B.S. Abdur Rahman

Crescent
Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

Regulations 2017
Curriculum and Syllabi

(Amendments updated upto June 2020)

B.Tech.
(Artificial Intelligence &
Data Science)

B.S. Abdur Rahman
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REGULATIONS 2017
CURRICULUM AND SYLLABI
(Amendments updated upto June 2020)

B.TECH.
ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

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 multidisciplinary areas of importance and to play a vital role in the Socio-Economic progress of the Country in a sustainable manner.

MISSION

- To blossom into an internationally renowned Institute.
- To empower the youth through quality and value-based education.
- To promote professional leadership and entrepreneurship.
- 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 data architect / data scientist.
- To inculcate the knowledge of mathematical foundations and algorithmic principles for effective problem solving.
- To provide knowledge in data sciencefor modern computational data analysis and modeling methodologies.
- To provide the knowledge in artificial intelligence techniquesand apply them to develop relevant models and real time products.
- To impart knowledge to analyze, design, test and implement the model 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 data science and artificial intelligence in terms of underlying statistical and computational principlesand apply the knowledge to solve practical problems.

PSO2: Implement Artificial Intelligence and data science techniques such as search algorithms, neural networks, machine learning and data analytics for solving a problem and designing novel algorithms for successful career and entrepreneurship

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REGULATIONS - 2017
B.TECH. DEGREE PROGRAMMES
(With Amendments incorporated upto June 2020)
(Under Choice Based Credit System)

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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 Programmelike Civil Engineering, Mechanical Engineering, etc.,

iii) **"Course"** means theory / practical / laboratory integrated theory / mini project / seminar / internship / project and any other subject that is normally studied in asemester like Mathematics, Physics, Engineering Graphics, Fluid Mechanics, 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 ofB.S.Abdur Rahman Crescent Institute of Science and Technologywho 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. Mechanical Engineering
10. Polymer Engineering
11. Biotechnology
12. Artificial Intelligence and Data Science
13. Computer Science and Engineering(Cyber Security)
14. Computer Science and Engineering(Internet of Things)

4.0 STRUCTURE OF THE PROGRAMME

4.1 Every Programmehas 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 or 80 hours per semester.

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

4.4 For the award of the degree, a student has to earn a minimum total credits specified in the curriculum of the respective programme of study.

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 shall 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 shall 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) are 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 shall 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 is constituted branch wise and semester wise

8.1 The composition of class committees for first and second semester is 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 is 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 three times during the semester. The first meeting shall 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 shall be decided for the first and second assessment. The second meeting shall be held within a week after

the date of first assessment report, to review the students' performance and for follow up action.

8.4 During these two meetings the student members, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process, curriculum and syllabi, etc.

8.5 The third 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 ENROLLMENT

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

9.2 For the subsequent semesters registration for the courses shall be done by the student one week before the last working day of the previous 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 continuous assessment testfor 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 continuous assessment testof 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 shall 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 ENROLLMENT & 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:

Assessments	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 Examination	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 shall 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 for the award of pass grade.

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 shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also submit an internship completion certificate issued by the industry / research organisation.

The weightage for Industry internship 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, an oral examination (viva voce) shall be conducted as semester end examination by an external examiner approved by Controller of Examinations. The weightage for periodic reviews shall be 50%. Of the remaining 50%, 20% shall be for the project report and 30% for the Viva Voce examination.

13.8 Assessment of seminars and comprehension shall 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 shall 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 is absent, for genuine reasons, may be permitted to write a substitute examination for any one of the two continuous assessment tests of a course by paying the prescribed substitute examination fee. 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 Head of the Department / Dean of School for that purpose. However there is no substitute examination for semester end examination.

14.2 A student 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 assessment test. However the substitute examination will be conducted only after the last working day of the semester and before the 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 in approved events etc.) to become eligible to appear for the semester end examination in that course, failing which the student shall be awarded "I" grade in that course. The cases in which the student is awarded "I" 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 shall consolidate and furnish the list of students who have earned less that 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 redo a core course wherein "I" or "W" grade is awarded. If the student is awarded, "I" or "W" 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 "U" grade in a course shall 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 "U" grade in the redo course, the marks scored in the continuous assessment test (redo) for that course shall be considered as internal mark for further appearance of arrear examination.

15.6 If a student with "U" grade, who prefers to redo any particular course, fails to earn the minimum 75% attendance while doing that course, then he / she is not permitted to write the semester end examination and his / her earlier "U" 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 shall 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 shall 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 the School 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 contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) 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 Ci, is the number of credits assigned for the ith course and GPi is the Grade Point in the ith 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) is calculated in a similar manner, considering all the courses enrolled from first semester.

"I" and "W" grades are excluded for calculating GPA.

"U", "I", "AB" and **"W"** grades are 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 shall 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 is not counted. The students who do not satisfy the above two conditions shall be classified as second class. For the purpose of classification, the CGPA shall 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 courses under SWAYAM up to 20% of credits of courses in a semester excluding project semester 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. The credits earned through online courses ratified by the respective Board of Studies shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

19.0 SUPPLEMENTARY EXAMINATION

Students of final year can apply for supplementary examination for a maximum of three 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 three 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 in both Odd and Even Semester.

20.0 PERSONALITY AND CHARACTER DEVELOPMENT

20.1 All students shall enroll, on admission, in any of the personality and character development programmes such as NCC, NSS, NSO, YRC, Rotaract, etc., and undergo related activities during the period of study.

21.0 DISCIPLINE

21.1 Every student is expected to observe disciplined and decorous behaviour both inside and outside the campus and not to indulge in any activity which tends to affect the reputation of the Institution.

21.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HOD / Dean shall be referred to a Discipline and Welfare Committee constituted by the Registrar 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. degreeprovided 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, etc.

iii) no disciplinary action pending against him/her.

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

23.0 MINOR DEGREES OFFERED FOR STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2020- 21

23.1 The students admitted inthe following B.Tech.Programmes from the academic year 2020 – 21 can graduatewith a minordegree, which is optional, along with a major degree:

• Civil Engineering	• Mechanical Engineering
• Electronicsand Communication Engineering	• Electrical and Electronics Engineering
• Automobile Engineering	• Aeronautical Engineering
• Polymer Engineering	• Biotechnology Engineering
• Electronics and Instrumentation Engineering	• Computer Science and Engineering
• Information Technology	• Artificial Intelligence and Data Science

• Computer Science and Engineering (IoT)	• Computer Science and Engineering(Cyber Security)

23.2 The eligibility for choosing the minor degree is given as below:

Sl. No.	Minor Degree (Optional)	Eligible Major Degree Programmes (from other Departments)
1.	Artificial Intelligence and Machine Learning	Mechanical Engineering Aeronautical Engineering
2.	Block Chain	Polymer Engineering
3.	Cyber Security	Automobile Engineering
4.	Data Science	Civil Engineering
5.	Internet of Things (IoT)	Biotechnology Electrical & Electronics Engg. Electronics & Instrumentation Engg.
6.	Virtual and Augmented Reality	Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electrical & Electronics Engineering Electronics & Instrumentation Engg. Electronics & Communication Engg.
7.	Sensor Technology	Mechanical Engineering Aeronautical Engineering Polymer Engineering Automobile Engineering Civil Engineering Biotechnology Electrical & Electronics Engg.
8.	Robotics	Artificial Intelligence and Data Science Computer Science &Engg. (Cyber Security) Computer Science & Engineering (IoT) Computer Science & Engineering Information and Technology Civil Engineering Biotechnology Electrical & Electronics Engg. Electronics & Instrumentation Engg.
9.	3D Printing	Artificial Intelligence and Data Science Computer Science &Engg. (Cyber Security)

		Computer Science & Engineering (IoT)
		Computer Science & Engineering
		Information and Technology
		Biotechnology
		Electrical & Electronics Engg.
		Electronics & Instrumentation Engg.
		Electronics & Communication Engg.
10.	Electric Vehicles	Artificial Intelligence and Data Science
		Computer Science &Engg. (Cyber Security)
		Computer Science & Engineering (IoT)
		Computer Science & Engineering
		Information and Technology
		Civil Engineering
		Biotechnology
		Electronics &Communication Engg.
11.	Industrial Automation	Artificial Intelligence and Data Science
		Computer Science &Engg. (Cyber Security)
		Computer Science & Engineering (IoT)
		Computer Science & Engineering
		Information and Technology
		Mechanical Engineering
		Aeronautical Engineering
		Polymer Engineering
		Automobile Engineering
		Civil Engineering
		Biotechnology
		Electronics & Communication Engg.
12.	GIS and Remote Sensing	Artificial Intelligence and Data Science
		Computer Science &Engg. (Cyber Security)
		Computer Science & Engineering (IoT)
		Computer Science & Engineering
		Information and Technology
		Mechanical Engineering
		Aeronautical Engineering
		Polymer Engineering
		Automobile Engineering
		Biotechnology
		Electrical & Electronics Engg.
		Electronics & Instrumentation Engg.
		Electronics & Communication Engg.

13.	Computational Biology	Artificial Intelligence and Data Science
		Computer Science &Engg. (Cyber Security)
		Computer Science & Engineering (IoT)
		Computer Science & Engineering
		Information and Technology
		Mechanical Engineering
		Aeronautical Engineering
		Polymer Engineering
		Automobile Engineering
		Civil Engineering
		Electrical & Electronics Engg.
		Electronics & Instrumentation Engg.
		Electronics & Communication Engg.

23.3 A student shall earn an additional 18 to 20 credits for the award of minor degree.

23.4 A student shall be awarded a minor degree only when he / she completes the requirements for the award of major degree stipulated in the respective programme.

24.0 POWER TO MODIFY

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

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B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE ANDTECHNOLOGY
B.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
CURRICULUM & SYLLABUS, REGULATIONS 2017

SEMESTER I

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/	English /	3	0	0	3
		ISC 1181/	Arabic /				
		LNC 1181/	Mandarin /				
		LNC 1182/	German /				
		LNC 1183	Japanese				
3.	BS	PHC 1181	Physics	3	0	2	4
4.	ESF	GEC 1101	Engineering Graphics	2	0	2	3
5.	ESF	GEC 1102	Engineering Design	2	0	0	2
6.	ESF	GEC 1103	Basic Engineering Practices Laboratory	0	0	2	1
7.	EC	CSC 1151	Programming in C and C++	3	1	0	4
8.	EC	CSC 1152	C and C++ Lab	0	0	2	1

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SEMESTER II

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 1281	Partial Differential Equations and Transforms	3	1	0	4
2.	BS	-	Physics Elective	2	0	2	3
3.	ESF	GEC 1211	Basic Engineering Mechanics	3	1	0	4
4.	BS	GEC 1212	Environmental Studies	2	0	0	2
5.	EC	CSC 1251	Introduction to Artificial Intelligence	3	0	0	3
6.	EC	CSC 1252	Programming in Python Language	3	0	0	3
7.	EC	CSC 1253	Digital Logic Design	3	0	2	4
8.	EC	CSC 1254	Python Programming Laboratory	0	0	2	1

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SEMESTER III

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 2181	Statistics	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 2151	Data Structures and Algorithms	3	1	0	4
5.	EC	CSC 2152	Fundamentals of Operating System	3	0	0	3
6.	EC	CSC 2153	Principles of Software Engineering	3	0	0	3
7.	EC	CSC 2154	Database Management and SQL	3	0	0	3
8.	EC	CSC 2155	Data structures and Algorithms Laboratory	0	0	2	1
9.	EC	CSC 2156	Database Management and SQL Laboratory	0	0	2	1

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SEMESTER IV

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	BS	MAC 2281	Probability	3	1	0	4
2.	HS	-	Humanities Elective II	2	0	0	2
3.	HS	ENC 2281	Written Communication	0	0	2	1
4.	EC	CSC 2251	Networking Methodologies	3	0	2	4
5.	EC	CSC 2252	Design and Analysis of Algorithms	3	1	0	4
6.	EC	CSC 2253	Knowledge Engineering	3	0	0	3
7.	EC	CSC 2254	Data warehousing and data mining	3	0	0	3
8.	EC	CSC 2255	Design and Analysis of Algorithms Laboratory	0	0	2	1
9.	EC	CSC 2256	Data mining Tools Laboratory	0	0	2	1

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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	ENC3181	Communication & soft skill - I	0	0	2	1
4.	EC	CSC 3151	Foundation of data science	2	0	0	2
5.	EC	CSC 3152	Artificial Neural Networks	3	0	0	3
6.	EC	CSC 3153	Cloud Computing Services	2	0	0	2
7.	EC	CSC 3154	Data Visualization	3	0	0	3
8.	EC	CSC 3155	Pattern Recognition	3	0	0	3
9.	EC	CSC 3156	Machine Learning Techniques	3	0	0	3
10.	EC	CSC 3157	Machine Learning Laboratory	0	0	2	1
11.	EC	CSC 3158	Data Visualization Laboratory	0	0	2	1

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SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	EF	MSC 3281 MSC 3282	CEO and Leadership Training / Social Entrepreneurship	3	0	0	3
2.	BS	MAC 3281	Statistical Methods for Data Analysis	2	0	0	2
3.	HS	ENC3281	Communication and soft skill - II	0	0	2	1
4.	EC	CSC 3251	Data Analytics	3	0	0	3
5.	EC	CSC 3252	Fundamendal concepts of IoT	3	0	0	3
6.	EC	CSC 3253	Exploratory Data Analysis	3	1	0	4
7.	EC	CSC 3254	Natural Language Processing	3	0	0	3

8.	EC	CSC 3255	Data Security	3	0	0	3
9.	EC	CSC 3256	Data AnalyticsLaboratory	0	0	2	1
10.	EC	CSC 3257	Mobile App Laboratory	0	0	2	1

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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 4151	Software Process and project management	3	0	0	3
3.	EC	CSC 4152	Predictive Analytics	3	0	0	3
4.	EC	CSC 4153	Deep Learning Algorithm and Architectures	3	1	0	4
5.	EC	CSC 4154	Model Deployment Laboratory / Mini Project	0	0	2	1
6.	EC	CSC 4155	Internship				1
7.	PE	-	Programme Elective ##1				9**

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SEMESTER VIII

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C	
1.	EC	CSC 4251	Project Work	0	0	24	12	**12**

Total credits – 176

* 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 ##1   (3+3+3*)
Elective 1

No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CSCX 501	IoT Architecture and Protocol	3	0	0	3
2.	PE	CSCX 502	Intelligent Information Retieval	2	0	0	2
3.	PE	CSCX 503	Advanced SAS Programming	2	0	0	2
4.	PE	CSCX 504	Advanced Python for Datascience	3	0	0	3
5.	PE	CSCX 505	Web and Social media mining	1	0	0	1
6.	PE	CSCX 506	Statistics for Business Analytics	3	0	0	3
7.	PE	CSCX 507	Automata Theory	2	0	0	2
8.	PE	CSCX 508	Web and Social Media Analytics	2	0	0	2
9.	PE	CSCX 509	Advanced Artificial Intelligence Systems	3	0	0	3
10.	PE	CSCX 510	Cognitive Analytics	3	0	0	3

Elective 2

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CSCX 511	Secure Cloud Computing	3	0	0	3
2.	PE	CSCX 512	Security Risk Assessment and Management	3	0	0	3
3.	PE	CSCX 513	Information Security	1	0	0	1
4.	PE	CSCX 514	Information Security and Legal Compliance	2	0	0	2
5.	PE	CSCX 515	Cyber Crime and Computer Ethics	2	0	0	2
6.	PE	CSCX 516	Secure Web App	2	0	0	2

7.	PE	CSCX 517	Database Security and Auidting	2	0	0	2
8.	PE	CSCX 518	Block Chain	3	0	0	3
9.	PE	CSCX 519	Ethics in Data Science	3	0	0	3
10.	PE	CSCX 520	Computer Security	2	0	0	2
							3

Elective 3

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CSCX 521	Applied Machine Learning	2	0	0	2
2.	PE	CSCX 522	Expert System	3	0	0	3
3.	PE	CSCX 523	Robotics and Intellgent Systems	3	0	0	3
4.	PE	CSCX 524	Agent based intelligent system	3	0	0	3
5.	PE	CSCX 525	Process Automation	3	0	0	3
6.	PE	CSCX 526	Information Technology	3	0	0	3
7.	PE	CSCX 527	Biometric Systems	2	0	0	2
8.	PE	CSCX 528	Human and Intelligent Systems	1	0	0	1
9.	PE	CSCX 529	Graph Theory and its applications in Data Science	3	0	0	3
10.	PE	CSCX 530	Business Intelligence	3	0	0	3
							3

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

** - Sum of the credits of the electives

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

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 Modelling	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.	SSCX 04	Economics of Sustainable Development	2	0	0	2
2.	SSCX 05	Industrial Sociology	2	0	0	2
3.	SSCX 06	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.	GECX 101	Disaster Management	Civil
2.	GECX 102	Total Quality Management	Mechanical
3.	GECX 103	Energy Studies	Mechanical
4.	GECX 104	Robotics	Mechanical
5.	GECX 105	Transport Management	Automobile
6.	GECX 106	Control Systems	EEE
7.	GECX 107	Introduction to VLSI Design	ECE
8.	GECX 108	Plant Engineering	EIE
9.	GECX 109	Network Security	CSE
10.	GECX 110	Knowledge management	CSE
11.	GECX 111	Cyber security	IT
12.	GECX 112	Genetic Engineering	LS
13.	GECX 113	Fundamentals of Project Management	CBS
14.	GECX 114	Operations Research	Mathematics
15.	GECX 115	Nano Technology	Physics / Chemistry
16.	GECX 116	Vehicle Maintenance	Automobile
17.	GECX 117	Fundamentals of Digital Image Processing	ECE

Group II Courses
(To be offered in VII semester)

Sl. No.	Course Code	Course Title	Offering Department
1.	GECX 201	Green Design and Sustainability	Civil
2.	GECX 202	Appropriate Technology	Civil / Mechanical
3.	GECX 203	Engineering System Modelling and Simulation	Mechanical
4.	GECX 204	Value Analysis and Engineering	Mechanical
5.	GECX 205	Industrial Safety	Mechanical
6.	GECX 206	Advanced Optimization Techniques	Mechanical
7.	GECX 207	Mat Lab Simulation	EEE
8.	GECX 208	Embedded Systems and its Applications	ECE
9.	GECX 209	Usability Engineering	CSE
10.	GECX 210	Supply Chain Management	CBS
11.	GECX 211	System Analysis and Design	CA
12.	GECX 212	Advanced Materials	Physics & Chemistry
13.	GECX 213	National Service Scheme	School of Humanities
14.	GECX 214	Automotive Pollution and Control	Automobile
15.	GECX 215	Motor Vehicle Act, Insurance and Policy	Automobile
16.	GECX 216	Principles of Communication Systems	ECE
17.	GECX 217	Lean Management	Civil

Sl. No.	Course Code	Course Title	Offering Department
18.	GECX 218	Spatial Data Modeling & Analysis	Civil
19.	GECX 219	Advanced Entreprenuership	MBA
20.	GECX 220	Electric Vehicles	EEE
21.	GECX 221	Artificial Intelligence and Evolutionary Computing using Matlab	EEE

SEMESTER I

| MAC 1181 | DIFFERENTIAL CALCULUS AND | L | T | P | C |
| | GEOMETRY | 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

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

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

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

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

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

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 cengagelearning,UK

OUTCOMES:

After completing the course, student will be able to

- Understand the matrix techniques and compute eigen values and eigenvectors of a given matrix.

- Do the problems based on 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 expereince

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 Rosenblunperry(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 A bridged 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.

ISC1181   **ARABIC**   **L   T   P   C**

                                                          3   0   0   3

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

MODULE I   PREPARATORY ARABIC   7

Introducing Arabic Alphabets.

Listening and Reading.

Audio & Video aided listening, Tajweed listening,

Writing Arabic Alphabets (connected & unconnected).

Introducing words.

Reading simple sentences.

Learning names of the things in and around the class room.

Exercises.

MODULE II   FUNCTIONAL ARABIC   7

Listening Arabic texts, stories and action verbs

Communicating Simple sentences.

Jumla' Ismiyya and Jumla' Fi'liyya

Situational Conversation:

Greetings, Introduction.

Classroom, College, Picnic.

Dining and Kitchen.

Reading skills.

Exercises

MODULE III   FUNCTIONAL ARABIC   8

Implication of effective listening.

Audio aids.

Writing Simple sentences.

Communicating ordinal and cardinal numbers.

Situational communication:

Playground, library.

Forms of plural – Sample sentences.

Introduction to tenses.

Exercises.

MODULE IV   FUNCTIONAL ARABIC   8

Communication:

Family, travel

Market, Prayer hall

Writing skills:

Note making.

Sequencing of sentences.

Developing answers from the questions.

Exercises.

MODULE V   TECHNICAL ARABIC   8

Importance of technical communication.

Reading and writing skills.

Audio & Video aided listening.

Introduction to Arabic terms related to administration.

Situation communication:

Air travel, Office administration, passport, visa.

Exercises

MODULE VI   TECHNICAL ARABIC   7

Situation communication:

Contractual work, machineries and equipments..

Computer, internet browsing.

Banking,

Exercises.

TOTAL HOURS :45

TEXT BOOKS:

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

REFERENCES:

1. Arabic Reader for Non Arabs (UmmulQura 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 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 + Arbeitsbuchmit Audio-CD zumArbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, TilSchönherr, Hueber Publisher, ISBN 978-3-19-001801-7

2. Practice book: Tangram aktuell 1 – Lektion 1–4 (Kursbuch + Arbeitsbuchmit Audio-CD zumArbeitsbuch), Rosa-Maria Dallapiazza, Eduard von Jan, TilSchönherr, HueberPublisher, ISBN 978-3-19-001801-7.

REFERENCES:

1. NETZWERK A1 TEXTBOOK, Deutsch alsFremdsprache,StefanieDengler,PaulRusch, 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 GaikokugoDaigaku; 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 ultrasonicwaves
- study of thermal conductivities of good and badconductors
- phenomenon of wave optics and its applications
- principle of fibre optic communication and its applications tosensors
- wave mechanics principle and its applications in electronmicroscopy
- green energy physics and its environmental impacts tosociety

MODULEI   **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 dislocationsand
their significance - Surface Defects.

MODULEII   **ULTRASONICS AND THERMAL**   **8**
                         PHYSICS

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.

MODULEIII   **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, CO_2 laser and Nd:YAG laser -
Applications : Laser Materials Processing .

MODULEIV   **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.

MODULEV   **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).

MODULEVI   **RENEWABLE ENERGY SOURCES**   **7**

Present Energy sources and sustainability - Solar energy - Solar photovoltaics - 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 Wedgemethod.
4. Determination of wavelength of light using spectrometer diffractiongrating.
5. Determination of angle of divergence of a laser beam using He-Nelaser.
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. SerwayR.A.andJewett,J.W."PhysicsforScientistsandEngineerswith 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. GodfreyBoyle,"RenewableEnergy:Powerforsustainablefuture",2nd edition, Oxford University Press, UK, 2009.

OUTCOMES:

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

- understand the different types of crystalstructures
- apply the concept of ultrasonic principle in engineering and medicalfield
- calculate thermal conductivities of good and badconductors
- differentiate the various laser systems and its applications in engineering and medicalfield
- apply the principle of fibre optics for communication and sensorapplications
- formulate wave mechanics principle for applications in electronmicroscopy
- Correlate the different renewable energy sources for societalneeds.
- To complement the knowledge acquired in the theoryclass.
- To correlate the experimental results forapplication.

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 Edtion, (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 ENGINEERING   08

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**   **L T P C**
                    LABORATORY   **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 1151   **PROGRAMMING IN C AND C++**   L   T   P   C

                                                              3   1   0   4

OBJECTIVES :

- To learn advance structured and procedural programming.
- To improve the concepts of decision making in branching and Looping skills.
- To provide code organization and functional hierarchical decomposition with using complex data types.
- To implement the basic concepts of object oriented programming using C++ concepts.
- To learn how to design C++ classes for code reuse.
- To explain the concepts of inheritance and polymorphism.

MODULE I   OVERVIEW , OPERATORS AND EXPRESSIONS   07

History of C – Importance of C – Structure of C - C Tokens – Keywords and Identifiers – Constants – Variables – Data Types – Declaration of Variables – Declaration of Storage class – Assigning Values to Variables - Operators- Arithmetic, Relational, Logical, Assignment, Increment, Conditional, Bitwise, Special, Expressions - Arithmetic, Evaluation, Type Conversion

MODULE II   DECISION MAKING AND ARRAY   08

Decision Making and Branching: Simple if Statements, The if.. else statements, Nesting of if…else statements, The else…if Ladder, Switch Statements, goto Statements, Looping: While, Do…While, For Statements, Array: One-Dimensional, Two-Dimensional, Multi-Dimensional Array.

MODULE III   USER-DEFINED FUNCTIONS AND POINTERS   08

Definition of Functions - Return Values and Their types – Function Calls – Function Declaration – Category of Functions – Nesting of Functions – Recursion – Understanding Pointers – Accessing the Address of a Variable – Declaring Pointer Variable – Chain of Pointers – Pointer Expressions.

MODULE IV   OVERVIEW OF C++   08

OOP Paradigm – Basic Concepts – Benefits of OOP – Applications of OOP - Simple C++ Program – Structure of C++ Programs – Tokens – Keywords – Identifiers and Constants – Basic Data types – Operators in C++ - Control Structures.

MODULE V   CLASSES AND OBJECTS   07

Specifying a Class – Defining Member Functions - C++ Program with Class – Nesting of Member Functions – Static Data Members – Static Member Functions - Arrays of Objects – Friendly Functions – Constructors and Destructors

MODULE VI   OPERATOR OVERLOADING AND INHERTANCE   07

Operator Overloading : Unary Operators, Binary Operators –Rules for Overloading Operators – Inheritance: Defining Derived Classes – Single inheritance – Multilevel Inheritance – Multiple Inheritance – Hierarchical Inheritance – Hybrid Inheritance – Virtual Base Classes.

L-45 ;T-15;TOTAL HOURS-60

REFERENCES :

1. Richard L. Stegman, "Focus on Fundamentals of Programming with C", Ninth Edition, ISBN -170077395X, 9781700773951, 2019.
2. E.Balagurusamy, "Programming in ANSI C", McGraw Hill Education, Eighth Edition, ISBN-13: 978-93-5316-513-0, ISBN-10: 93-5316-513-X, 2019.
3. TanmeyKasby, "An Object Oriented Programming with C++", First Edition, ISBN:9788193270646, 2019.
4. E.Balagurusamy , "Object Oriented Programming with C++", McGraw Hill Education, Seventh edition, ISBN-10: 1-25-902993-X,   ISBN-13: 978-1-25-902993-6, 2017.

OUTCOMES:

Students who complete this course will be able to

* Impart knowledge on all types of operators and expressions.
* Bring out the essentials of Decision Making.
* Ability to design and develop the concept of pointers and functions.
* Apply an object-oriented approach to develop applications in various complications.
* Implement constructors and member functions using object oriented programming.
* Analyze how inheritances promote code reuse in object oriented programming.

CSC 1152   **C AND C++ LAB**   **L   T   P   C**

                                                 0   0   2   1

OBJECTIVES :

- To make familiar with the structure of C programs
- To design real time problems and find the way to implement the solution.
- To implement the Control statements, Arrays, Functions and Pointers.
- To prepare students to get full use of code reusability using object oriented programming.
- To implement the basic concepts of object oriented programming using C++ concepts.
- To focus on solving problems based on analyzing, designing and implementing programs in C and C++.

SOFTWARE REQUIRED : C/C++

Design problems and implement solutions for the following concepts:

C Programs

1. Structure of a basic program, Typeconversions and Operators
2. Decision Making – Branching and looping
3. Arrays – Sorting andsearching.
4. Functions.
5. Pointers.

C++ Programs

6. Simple C++ program with Controlstatements.
7. Classes with Object
8. Constructors and destructors.
9. Methodoverloading.
10. Operator Overloading
11. Inheritance
12. Virtual base Classes

                              P-15   TOTAL HOURS – 15

OUTCOMES :

Students who complete this course will be able to

- Acquire basic knowledge about structure of C programs.
- Debug the programs and find the solution using Decision Making.
- Create programs using arrays, functions and pointers.
- Develop programs using concepts of object oriented programming.

- Apply constructor and destructors in object oriented programming.
- Build Knowledge on reusability.

SEMESTER II

MAC 1281   PARTIAL DIFFERENTIAL EQUATIONS AND   L   T   P   C
TRANSFORMS   3   1   0   4

OBJECTIVES:

The aims of this course are to

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

MODULE I   PARTIAL DIFFERENTIAL EQUATIONS   8 + 2

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

MODULE II   FOURIER SERIES   8+2

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

MODULE III   FOURIER TRANSFORMS   7+3

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

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

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

MODULE V   LAPLACE TRANSFORM   8+2

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

Resonance - Solution of differential equations

MODULE VI   Z – TRANSFORM   7+3

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

L – 45; T – 15; Total Hours –60

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

REFERENCES:
1. Veerarajan.T., "Engineering Mathematics", 5th edition, Tata Mc Graw Hill Publishing Co. New Delhi, 2012.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.
3. Dennis G. Zill, Warren S. Wright, "Advanced Engineering Mathematics", 4th edition, Jones and Bartlett publishers, Sudbury, 2011.
4. Alan Jeffrey, "Advanced Engineering Mathematics", Academic Press, USA, 2002.

OUTCOMES:
After completing the course, student will be able to
- solve the partial differential equations.
- derive a Fourier series of a given periodic function by evaluating Fourier coefficients.
- apply integral expressions for the forward and inverse Fourier transform to a range of non-periodic waveforms.
- solve wave equation and heat flow equation.
- solve ordinary differential equations using Laplace transform.
- solve difference equation using Z-transform.

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. Hibbeller, 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

To make the student conversant with the
- various natural resources, availability, utilisation 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-utilisation 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, 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

L:30 periods
Total: 30 periods

TEXT BOOKS

1. ErachBharucha, 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 Jersy, 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.

➢ analyse 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 1251   INTRODUCTION TO ARTIFICIAL INTELLIGENCE   L   T   P   C
                                                           3   0   0   3

OBJECTIVES :

This course aims

- To impart concepts of the Artificial Intelligence.
- To learn the methods of solving problems using Artificial Intelligence.
- To introduce the fundamental concepts of Expert Systems.
- To study about problem solving techniques using various AI based algorithms.
- To understand various knowledge representation techniques.
- To provide knowledge of AI systems and its variants.

MODULE I   INTRODUCTION   08

Introduction - Foundation and history of AI - AI Problems and techniques - AI programming languages – Introduction to LISP and PROLOG – Problem spaces and searches - Blind search strategies; Breadth first - Depth first – Heuristic search techniques Hill climbing - Best first – A* algorithm AO* algorithm – game trees - Minimax algorithm – Game playing – Alpha beta pruning.

MODULE II   KNOWLEDGE REPRESENTATION   08

Knowledge representation issues – Predicate logic – logic programming – Sematic nets - Frames and inheritance - constraint propagation –Representing Knowledge using rules – Rules based deduction system.

MODULE III   REASONING UNDER UNCERTAINTY   08

Introduction to uncertain knowledge review of probability – Baye's Probabilistic inferences and Dempster Shafer theory –Heuristic methods – Symbolic reasoning under uncertainty- Statistical reasoning – Fuzzy reasoning – Temporal reasoning- Non monotonic reasoning.

MODULE IV   PLANNING AND LEARNING   07

Planning - Introduction, Planning in situational calculus - Representation for planning – Partial order planning algorithm- Learning from examples- Discovery as learning – Learning by analogy – Explanation based learning –Introduction to Neural nets – Genetic Algorithms.

MODULE V   EXPERT SYSTEMS   07

Expert systems - Architecture of expert systems, Roles of expert systems - Knowledge Acquisition - Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells.

MODULE VI   APPLICATIONS   07

Principles of Natural Language Processing Rule Based Systems Architecture - AI application to robotics - Current trends in Intelligent Systems.

L-45 ;T-0;TOTAL HOURS-45

REFERENCES :

1. Daugherty, Paul R., and H. James Wilson. Human+ machine: reimagining work in the age of AI. Harvard Business Press, 2018.
2. Prateek, J.: Artificial Intelligence with Python, pp. 14–16. Packt Publishing, Birmingham (2017).
3. Husain, Amir. The sentient machine: The coming age of artificial intelligence. Simon and Schuster, 2017.
4. Kaplan, Jerry. Artificial intelligence: What everyone needs to know. Oxford University Press, 2016.

OUTCOMES:

Upon the completion of this course, the students will be able to meet the following outcomes:

- An ability to analyze a problem, identify and define the computing requirements appropriate to its solution.
- An ability to design, implement and evaluate a system / computer based system process, component or program to meet desired needs
- An ability to identify, formulate and solve engineering problems using the concepts of Artificial Intelligence.
- Design and conduct experiments as well as analyze and interpret data using Machine Learning Algorithms
- An ability to use current techniques and skills necessary for computing and engineering practice
- Get familiarized with the tools mandatory for handling problem solving techniques

CSC 1252 **PROGRAMMING IN PYTHON LANGUAGE** L T P C
                                                  3 0 0 3

OBJECTIVES :

- Describe the core syntax and semantics of Python programming language.
- Discover the need for working with the strings and functions.
- Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.
- Indicate the use of modules, packages and built-in functions to navigate the file system.
- Infer the Object-oriented Programming concepts in Python.
- To develop the ability to write database applications in Python.

MODULE I   BASICS OF PYTHON   08

Basic concepts of Python-Variables-Data types- Operators-Conditional Statements-Looping-Control Statements-If-If else-Nested If else-Looping Statements- for-while-nested loop-Control Statements

MODULE II   PYTHON DATASTRUCTURES   08

Lists-Introduction -Accessing list-Operations-Working with lists -Function and Method-Tuple-Introduction-Accessing-Tuples-Operations- Working- Functions and Methods-Dictionaries-Introduction- Accessing values in dictionaries- Working with dictionaries- Properties- Functions

MODULE III   STRINGS AND FUNCTIONS   07

String Manipulation-Accessing Strings- Basic Operations-String slices- Function and Methods- Functions-Defining a function- Calling a function- Types of functions-Function Arguments-Anonymous functions- Global and local variables

MODULE IV   OOPS CONCEPTS   07

Classes and objects- Attributes- Inheritance- Overloading- Overriding- Data hiding

MODULE V   MODULES AND PACKAGES   08

Standard modules-Importing own module as well as external modules Understanding Packages Powerful Lamda function in python Programming using functions, modules and external packages

MODULE VI   WORKING WITH DATA IN PYTHON   07

Printing on screen- Reading data from keyboard- Opening and closing file- Reading and writing files- Functions-Loading Data with Pandas-Numpy

L-45 ;T-0;TOTAL HOURS-45

REFERENCES :

1. Larry Lutz, "Python for Beginners: Step-By-Step Guide to Learning Python Programming", CreateSpace Independent Publishing Platform, First edition, ISBN- 1717410588, 9781717410580, 2018

2. Nicholas Ayden, "Python Programming", Independently Published, First Edition, ISBN- 1707051933, 9781707051939, 2019.

3. Michał Jaworski, Tarek Ziadé, "Expert Python Programming", Packt Publishing Ltd., Third Edition, ISBN-9781789808896, 2019.

OUTCOMES:

Students who complete this course will be able to

- Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.

- Express proficiency in the handling of strings and functions.

- Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.

- Identify the commonly used operations involving file systems and packages.

- Develop cost-effective robust applications using the latest Python trends and technologies.

- Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python.

CSC 1253   **DIGITAL LOGICDESIGN**   **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 register-transfer logic for Digital Systems.

MODULE I   BINARY SYSTEMS AND LOGIC GATES   07

Digital Computers and Digital Systems - Binary Numbers – Number base conversion – Complements - Binary Codes – Binary Logic - Boolean Algebra and Theorems - Boolean functions - Canonical and Standard forms - 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 – Tabulation Method.

MODULE III   COMBINATIONAL LOGIC   08

Combinational circuits - Design procedures - Adder, Subtractor - Decimal adder – Binary Multiplier - Magnitude Comparators - Encoder - Decoder - Multiplexer – Demultiplexer.

MODULE IV   SYNCHRONOUS SEQUENTIAL LOGIC   08

Sequential Circuits - Latches and Flip Flops - Analysis of clocked 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 - Read-Only Memory –

Programmable Logic Array - Programmable Array Logic - Sequential Programmable Devices.

MODULE VI   PROCESSOR AND CONTROL LOGIC DESIGN   08

Processor Organization – Arithmetic Logic Unit – Design of Arithmetic Circuit – Design of Logic Circuit – Design of Arithmetic Logic Unit – Design of shifter – Design of Accumulator – Control Organization – Hard-wired Control – Microprogram Control – Control of Processor Unit.

L – 45; P – 30; TOTAL HOURS-75

REFERENCES :

1. Sonali Singh, "Digital Logic Design: Learn the Logic Circuits and Logic Design", Illustrated Edition, BPB Publication, ISBN:978-81-8333-5805, 2018.

2. M. Morris Mano "Digital Logic and Computer Design", Pearson Education, 2nd Edition, ISBN : 978-93-325-4252-5, 2016.

3. 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.

4. Charles H.Roth, Jr., Kinney, "Fundamentals of Logic Design", Brooks Publications, Seventh Edition, ISBN-13 :978 -1-133-62848-4, 2013.

5. 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 itsoperations

- Demonstrate the use of Karnaugh map and perform an algorithmic reduction of logicfunctions.

- Define the following combinational circuits: buses, encoders/decoders, (de)multiplexers, exclusive-ORs, comparators, arithmetic-logic units; and to build simpleapplications

- Evaluate the concepts of state and state transition for analysis and design of sequentialcircuits.

- Design and develop simple projects Using flip flops after state machine analysis.

- Expose the basics of processor and control logic design in digitalsystems.

CSC 1254   **PYTHON PROGRAMMING LAB**   **L   T   P   C**

                                                             0   0   2   1

OBJECTIVES :

- Interpret the use of procedural statements like assignments, conditional statements, loops and function calls.
- Learn the syntax and semantics and create the functions in Python.
- Infer the supported data structures like lists, dictionaries and tuples in Python.
- Illustrate the application of matrices and regular expressions in building the Python programs.
- Discover the use of external modules in creating excel files and navigating the file systems.
- Describe the need for Object-oriented programming concepts in Python.

SOFTWARE REQUIRED : Python 3.8.2

Design problems and implement solutions for the following concepts:

1. Basic Python concepts
2. Python Datastrucutres
3. String Manipulation and Functions
4. Classes and Objects
5. Overloading
6. Overriding
7. Inheritance
8. Information hiding
9. Modules and Packages
10. File handling
11. Loading Data with Pandas-Numpy

                                            P-15   **TOTAL HOURS – 15**

OUTCOMES :

Students who complete this course will be able to

- Apply the Python language syntax including control statements, loops and functions to write the programs for the wide variety of problems in mathematics, science, and games.
- Examine Python syntax and semantics and be fluent in the use of

Python flow control and functions.

- Examine the core data structures like lists, dictionaries, tuples and sets in Python to store, process and sort the data.

- Interpret the concepts of Object-oriented programming as used in Python using encapsulation, polymorphism and inheritance, polymorphism and inheritance.

- Discover the capabilities of Python regular expression for data verification and utilize matrices for building performance efficient Python programs.

- Identify the external modules for creating and writing data to excel files and inspect the file operations to navigate the file systems.

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

MODULE I CONDUCTING AND SEMICONDUCTING MATERIALS   7

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

MODULE II DIELECTRIC MATERIALS   8

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 FERAM - multiferroic materials and its applications.

MODULE III   MAGNETIC MATERIALS   7

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, grapheme - nanocomposites – applications.

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 periods, P: 30 periods, Total: 60 periods

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.
2. Pillai, S.O., Solid State Physics, New Age International, New Delhi, 2005.
3. Charles P.Poole and Frank J. Owens, "Introduction to nanotechnology", Wiley (India), 2009.
4. 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

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

| PHCX 02 | **HEAT AND THERMODYNAMICS** | **L** | **T** | **P** | **C** |
| | | **2** | **0** | **2** | **3** |

OBJECTIVES:

- To familiarize students with basic concepts of heat.
- To help students acquire the fundamentals of heat conduction and radiation.
- To enable students acquaint with the basics of thermodynamic concepts.
- To make students understand the fundamentals of heat based experiments.

MODULE I CONCEPTS OF HEAT   **10**

Definition of temperature, thermal and thermodynamic equilibrium- relationship between temperature and kinetic energy- definition of solid, liquid, gas- Introduction to phase transitions, critical and triple points- definition of heat capacity, mechanical equivalent of heat -Joule's calorimeter- latent heat- Microscopic model of ideal gas- equation of state, internal energy, equipartition theorem- equation of state for non-ideal gases.

MODULE II CONDUCTION AND RADIATION   **10**

Thermal conductivity – rectilinear flow of heat – thermal conductivity of a good conductor – Forbe's method – thermal conductivity of a bad conductor – Lee's disc method – conduction of heat through compound media-radiation – Planck's law blackbody radiation – Wien's law – Stefan's law – Newton's law of cooling from Stefan's law – Solar constant – Pyrometry.

MODULE III FUNDAMENTALS OF THERMODYNAMICS   **10**

Thermodynamic equilibrium – zeroth law of thermodynamics – first law of thermodynamics – Reversible and irreversible processes – second law of thermodynamics -Heat engine – Carnot's engine – Carnot's theorem – Internal combustion engines – petrol and diesel engines(qualitative) – Entropy – entropy and available energy – temperature – entropy diagram for Carnot's cycle - Third Law of thermodynamics(qualitative).

L : 30 periods

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 bad conductor-Lee's disc method

5. Determination of thermal conductivity of a good conductor-Forbe's method

P: 30 periods

Total: 60 periods

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.

- Understand and apply the ideas of laws of thermodynamics in thermodynamic systems.

- Perform heat based experiments and determine its various properties.

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

OBJECTIVES:
- To acquire basic knowledge about the nanomaterials and applications.
- To learn about the 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, graphene- 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
Photolithgraphy - electron beam lithography - X-ray and Ion beam lithography-nanoimprint lithography - soft lithograpy - nanoelectromechnical systems (NEMS) - nanoindentation principles.

L : 30 periods

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.

P: 30 period

Total: 60 periods

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 INSTRUMENTATION6

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.

L : 30 periods

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.

P: 30 periods

Total: 60 periods

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 a basis for understanding 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 MATERIALS   8

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   7

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   8

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 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 periods, P: 30 periods

Total: 60 periods

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 the concepts and applications of Dielectric, 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.

L : 30 periods

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.

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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.

P: 30 periods
Total: 60 periods

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.

PHCX 07   **PROPERTIES OF MATTER AND ACOUSTICS**   **L   T   P   C**
                                                         2   0   2   3

OBJECTIVES:

- To understand principles and properties of elasticity.
- To understand the basic concepts and application of viscosity.
- To analysis acoustic of building.
- To know about photoelasticity and its 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 VISCOSITY   8

Viscosity- Newton's formula for viscous flow- Streamline and turbulent motion- Reynolds number - Poiseuille's formula- Determination of coefficient of viscosity- factors affecting viscosity - capillary flow method - Stoke's formula- viscosity of highly viscous liquids – Stoke's method - Lubricants and its applications –viscosity measurements- Viscometer- Variation of Viscosity with Temperature.

MODULE III ACOUSTICS OF BUILDING   7

Basic requirement for the acoustically good halls - Reverberation and time of reverberation – Sabine's formula for reverberation time - Absorption coefficient and its measurement -Transmission of sound and transmission loss - Factors affecting the architectural acoustics and their remedy-sound absorbing materials-vibration and noise control systems for buildings.

MODULUE IV PHOTOELASTICITY   7

Polarization- double refraction-Theory of Plane, Circularly and Elliptically polarized light- Quarter wave plate and half wave plate- photo elasticity- Theory of photo-elasticity- Stress optic relations- model materials-analysis techniques- Photo elastic

bench.- Three dimensional photo elasticity-Digital photo elasticity- Photo elastic coatings.

L : 30 periods

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.

P: 30 periods
Total: 60 periods

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.
- Illustrate the fundamental concept of photo elasticity and its use for the stress analysis of the object.

PHCX 08	PROPERTIES OF MATTER AND	L	T	P	C
	NONDESTRUCTIVE TESTING	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.

L : 30 periods

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.

P: 30 periods
Total: 60 periods

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. BaldevRaj.,Jayakumar T., ThavasimuthuM.,"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.
- Illustrate the low temperature systems and its applications.

PHCX 09	SEMICONDUCTOR PHYSICS	L	T	P	C
AND OPTOELECTRONICS		2	0	2	3

OBJECTIVES:

- To understand the Physics of Semiconductor devices.
- To make the students learn the fundamentals of Photoluminous - semiconductors, Optoelectronic devices, Optical modulators/detectors.
- To make them understand the technology behind latest Display devices like LCD, Plasma and LED Panels.
- To enable the students to correlate theoretical principles with practical applications.

MODULE I   PHYSICS OF SEMICONDUCTORS   8

Elemental and compound semiconductors – Drift and diffusion current - Intrinsic semiconductors – Carrier concentration (derivation) – Fermi energy – Variation of Fermi energy level with temperature – Mobility and electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in n-type and p-type semiconductor (derivation) – Variation of Fermi level with temperature and impurity concentration – Variation of Electrical conductivity with temperature – Hall effect – Experiment and applications of Hall effect.

MODULE II   OPTOELECTRONIC DEVICES   7

Light Emitting Diodes (LED) – power and efficiency - double hetero LED - LED structure - LED characteristics - White LED – Applications. Liquid crystal displays – Dynamic scattering and Twisted nematic display, Semiconductor Lasers, Homojunction and Heterojunction laser diodes - Optical processes in semiconductor lasers.

MODULE III   OPTICAL MODULATORS   7

Modulation of light – birefringence –Modulation Techniques - Electro optic effect – Electro optic materials –Types of Electro optic Modulators :   Kerr and Pockel modulators –- Magneto optic effect - Magneto optic Modulators – Acousto Optic modulators.

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.

L : 30 periods

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.

P: 30 periods

Total: 60 periods

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.