lubricant – liquid lubricant: vegetable and animal oils – mineral oils, semisolid: grease(calcium, lithium, aluminium) – petroleum jelly, solid lubricant: graphite - molybdenum disulphide, Properties of lubricant: viscosity - viscosity index - flash point and fire point - cloud point and pour point – oiliness - aniline point - carbon residue.

MODULE IV COMPOSITE MATERIALS 7

Introduction – advantageous characteristics of composites, applications of composites, main constituent of composites, types and applications of composites: RCC fibre-reinforced plastics (glass , carbon and aramid) - particulate composite - metal matrix composite - layered composites - failures in fibre-reinforced composites, ceramic matrix composites (CMC) – properties and applications.

PRACTICALS:

1. Preparation of refractory bricks
2. Preparation of abrasive papers/cloth
3. Preparation of simple adhesives
4. Estimation of alkalinity in cements
5. Determination of cloud point and pour point
6. Determination of flash point and fire point
7. Preparation of fibre-reinforced composite

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. B.Sivasnagar, “Engineering Chemistry”, Tata McGraw-Hill Publication Limited, New Delhi, second reprint 2008.
3. Engineering Chemistry, Wiley India Editorial Team, Wiley India Publisher, New Delhi, 2011.
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand & Company Ltd, New Delhi, 2014.

OUTCOMES:

The student will be able to

- Classify and describe the manufacture the refractories and enumerate the properties and uses of abrasive materials.
- Elaborate the manufacture, properties and uses of various adhesives and binding materials.
- Classify lubricants and describe the properties and uses of them
- Enumerate the properties and uses of various composite materials.

CHCX05	FUELS AND COMBUSTION	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the students conversant with the

- Three types of fuels available and the different processes involved in it.
- Analysis of fuel characteristics and manufacture of fuels
- Calculations involved in calorific values and minimum air requirement for complete combustion.
- Classification, functions, mechanism and properties of lubricants.

MODULE I SOLID FUELS 7

Characteristics of good fuel. Solid fuel – Wood, Coal – Ranking of coal – selection of coal. Analysis of coal – Proximate analysis. Pulverized coal – Metallurgical coke – Carbonization of coal – types. Manufacture of metallurgical coke – Beehive oven and Otto Hoffman's by-product oven methods.

MODULE II LIQUID AND GASEOUS FUELS 8

Liquid fuel: Petroleum: Refining of petroleum, Liquid fuels derived from petroleum – Cracking: Thermal (Liquid and Vapour phase) – Catalytic (fixed bed and moving bed cracking – Synthetic petrol: Fischer-Tropsch method– Knocking in petrol and diesel engine: octane number and antiknocking – cetane number and improvement of cetane number – biodiesel (trans-esterification) – Gaseous fuels: Compressed natural gas (CNG) □ LPG – oil gas – producer gas – water (blue) gas – biogas.

MODULE III COMBUSTION 8

Calorific value: Gross and net caloric value □ Bomb Calorimeter, Gas calorimeter - Definition of combustion – calculation of minimum requirement of air (problems) – theoretical calculation of calorific values (Dulong's formula), Gross and net calorific values ((problems) – Analysis of flue gas: Orsat's gas analysis method, explosive range, Ignition temperature. Introduction to air pollution from IC (Internal combustion) engines, photochemical smog, primary and secondary pollutants.

MODULE IV LUBRICANTS**7**

Friction and wear – lubricants: definition, functions and mechanism of lubrication (thick film and thin film) –classification: liquid lubricants: animal and vegetable origin, mineral oil, blended oils, lubricating emulsions and silicones – properties of lubricating oils: viscosity and viscosity index; Flash and fire-point, Cloud and pour point, oiliness, emulsification number, volatility, carbon residue, aniline point – semisolid lubricant: greases and waxes – solid lubricant: graphite and molybdenum disulphide – nanolubricants.

PRACTICALS:

1. Testing of fuels - proximate analysis (moisture, volatile matter, ash content and fixed carbon present in coal, coke, charcoal etc)
2. Ash content and carbon residue test
3. Biodiesel synthesis by trans-esterification method (from coconut, groundnut, mustard oil, palm oil)
4. Determination of calorific value of a solid fuel using Bomb calorimeter (coal, charcoal, coke etc)
5. Determination of calorific value of a liquid fuel using Bomb calorimeter (petrol, diesel, biodiesel etc)
6. Determination of cloud point and pour point of a lubricant
7. Determination of flash and fire point of diesel.
8. Aniline Point of diesel
9. Viscosity Index of lubricants and Fuels by Viscometer
10. Flue gas analysis by Orsat's gas analysis method – Demonstration
11. Working of internal combustion engine – Demonstration

L – 30; P – 30; TOTAL HOURS – 60**REFERENCES:**

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi, 2001.
2. Engineering Chemistry, Wiley India Editorial Team, Wiley India Publisher, New Delhi, 2011.
3. John Griswold, Fuels Combustion and Furnaces, Mc-Graw Hill Book Company Inc. University of Michigan, 1946.
4. J.B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1989.
5. Bahl B.S., Tuli and Arun Bahl, Essentials of Physical Chemistry, S. Chand and Company Ltd., New Delhi, 2004.

OUTCOMES:

The students will be able to

- Compare and contrast the solid, liquid and gaseous fuels and also describe the processes involved in liquid and gaseous fuels.
- Analyse the fuel properties such as moisture, volatile matter, ash content, calorific value etc
- Calculate minimum air required for complete combustion and calorific values of fuels.
- Categorize different lubricants into three types, explain the preparation and determine their properties.

CHCX06	FUNDAMENTALS OF PHYSICAL CHEMISTRY	L	T	P	C
		2	0	2	3

OBJECTIVES:

The students will be conversant with the

- Various thermodynamic terms and relate the laws of thermodynamics in chemical processes
- Molecularity and order of reaction and derive the rate constant for different order of reactions
- Basics of adsorption of different materials and propose mechanisms and surface area measurement
- Conditions for equilibrium and learn different components at Equilibrium

MODULE I BASIC THERMODYNAMICS 8

Introduction - Thermodynamic terms - Thermodynamic equilibrium and processes - 1st law of thermodynamics: internal energy, enthalpy, heat capacity, isothermal and adiabatic expansion, Joule-Thomson effect - Zeroth law of thermodynamics: absolute temperature - 2nd law of thermodynamics: - spontaneous and cyclic process, Entropy in isothermal, isobaric and isochoric processes, work and free energy function, Maxwell's relation - 3rd law of Thermodynamics.

MODULE II CHEMICAL KINETICS 8

Rate of chemical reaction - order and molecularity of a reaction - Rate constant - kinetics of opposing, parallel and consecutive and chain reactions - isotope effects - effect of temperature on reaction rate - collision theory - absolute reaction rate theory - kinetics in enzyme catalysis.

MODULE III SURFACE SCIENCE AND CATALYSIS 8

Adsorption - adsorption isotherms - uni and bimolecular adsorption reactions - parahydrogen conversion - factors affecting adsorption – Langmuir adsorption isotherm - Hinshelwood mechanism and *Eley-Rideal* mechanism with example - adsorption of gases on solids and surface area measurement by BET method - Terms in catalysis - homogeneous and heterogeneous and enzyme catalysis with example.

MODULE IV PHASE RULE**6**

Terms involved - Conditions for equilibrium - application of phase rule to water, lead-silver system, freezing mixtures, thermal analysis: cooling curves.

PRACTICALS:

1. Determination of the heat capacity of benzoic acid, internal energy of combustion of camphor using Bomb calorimeter. Calculation of enthalpy of combustion and formation for camphor.
2. Determination of adsorption isotherm of (i) acetic acid on charcoal (ii) oxalic acid on charcoal.
3. *Kinetics of first and second order reactions.*
4. Phase rule experiments with organic compounds: (i) naphthalene and p-dichloro benzene (ii) naphthalene and diphenyl (iii) m-dinitrobenzene and p-nitro toluene.

L – 30; P – 30; TOTAL HOURS – 60**REFERENCES:**

1. Rajaram J. and Kuriacose J.C., Chemical Thermodynamics: Classical, Statistical and Irreversible, Pearson Education, India, 2013.
2. Samuel Glasstone, Thermodynamics for Chemists, Read Books, United Kingdom, 2007.
3. James E. House, Principles of Chemical Kinetics, 2nd Edition, Academic Press, United States of America, 2007.
4. Keith J. Laidler, Chemical Kinetics, Pearson Education, India, 1987.
5. Douglas M. Ruthven, Principles of Adsorption and Adsorption Processes, John Wiley & Sons, 1984.
6. Puri B.R., Sharma L.R. and Pathania M.S., Principles of Physical Chemistry, 47th Edition, Vishal Publishing Co. India, 2016.

OUTCOMES:

The student will be able to

- Calculate entropy, enthalpy and free energy change for different chemical processes
- Calculate the rate constant for any chemical and biochemical processes
- Differentiate the adsorption processes and calculate the surface area and predict the suitability of catalysts for different chemical processes
- Predict the equilibrium conditions for water, alloys, freezing mixtures and draw the thermal curves for phase transition

CHCX07	GREEN TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- Basic principles of green chemistry and green technology.
- Wastes that causes hazards to human health
- Chemicals that harms our environment
- Need for green processes in various industries

MODULE I GREEN CHEMISTRY PROTOCOL 7

Need – Significance – 12 Principles with examples – R4 model – Life cycle analysis – sustainable and cleaner production - Green Technology: definition, examples: CFC free refrigerants, green building, energy, 3D printers, nanotechnology – Awards for Green chemistry – organization promoting green chemistry.

MODULE II WASTE & WASTE MINIMISATION 8

Source of wastes: domestic, industrial, medical, nuclear, e-waste; problems; prevention – economy of waste disposal – Waste minimization techniques: general waste treatment and recycling – alternate waste water treatment technologies: hybrid process – Green computing: goals, green cloud, green ICT - Pollution statistics from various industries (Industrial case studies).

MODULE III GREEN SYNTHESIS 7

Introduction - Solvent free reactions - green reagents, green solvents in synthesis - microwave and ultrasound assisted reactions – supercritical fluid extraction – green oxidation and photochemical reactions – catalyst and biocatalysts.

MODULE IV GREEN INDUSTRIAL PROCESSES 8

Polymer industry: biodegradable polymer - textile industry: greener approaches of dyeing, waste disposal – ecofriendly agrochemicals: biofertilizers, biopesticides – Pharmaceutical industry: atom economy, reduction of toxicity, use of biocatalyst, zero waste disposal – Leather industry: greener process in tanning, crusting, surface coating – ecofriendly batteries & fuel cells.

PRACTICALS

1. Synthesis of an ionic liquids (Ex: imidazolium) and testing the solubility of organic chemicals.
2. Green bromination of stilbene (using pyridine hydrobromide).
3. Green synthesis: Photocatalytic reactions, solvent-free organic reaction – Aldol; green oxidation, green reduction.
4. Microwave assisted chemical reaction. (synthesis of aspirin, pinacol-pinacolone reaction, etc).
5. Comparison of conventional reaction with microwave assisted reactions (atom economy, solvent, etc) [Ex: aldehyde and ketones with hydrazines to give hydrazones].
6. Diels-Alder reaction in eucalyptus oil (green process).

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
2. V. K. Ahluwalia, Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.
3. Paul Anastas, John C. Warner, John Warner Joint; Green Chemistry: Theory & Practice New Ed Edition; Oxford University press, USA, 2000.
4. Rashmi Sanghi, M. M. Srivastava, Green chemistry, Narosa publishers, New Delhi, 2003.

OUTCOMES:

The students will be able to

- Outline the principles and implications of green chemistry.
- Comprehend the potential risks of waste generated and analyse the threats to human and environment.
- Integrate information into design of molecules to avoid/eliminate toxic solvents & reagents or reduce toxic products.
- Identify various alternate greener technologies for various industries.

CHCX08	ORGANIC CHEMISTRY OF BIOMOLECULES	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make students conversant with the

- Basic concepts in organic chemistry
- Types and structure of carbohydrates and lipids
- Formation of different structures of proteins from amino acid
- Structure of nucleic acids
-

MODULE I BASIC CONCEPTS IN ORGANIC CHEMISTRY 8

Classification and IUPAC nomenclature of organic compounds – stereochemistry – optical, stereo and geometrical isomerism – types of reagents: electrophiles and nucleophiles – types of reactions: addition, substitution, elimination and rearrangement reactions.

MODULE II CARBOHYDRATES, LIPIDS AND VITAMINS 7

Structure and functions of carbohydrates: mono, di, oligo and polysaccharides – lipids: phospholipids, glycolipids, sphingolipids – cholesterol – steroids – Structure, functions and deficiency disorders of fat soluble vitamins: A, D, E & K - Water soluble vitamins B & C: Thiamine, riboflavin, pantothenic acid, niacin, pyridoxine, biotin, cobalamine, folic acid and ascorbic acid.

MODULE III AMINO ACIDS, PEPTIDES AND PROTEINS 7

Aminoacids: classification, properties - peptides – polypeptides – proteins: primary, secondary, tertiary and quaternary structure – glycoproteins – lipoproteins – Enzymes: classification and functions.

MODULE IV NUCLEIC ACIDS 8

Nucleic acids – importance - structure of purines and pyrimidines – nucleotides – polynucleotides - RNA – types & structure - DNA – phosphodiester bonds – chemical, helical structure and functions – DNA replication – gene modification.

PRACTICALS:

1. Qualitative tests to identify carbohydrates.
2. Quantitative estimation of carbohydrates.
3. Separation of sugars – TLC and/or paper chromatography.
4. Quantitative estimation of lipids.
5. Separation of amino acids – TLC and/or paper chromatography.
6. Quantitative estimation of proteins by Lowry's method.

L – 30; P – 30; TOTAL HOURS – 60

REFERENCES:

1. V. K. Ahluwalia, Organic Reaction Mechanism, Narosa Publishers, New Delhi, 2002.
2. Johnson Arthur T., Biology for Engineers, CRC Press, Finland, 2011.
3. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
4. David L. Nelson, Michael M. Cox, Lehninger Principles of biochemistry, Macmillan press, London, 2010

OUTCOMES:

The students will be able to

- Classify organic compounds and explain the mechanism of various organic reactions.
- Draw the structures and enumerate the functions of carbohydrate, lipids and vitamins.
- Correlate the relationship among amino acids, peptides and proteins.
- Recognize the role of nucleic acid in the formation of rna & dna and differentiate dna & rna using their structure and function.

CHCX09	POLYMER SCIENCE AND TECHNOLOGY	L	T	P	C
		2	0	2	3

OBJECTIVES:

To make the student conversant with the

- Basic concepts of polymers, classification, types of polymerization and molecular weight & its distribution
- Preparation, properties and applications of thermoplastics and introduction to biodegradable polymers
- Properties and applications of thermosets, elastomers and frp
- Different types of moulding techniques

MODULE I BASIC CONCEPTS OF POLYMERS 8

Definitions: monomer, polymer, functionality, degree of polymerization – classification of polymers: source, structure, application, thermal processing behavior (thermoplastics and thermosets), composition and structure (addition and condensation), mechanism (chain growth and step-wise growth) – copolymer: types – Definition –nomenclature of polymers – tacticity – types of polymerization : free radical, cationic and anionic polymerization (concepts only) – average molecular weight of polymer: number, weight – molecular weight distribution (problems)

MODULE II THERMOPLASTICS AND BIODEGRADABLE POLYMERS 8

Preparation, properties and applications : LDPE, HDPE, polypropylene, PVC, PTFE, PET, polyamides (Nylon-6 and Nylon 6,6) and polycarbonates – polymer blends and alloys – basics of biodegradable polymers.

MODULE III THERMOSET RESINS, ELASTOMERS AND FRP 7

Thermoset resins : phenolic resins, amino resins (urea and melamine formaldehyde), epoxy resins, unsaturated polyesters – polyurethanes – elastomers : vulcanization of natural rubber, diene based elastomers –fibre reinforced plastics: glass, aramid and carbon.

MODULE IV MOULDING TECHNIQUES 7

Moulding constituents: functions – moulding techniques: compression, injection, extrusion (single screw), blow moulding, thermoforming, (mechanical and vacuum forming), lamination.

PRACTICALS :

1. Determination of molecular weight and degree of polymerization using Oswald's viscometer.
2. Free radical polymerization of styrene.
3. Free radical polymerization of PMMA.
4. Preparation of phenol-formaldehyde.
5. Preparation of urea-formaldehyde.
6. Synthesis of epoxy resin.
7. Synthesis of unsaturated polyester.
8. Preparation of FRP laminates.
9. Demonstration of injection moulding, compression moulding and blow moulding.

L – 30; P – 30; TOTAL HOURS – 60**REFERENCES:**

1. Billmeyer F.N., Text Book of Polymer Science, 3rd Edition, John Wiley and Sons, New York, 1994.
2. George Odian, Principles of Polymerisation, 3rd Edition, McGraw Hill Book Company, New York, 1991.
3. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
4. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
5. Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV, H.F. Mark and N. Gaylord, Interscience, 2nd Ed. 1988.
6. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.

OUTCOMES:

The student will be able to

- Classify various polymers, name the polymers and types of polymerization reactions, calculate molecular weight of polymers.
- Summarize preparation, properties and applications of thermoplastics and give examples of biodegradable polymers.
- Elaborate the properties and applications of thermosets, elastomers and frp
- Select the appropriate moulding technique for a given polymer, based on the application.

General Elective
Group I Courses
(To be offered in V semester)

GECX109	NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES :

The students should be able to

- Discuss the basic concepts of computer security, model and attacks
- Examine the major types of threats and the associated attacks
- Identify the encryption techniques in real time applications
- Understand the special requirements for wireless security and how authentication is implemented in wireless systems
- Understand the functions of Network Security Device Firewall and its types
- Interpret the various network intrusion such as computer viruses, network worms etc

MODULE I	INTRODUCTION	6
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Computer Security Concepts - The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - A Model for Network Security - Standards – classical encryption techniques.

MODULE II	SYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY	7
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Symmetric Encryption Principles - Symmetric Block Encryption Algorithms - Random and Pseudorandom Numbers - Stream Ciphers and RC4 - Cipher Block Modes of Operation

MODULE III	PUBLIC KEY CRYPTOGRAPHY AND MESSAGE AUTHENTICATION	8
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Approaches to Message Authentication - Secure Hash Functions - Message Authentication Codes - Public-Key Cryptography Principles - Public-Key Cryptography Algorithms - Digital Signatures

OUTCOMES :

Students who complete this course will be able to

- Recognize the computer security concepts, architecture attacks and model
- Distinguish the symmetric and asymmetric encryption techniques
- Apply the cryptographic algorithms in different applications
- Express the network security designs using available secure solutions such as PGP,SSL, IPSec, etc.
- Describe the firewalls principles and different types of firewalls applied in organization
- Identify abnormalities within the network caused by worms, viruses and Network related security treats.

GECX110**KNOWLEDGE MANAGEMENT**

L	T	P	C
3	0	0	3

OBJECTIVES :

- Focuses on positioning knowledge as a valuable commodity, embedded in products and in the tacit knowledge of highly mobile individual employees.
- Presents KM as a deliberate and systematic approach to cultivating and sharing an organization's knowledge base.
- Appreciate the role and use of knowledge in organizations and institutions, and the typical obstacles that KM aims to overcome
- Critically evaluate current trends in knowledge management and their manifestation in business and industry.
- Know the core concepts, methods, techniques, and tools for computer support of knowledge management
- Brings out the paradigm in terms of information technology and intellectual capital.

MODULE I**KNOWLEDGE MANAGEMENT****06**

KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – History of Knowledge Management - From Physical assets to Knowledge Assets – Expert knowledge – Human Thinking and Learning.

MODULE II**KNOWLEDGE MANAGEMENT SYSTEMS AND MODELS****09**

Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – KM cycle - Different variants of KM cycle - KM models - Implications and practical implementations.

MODULE III**CAPTURING KNOWLEDGE AND SHARING****09**

Tacit knowledge capture - Explicit knowledge codification - Knowledge taxonomies - Knowledge sharing - Communities - Obstacles to knowledge capture and sharing.

MODULE IV**KNOWLEDGE MANAGEMENT TOOLS****09**

KM System tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Knowledge capture and creation tools - Content creation tools - Data mining and knowledge discovery - Content management tools - Knowledge sharing and dissemination tools - Group ware and Collaboration tools - Intelligent filtering tools.

MODULE V KNOWLEDGE APPLICATION 06

KM at individual level - Knowledge workers - Task analysis and modeling - Knowledge application at group and organizational levels - Knowledge repositories - Knowledge reuse -Case study: e-learning

MODULE VI VALUE OF KNOWLEDGE MANAGEMENT 06

KM return on investment and metrics - Benchmarking method - Balanced scorecard method - House of quality method - Results based assessment method - Measuring success - Future challenges for KM.

L-45; TOTAL HOURS-45

REFERENCES :

1. Elias M. Awad, Hassan M. Ghaziri, "Knowledge Management", Prentice Hall, 2nd Edition, 2010.
2. Jay Liebowitz, "Handbooks on Knowledge Management", 2nd Edition, 2012.
3. Irma Becerra-Fernandez, Rajiv Sabherwal, "Knowledge Management: Systems and Processes", 2010.

OUTCOMES :

Students who complete this course will be able to

- Describe the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
- Explains the core concepts, methods, techniques, and tools for computer support of knowledge management.
- Analyze the flow of knowledge in a community of practice using appropriate tools and techniques to identify enablers and obstacles to knowledge sharing
- Sketch out the major components of a knowledge repository and explain how organizations and organizational users would make optimal use of one.
- Define organizational learning and describe the links between individual and organizational learning
- Critically evaluate current trends in knowledge management and apply it for e-learning

Group II Courses**(To be offered in VII semester)**

GECX209	USABILITY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To explore concept of usability engineering in the software development life cycle
- To create good user interface in a program or a website.
- To learn about human computer interaction with the help of interfaces that has high usability.
- Provide an overview on various usability testing methods.
- To demonstrate various assessment methods.
- To illustrate and compare the international standards, Guidelines for Internationalization.

MODULE I INTRODUCTION 6

Cost Savings – Usability Now – Usability Slogans – Discount Usability Engineering – Usability – Definition – Example – Trade-offs – Categories – Interaction Design – Understanding & Conceptualizing Interaction – Cognitive Aspects.

MODULE II USER INTERFACES 8

. Generation of User Interfaces – Batch Systems, Line Oriented Interfaces, Full Screen Interfaces, Graphical User Interfaces, Next Generation Interfaces, Long Term Trends – Usability Engineering Life Cycle – Interfaces – Data Gathering – Data Analysis Interpretation and Presentation.

MODULE III INTERACTION DESIGN 8

Process of Interaction Design - Establishing Requirements – Design, Prototyping and Construction - Evaluation and Framework.

MODULE IV USABILITY TESTING 8

Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation – Usability Testing - Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

MODULE V USABILITY ASSESSMENT METHODS 8

Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Usability Methods – Interface Standards - National, International and Vendor Standards, Producing Usable In-House Standards

MODULE VI USER INTERFACES 7

International Graphical Interfaces, International Usability Engineering, Guidelines for Internationalization, Resource Separation, Multistate Interfaces – Future Developments – Case Study.

L-45; TOTAL HOURS-45

TEXT BOOKS:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, "Interaction Design: Beyond Human - Computer Interaction", John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).
2. Jakob Nielsen, "Usability Engineering", Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES :

1. Ben Shneiderman, Plaisant, Cohen, Jacobs, "Designing the User Interface: Strategies for Effective Human Interaction", Pearson Education, 5th Edition, 2010
2. Laura M. Leventhal, Julie A. Barnes, "Usability Engineering: Process, Products, and Examples", Pearson/Prentice Hall, 2008

OUTCOMES :

Students who complete this course will be able to

- Build effective, flexible and robust user interfaces.
- Translate system requirements into appropriate human/computer interaction sequences.
- Choose mode, media and device for the application requirements.
- Illustrate the different method used in usability testing.
- Asses the various usability assessment methods.
- Demonstrate the design of graphical Interfaces.