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

B.TECH.

CIVIL ENGINEERING

(Updated Feb 2019)

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 CIVIL ENGINEERING

VISION AND MISSION

VISION

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

MISSION

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

PROGRAMME EDUCATIONAL OBJECTIVES

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

PROGRAMME OUTCOMES

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

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

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

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

REGULATIONS - 2017
B.TECH. DEGREE PROGRAMMES

1.0 PRELIMINARY DEFINITIONS & NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) **"Programme"** means B.Tech. Degree Programme.

ii) **"Branch"** means specialization or discipline of B.Tech. Degree Programme like Civil Engineering, Mechanical Engineering, etc.,

iii) **"Course"** means a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, Engineering Graphics, Computer Practice, etc.,

iv) **"Institution"** means B.S.Abdur Rahman Crescent Institute of Science and Technology.

v) **"Dean (Academic Affairs)"** means the Dean (Academic Affairs) of B.S.Abdur Rahman Crescent Institute of Science and Technology.

vi) **"Dean (Student Affairs**)" means the Dean (Students Affairs) of B.S.Abdur Rahman Crescent Institute of Science and Technology.

vii) **"Controller of Examinations"** means the Controller of Examination of B.S.Abdur Rahman Crescent Institute of Science and Technology who is responsible for conduct of examinations and declaration of results.

2.0 ADMISSION

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

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

2.2 Notwithstanding the qualifying examination the candidate might have passed, the candidate shall also write an entrance examination prescribed by the

Institution for admission. The entrance examination shall test the proficiency of the candidate in Mathematics, Physics and Chemistry on the standards prescribed for Ten plus Two academic stream.

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

3.0 BRANCHES OF STUDY

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

B.TECH. DEGREE PROGRAMMES:

1. Aeronautical Engineering
2. Automobile Engineering
3. Civil Engineering
4. Computer Science and Engineering
5. Electrical and Electronics Engineering
6. Electronics and Communication Engineering
7. Electronics and Instrumentation Engineering
8. Information Technology
9. Manufacturing Engineering
10. Mechanical Engineering
11. Polymer Engineering
12. Biotechnology
13. Cancer Biotechnology
14. Food Biotechnology

4.0 STRUCTURE OF THE PROGRAMME

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

i) Basic Sciences (BS)
ii) Humanities & Social Sciences (HS)
iii) Management Sciences (MS)
iv) Engineering Sciences Fundamentals (ESF)
v) Engineering Core Courses (EC)
vi) Professional Electives (PE)
vii) General Electives (GE)

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

4.2 Each course is normally assigned certain number of credits :

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

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

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

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

5.0 DURATION OF THE PROGRAMME

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

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

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

6.0 CLASS ADVISOR AND FACULTY ADVISOR

6.1 CLASS ADVISOR

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

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

However, for the first and second semester, the class advisors (First year class

advisors) will be nominated by the first year coordinator.

6.2 FACULTY ADVISOR

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

7.0 COURSE COMMITTEE

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

8.0 CLASS COMMITTEE

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

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

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

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

i) One senior faculty member preferably not handling courses for the concerned semester, appointed as chairman by the Head of the Department

ii) Faculty members of all courses of the semester

iii) Six student representatives (male and female) of each class nominated by the Head of the Department in consultation with the relevant faculty advisors

iv) All faculty advisors and the class advisors.

v) Head of the Department

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

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

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

9.0 REGISTRATION AND ENROLMENT

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

along with a late fee will be permitted up to the last working day of the current semester.

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

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

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

10.0 COURSE CHANGE / WITHDRAWAL

10.1 CHANGE OF A COURSE

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

10.2 WITHDRAWAL FROM A COURSE

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

11.0 TEMPORARY BREAK OF STUDY FROM PROGRAMME

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

12.0 CREDIT LIMIT FOR ENROLMENT & MOVEMENT TO HIGHER SEMESTER

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

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

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

13.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

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

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

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

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

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

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

13.6 In the case of Industrial training, the student shall submit a report, which will be evaluated along with an oral examination by a committee of faculty members, constituted by the Head of the Department. A progress report from the industry

will also be taken into account for evaluation. The weightage for report shall be 60% and 40% for Viva Voce examination.

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

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

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

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

14.0 SUBSTITUTE EXAMINATIONS

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

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

However the Substitute Examination will be conducted after the last working day of the semester and before Semester End Examination.

15.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

15.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds or representing the Institution in approved events etc.) to become eligible to appear for the semester-end examination in that course, failing which the student shall be awarded "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 will 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 re-do 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 will have the option to either write the semester end arrear examination at the end of the subsequent semesters, or to redo the course in the evening when the course is offered by the department. Marks scored in the continuous assessment during the redo classes shall be considered for grading along with the marks scored in the semester-end (redo) examination. If any student obtained "U" grade in the redo course, the marks scored in the continuous assessment test (redo) for that course will be considered as internal mark for further appearance of arrear

examination.

15.6 If a student with "U" grade, who prefers to redo any particular course, fails to earn the minimum 75% attendance while doing that course, then he / she will not be permitted to write the semester end examination and his / her earlier "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 will be the same as those during regular semesters except that there is no provision for any substitute examination and withdrawal from an evening redo course.

17.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

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

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

"W" denotes withdrawal from the course.

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

"U" denotes unsuccessful performance in the course.

"AB" denotes absence for the semester-end examination.

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

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

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

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

If Ci, is the number of credits assigned for the i^{th} course and GPi is the Grade Point in the i^{th} course

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

Where n = number of courses

The Cumulative Grade Point Average CGPA shall be calculated in a similar manner, considering all the courses enrolled from first semester.

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

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

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

Percentage Equivalent of Marks = CGPA X 10

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

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

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

CGPA will be considered up to three decimal places.

18.0 ELECTIVE CHOICE:

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

18.2 ONLINE / SELF STUDY COURSES

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

19.0 SUPPLEMENTARY EXAMINATION

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

20.0 PERSONALITY AND CHARACTER DEVELOPMENT

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

- **National Cadet Corps (NCC)** will have to undergo specified number of parades.
- **National Service Scheme (NSS)** will have social service activities in and around Chennai.

- **National Sports Organization (NSO)** will have sports, games, drills and physical exercises.
- **Youth Red Cross (YRC)** will have social service activities in and around Chennai.
- **Rotaract** will have social service activities in and around Chennai.

21.0 DISCIPLINE

21.1 Every student is required to observe disciplined and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to affect the prestige of the Institution.

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

22.0 ELIGIBILITY FOR THE AWARD OF DEGREE

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

i) successfully completed all the required courses specified in the programme curriculum and earned the number of credits prescribed for the specialization, within a maximum period of 14 semester (12 semesters for lateral entry) from the date of admission, including break of study

ii) no dues to the Institution, Library, Hostels

iii) no disciplinary action pending against him/her.

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

23.0 POWER TO MODIFY

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

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

B.TECH. CIVIL ENGINEERING

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/ ISC 1181/ LNC 1181/ LNC 1182 / LNC 1183	English / Arabic / Mandarin / German / Japanese	3	0	0	3	
3.	BS	PHC1182	Physics	3	0	2	4	
4.	BS	CHC 1181	Chemistry	3	0	2	4	
5.	ESF	GEC 1101	Engineering Graphics	2	0	2	3	
6.	ESF	GEC 1102	Engineering Design	2	0	0	2	
7.	ESF	GEC 1103	Basic Engineering Practices Laboratory	0	0	2	1	
8.	ESF	GEC 1104	Computer Programming I	1	0	2	2	**23**

SEMESTER II

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

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

SEMESTER III

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

SEMESTER IV

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

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

SEMESTER V

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

SEMESTER VI

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	MS	MSC 3181/ MSC 3182	Leadership and CEO Training/ Social Entrepreneurship	3	0	0	3
2.	BS	-	Mathematics Elective II	2	0	0	2
3.	HS	ENC3281	Communication and soft skill II – Confidence Building	0	0	2	1
4.	EC	CEC3211	Structural Analysis – II	3	0	0	3
5.	EC	CEC3212	Geotechnical Engineering II	3	0	0	3
6.	EC	CEC3213	Design of Steel Structures	3	0	0	3
7.	EC	CEC3214	Computer Modeling and Structural Design Laboratory	0	0	2	1
8.	EC	CEC3215	Survey and Geotechnical	0	0	2	1

			Investigation Camp		
9.	PE	-	Programme Elective III	6#	**23**

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	CEC4101	Estimation and Costing of Infrastructure Projects	2	0	2	3	
3.	EC	CEC4102	Design of Hydraulic Structures	2	0	0	2	
4.	EC	CEC4103	Prestressed Concrete	3	0	0	3	
5.	EC	CEC4104	Infrastructure and construction management	3	0	0	3	
6.	PE	-	Programme Elective IV	3	0	0	8##	
7.	EC	CEC4105	Industrial Internship				1***	**23**

SEMESTER VIII

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

Total credits – 175

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

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

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

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

*** Internship will be undertaken during Third year summer vacation for two weeks. The credit will be awarded in the 7th Semester.

PROGRAMME ELECTIVES
IV SEMESTER

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

V SEMESTER

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

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

VI SEMESTER

Sl. No.	Course Group	Course Code	Course Title	L	T	P	C
1.	PE	CECX30	Dynamics of Structures	3	0	0	3
2.	PE	CECX31	Advanced Concrete Design	3	0	0	3
3.	PE	CECX32	Repair and Rehabilitation of Structures	3	0	0	3
4.	PE	CECX33	Ground Improvement Techniques	3	0	0	3
5.	PE	CECX34	Pavement Design	3	0	0	3
6.	PE	CECX35	Housing, Planning and Management	3	0	0	3
7.	PE	CECX36	Building Services	3	0	0	3
8.	PE	CECX37	Engineering Ethics	3	0	0	3
9.	PE	CECX38	Environmental Risk Assessment	3	0	0	3
10.	PE	CECX39	Remote Sensing	3	0	0	3
11.	PE	CECX40	Modern Surveying	3	0	0	3
12.	PE	CECX41	Islamic Architecture	3	0	0	3

VII SEMESTER

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

4.	PE	CECX48	Prefabricated Structures	3	0	0	3
5.	PE	CECX49	Tall Structures	3	0	0	3
6.	PE	CECX50	Design of Machine Foundation	3	0	0	3
7.	PE	CECX51	Ground Water Engineering	3	0	0	3
8.	PE	CECX52	Environmental Impact Assessment	3	0	0	3
9.	PE	CECX54	GIS in Infrastructure Management	3	0	0	3
10.	PE	CECX55	Geodesy	2	0	0	2
11.	PE	CECX56	Building Information Modeling	2	0	0	2
12.	PE	CECX57	Design of cold formed Steel Structures	2	0	0	2
13.	PE	CECX58	Corrosion Control of Steel in Concrete	2	0	0	2
14.	PE	CECX59	Storm Water and Flood Management	2	0	0	2
15.	PE	CECX60	Urban & Indoor Air Quality Management	2	0	0	2
16.	PE	CECX61	Contract laws and Regulations	2	0	0	2
17.	PE	CECX62	Smart Cities	2	0	0	2
18.	PE	CECX63	Environmental Monitoring	2	0	0	2

Physics Elective Courses

(To be offered in II Semester)

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

Chemistry Elective Courses

(To be offered in II Semester)

Sl. No.	Course code	Name of the Courses	L	T	P	C
1.	CHCX01	Analytical instrumentation	2	0	2	3
2.	CHCX02	Corrosion and its control	2	0	2	3
3.	CHCX03	Electrical materials and batteries	2	0	2	3
4.	CHCX04	Engineering materials	2	0	2	3
5.	CHCX05	Fuels and combustion	2	0	2	3
6.	CHCX06	Fundamentals of physical chemistry	2	0	2	3
7.	CHCX07	Green technology	2	0	2	3
8.	CHCX08	Organic chemistry of biomolecules	2	0	2	3
9.	CHCX09	Polymer science and technology	2	0	2	3

Maths Elective Courses

(To be offered in IV Semester)

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

Maths Elective Courses

(To be offered in VI Semester)

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MACX 05	Mathematical Programming	2	0	0	2
2.	MACX 06	Statistical Methods for Data Analysis	2	0	0	2
3.	MACX 07	Numerical Methods for Integral and Differential Equations	2	0	0	2
4.	MACX 08	Mathematical 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.	SSCX04	Economics of Sustainable Development	2	0	0	2
2.	SSCX05	Industrial Sociology	2	0	0	2
3.	SSCX06	Law for Engineers	2	0	0	2

General Elective

Group I Courses

(To be offered in V semester)

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

Group II Courses

(To be offered in VII semester)

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

SEMESTER I

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

OBJECTIVES:

The aims of this course are to

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

MODULE I MATRICES 8+2

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 VARIABLES** **8+2**

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 EQUATIONS** **7+3**

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

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

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

REFERENCES:

1. Veerarajan.T., "Engineering Mathematics" (5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
2. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
3. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, Cengage Learning, 2011.

4. Dennis G. Zill, Warren S. Wright, “Advanced Engineering Mathematics”, 4th edition, Jones and Bartlett publishers, Sudbury, 2011.

5. Alan Jeffrey, “Advanced Engineering Mathematics”, Academic Press, USA, 2002.

6. Venkataraman, M.K., “Engineering Mathematics”, Volume I, 2nd edition, National Publishing Co., Chennai, 2003.

7. James Stewart “.Calculus” (7th edition),Brooks/Cole cengage learning,UK

OUTCOMES:

After completing the course, student will be able to

- Understand the matrix techniques and compute 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.

7

MODULE III

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 Rosenblun perry(2011). The Fine Art of Technical Writing. Create Space Independent Publishing Platform, New Delhi.

2. Dutt, P.K. Rajeevan. G and Prakash , C.L.N. (2007) A course in Communication Skills. Cambridge Univesity Press, India.
3. Kala, Abdul & Arun Tiwari (2004). Wings of Fire: An Autobiography (Simplified and 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 (Ummul Qura University, Makkah), Kilakarai Bukhari Aalim Arabic College, 2005.

OUTCOMES:

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

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

LNC1181	MANDARIN	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I **8**

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

MODULE II **8**

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

MODULE III **7**

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

MODULE IV **7**

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

MODULE V **8**

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

MODULE VI **7**

· Making Suggestions with *haoma* ·Colors · Clothing · Body parts · Talking about Likes and

Dislikes · Measurement Words in Chinese

TOTAL HOURS :45

TEXT BOOKS:

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

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

OUTCOMES:

On completion of the course, students will be able to

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

LNC1182	GERMAN	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I **8**

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

MODULE II **8**

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

MODULE III **7**

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

MODULE IV **7**

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

MODULE V **8**

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

MODULE VI **7**

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

TOTAL HOURS :45

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

On completion of the course, students will be able to

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

LNC1183	JAPANESE	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I **7**

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

MODULE II **8**

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

MODULE III **7**

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

MODULE IV **8**

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

MODULE V **7**

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

MODULE VI **8**

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

TOTAL HOURS :45

REFERENCES:

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

OUTCOMES:

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

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

SEMESTER I

PHC 1182	PHYSICS I	L	T	P	C
		3	0	2	4

OBJECTIVES

To make students conversant with the

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

MODULE I CRYSTAL PHYSICS 8

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

MODULE II ULTRASONICS AND THERMAL PHYSICS 8

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

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

MODULE III APPLIED OPTICS 8

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

Introduction to Laser – Characteristics of Laser – Spontaneous and Stimulated Emissions – Einstein's Coefficients - Population inversion – Pumping Mechanism – Laser Action – Types of Laser: He-Ne laser, CO_2 laser and Nd:YAG laser - Applications : Laser Materials Processing .

MODULE IV FIBRE OPTICS 7

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

MODULE V QUANTUM MECHANICS 7

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

MODULE VI MODERN ENGINEERING AND BIOMATERIALS 7

Modern Engineering Materials: Shape memory alloys - Metallic glasses – Advanced Ceramics – Composites.

Bio-materials: Classification of bio-materials (based on tissue response) – Comparison of properties of some common biomaterials – Metallic implant materials (stainless steel, cobalt-based and titanium-based alloys) – Polymeric implant materials (Polyamides, polypropylene, Acrylic resins and Hydrogels) – Tissue replacement implants – Soft and hard tissue replacements.

L:45 periods

PRACTICALS

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

P: 30 periods

Total: 75 periods

REFERENCES:

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

OUTCOMES:

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

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

CHC1181 CHEMISTRY L T P C

3 0 2 4

OBJECTIVES

To make the students conversant with

- the basic problems like hardness, alkalinity, dissolved oxygen associated with the water and treatment processes involved.
- types of electrodes, determination of pH, emf measurement, conductometric and potentiometric titration.
- the basic analytical techniques like colorimetry, UV-Visible, flame photometry and AAS.
- concepts of photochemistry related to physical processes and chemical reactions induced by photon absorption and their applications.
- the non-renewable sources such as thermal and nuclear energy, importance of renewable energy sources like solar, wind, biogas, biomass, geothermal, ocean with their advantages and limitations.
- the synthesis, properties and applications of nanomaterials.

MODULE I WATER TECHNOLOGY 9

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

MODULE II ELECTROCHEMISTRY 8

Types of electrodes (principle and working) : gas (SHE), metal/metal ion electrode, metal-metal insoluble salt (calomel electrode), ion-selective (glass electrode) – pH determination using glass electrode – concentration cells (problems) – standard cell (Weston-cadmium) – EMF measurement (problems) – conductometric titrations – potentiometric titrations.

MODULE III ANALYTICAL TECHNIQUES 7

Spectroscopy: (relation between interaction of electromagnetic radiation with matter and type of spectroscopy), electromagnetic spectrum – types of transitions – types of spectra (atomic and molecular) – Beer-Lamberts law (problems) – principles, instrumentation (block diagram only) and applications of: colorimetry (includes estimation of concentration of a solution) – UV-Vis spectrophotometer – atomic absorption spectroscopy – flame photometry (includes estimation of concentration of alkali metal).

MODULE IV PHOTOCHEMISTRY 7

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

MODULE V ENERGY SOURCES 8

Renewable and non-renewable energy: comparison, advantages and limitations – non-renewable energy : thermal energy (principle only) – nuclear reactor (components and functions) – nuclear energy (problems) – renewable energy: needs of renewable energy – solar energy : solar photovoltaic, advantages and limitations – wind energy: wind resources, wind turbines, advantages and limitations – bioenergy: biogas generation, factors affecting biogas generation, biomass gasifier, advantages and limitations – geothermal energy: principle, types of geothermal resources, advantages, limitations and applications – ocean energy: tidal and ocean thermal energy (principle, advantages and limitations).

MODULE VI NANOCHEMISTRY **6**

Introduction – distinction between molecules, bulk materials and nanoparticles – classification based on dimension with examples – synthesis :– top-down approach: chemical vapour deposition, laser ablation, electrodeposition – bottom-up approach: precipitation, thermolysis (hydrothermal and solvothermal) – properties and applications of nanomaterials.

L:45 periods

PRACTICALS

1. Estimation of hardness in the given water sample.
2. Estimation of the alkalinity of the given water sample.
3. Estimation of dissolved oxygen in the given water sample.
4. Determination of EMF of the cell.
5. Estimation of a strong acid by conductometry.
6. Estimation of Fe^{2+} present in the given sample by potentiometry.
7. Verification of Beer-Lamberts law and estimation of metal ion concentration of the given sample.
8. Estimation of sodium and potassium present in the given sample by flame photometry (demonstration).

P:30 periods

Total: 75 periods

REFERENCES

1. S. Vairam, P. Kalyani and Suba Ramesh, “Engineering Chemistry”, Wiley India Ltd., New Delhi, 2011.
2. G.A. Ozin and A.C. Arsenault, “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, Thomas Graham House, Cambridge, 2005.
3. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand & Company Ltd, New Delhi, 2014.

5. G.D.Rai, “Non conventional energy sources,” Khanna Publishers, New Delhi, 2011.
6. John Twidell and Tony Weir, “Renewable Energy Resources, Taylor & Francis Ltd, London, United Kingdom, 2005
7. Principles of molecular photochemistry: An introduction, Nicholas J. Turro, V.Ramamurthy and Juan C. Scaiano, University Science Books, Sausalito, CA, 2009.

OUTCOMES

The students will be able to

- solve problems related to hardness, alkalinity, dissolved oxygen associated with the water and describe the treatment processes.
- describe the various types of electrodes, determine pH, measure EMF, explain and determine the concentration of acid and ions using conductometric and potentiometric titrations.
- verify and derive Beer-Lambert’s law, state the principle and illustrate the instrumentation of various analytical techniques.
- apply the concepts of photochemistry to elaborate various photo-physical and photochemical reactions.
- describe the various components and functions of nuclear reactor, explain the principle and enumerate the advantages and limitations of various renewable energy sources.
- classify nanomaterials and discuss their properties & applications; and apply nanochemistry approach to synthesize the nanomaterials.

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 LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

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

CIVIL ENGINEERING PRACTICE

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

MECHANICAL ENGINEERING PRACTICE

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

ELECTRICAL ENGINEERING PRACTICE

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

ELECTRONICS ENGINEERING PRACTICE

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

TOTAL HOURS – 30

OUTCOMES:

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

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

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

OBJECTIVES:

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

MODULE I COMPUTER FUNDAMENTALS **7**

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

MODULE II PROGRAMMING IN C **8**

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

LIST OF EXPERIMENTS:

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

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

1. Ashok N Kamthane, “Computer Programming”, Pearson Education, 2nd Edition, ISBN 13: 9788131704370, 2012

2. Paul J. Deitel, Deitel & Associates, “C How to Program”, Pearson Education, 7th Edition, ISBN-13: 978-0132990448, 2012

OUTCOMES:

Students who complete this course will be able to

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

SEMESTER II

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

OBJECTIVES:

The aims of this course are to

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

MODULE I MULTIPLE INTEGRATION AND ITS APPLICATIONS 8+2

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

MODULE II TRANSFORMATION OF COORDINATES AND SPECIAL FUNCTIONS 7+3

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

MODULE III VECTOR DIFFERENTIATION 7+3

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

MODULE IV VECTOR INTEGRATION 8+2

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

MODULE V

ANALYTIC FUNCTION **8+2**

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

MODULE VI COMPLEX INTEGRATION **7+3**

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

L – 45; T – 15; TOTAL HOURS – 60

TEXT BOOKS:

1. Veerarajan.T., "Engineering Mathematics "(5th edition) Tata Mc Graw Hill Publishing Co. New Delhi, 2012
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. Kreyszig, E., "Advanced Engineering Mathematics", 10th edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2001.
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.
5. Ramana, B.V., "Higher Engineering Mathematics" Tata Mc Graw Hill Publishing Co. New Delhi, 2006.
6. Venkataraman, M.K., "Engineering Mathematics", Volume 2, 2nd edition,

National Publishing Co., Chennai, 2003.

7. James Stewart ".Calculus" (7th edition),Brooks/Cole cengage learning,UK.

OUTCOMES:

After completing the course, student will be able to

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

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

OBJECTIVES:

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

MODULE I VECTOR APPROACH TO MECHANICS **07**

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

MODULE II EQUILIBRIUM OF PARTICLE **06**

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

MODULE III EQUILIBRIUM OF RIGID BODY **06**

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

MODULE IV PROPERTIES OF SURFACES **08**

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

MODULE V FRICTION 08

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

MODULE VI LAWS OF MOTION 10

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

L – 45; T – 15; TOTAL HOURS – 60

REFERENCES:

1. Beer, F.P and Johnston Jr. E.R, "Vector Mechanics for Engineers, Dynamics & Statics", Third SI Metric Edition, Tata McGraw-Hill International Edition, 2001.
2. 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. Erach Bharucha, Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education for University Grants Commission, Orient Blackswan Pvt Ltd, Hyderabad, India, 2013.
2. Benny Joseph, Environmental Studies, Tata McGraw-Hill Education, India, 2009.
3. Ravikrishnan A, Environmental Science and Engineering, Sri Krishna Publications, Tamil Nadu, India, 2015.
4. Raman Sivakumar, Introduction to Environmental Science and Engineering, McGraw Hill Education, India, 2009.
5. Venugopala Rao P, Principles of Environmental Science and Engineering, Prentice Hall India Learning Private Limited; India, 2006.
6. Anubha Kaushik and Kaushik C.P., Environmental Science and Engineering, New Age International Pvt Ltd., New Delhi, India, 2009.

REFERENCES

1. Masters G.M., Introduction to Environmental Engineering and Science, Prentice Hall, New Delhi, 1997.
2. Henry J.G. and Heike G.W., Environmental Science and Engineering, Prentice Hall International Inc., New 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.

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

OBJECTIVES:

- To provide knowledge about the benefits of Object Oriented Programming over Procedure oriented programming.
- To learn various File operations
- To expose fundamental concepts of object-oriented programming in classes, invoking methods and functions.
- 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++.

MODULE I PROGRAMMING IN C 7

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

MODULE II PROGRAMMING IN C++ 8

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

LIST OF EXPERIMENTS:

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

L – 15; P – 30; TOTAL HOURS – 45

REFERENCES:

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

OUTCOMES:

Students who complete this course will be able to

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

CEC1211	ENGINEERING GEOLOGY	L	T	P	C
		2	0	0	2

OBJECTIVES:

The objective of the course is to

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

MODULE I PHYSICAL GEOLOGY **6**

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

MODULE II MINERALOGY & PETROLOGY **9**

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

MODULE III STRUCTURAL GEOLOGY **9**

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

MODULE IV GEOLOGY FOR CIVIL ENGINEERING **6**

Geological conditions necessary for construction of tunnels, dams, reservoirs

TOTAL HOURS – 30

TEXT BOOKS:

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

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

REFERENCES:

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

OUTCOMES:

On completion of this course students will be able to

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

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

OBJECTIVES:

The main objective of this course is

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

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

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

MODULE II BRICKS – BLOCKS **8**

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

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

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

MODULE IV BUILDING ELEMENTS **8**

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

Types of structures – Load Bearing – Non Load Bearing – Steel – Composite-

Foundation – safe bearing capacity of soil, Function and requirements of good foundation, types of foundation- Shallow – Deep Foundation - Types of walls - load bearing, partition walls, cavity walls . Doors, Windows and Ventilators - Location of doors and windows, technical terms, Materials for doors and windows, Paneled door, Flush door, Collapsible door, Rolling shutter, PVC Door, Panelled and glazed Window, Bay Window, French window. Ventilators.

MODULE V ROOFS, FLOORS AND STAIRS 8

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

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

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

MODULE VI MASONRY AND FINISHES 7

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

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

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

TOTAL HOURS – 45

TEXT BOOKS:

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

REFERENCES:

1. Jagadish.K.S, “Alternative Building Materials Technology”, New Age International, 2007.
2. Gambhir. M.L., & Neha Jamwal., “Building Materials, products, properties and systems”, Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012.
3. S.S. Bhavikatti., “ Basic Civil Engineering’, New Age International (p) Limited, New Delhi, 2010
4. IS456 – 2000: Indian Standard specification for plain and reinforced concrete.
5. IS4926–2003: Indian Standard specification for ready–mixed concrete.
6. IS383–1970: Indian Standard specification for coarse and fine aggregate from natural Sources for concrete.
7. IS1542–1992: Indian standard specification for sand for plaster.

OUTCOMES:

On completion of the course the student will be able to

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

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

OBJECTIVES:

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

MODULE I INTRODUCTION TO BUILDING COMPONENTS 6

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

MODULE II BASIC PLANS 6

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

MODULE III BUILDINGS WITH INCLINED ROOF 9

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

MODULE IV MULTI STOREYED STRUCTURES 9

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

MODULE V INDUSTRIAL STRUCTURES 9

Plan - elevation - sectional view of Industrial structures

MODULE VI SERVICE PLANS 6

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

TOTAL HOURS – 45

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

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

SEMESTER III

MAC 2181	**PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS**	**L**	**T**	**P**	**C**
		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 TRANSFORMS 7+3

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. **Error! Hyperlink reference not valid.**, "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.

ENC 2181 ORAL COMMUNICATION

L	T	P	C
0	0	2	1

OBJECTIVES:

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

MODULE I **4**

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

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

MODULE II **4**

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

Understanding Negotiation, persuasion and marketing skills through Podcasts

Listening to short conversations and monologues for understanding real life conversations

MODULE III **4**

Making Poster presentations on current issues

Understanding nuances of making effective presentations (TED Videos)

MODULE IV **6**

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

Viewing videos on debates (NDTV Discussions)

MODULE V **6**

Discussing social issues or current affairs in groups

Viewing group discussions and listening for specific information

MODULE VI **6**

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

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

P – 30; Total Hours –30

REFERENCES:

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

OUTCOMES:

On completion of the course, students will be able to

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

CEC 2101 MECHANICS OF SOLIDS L T P C

3 0 2 4

OBJECTIVES:

The objective of the course is

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

MODULE I STRESS, STRAIN AND DEFORMATION OF SOLIDS 8

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

MODULE II STRESSES IN BEAMS 9

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

MODULE III DEFLECTION OF BEAMS 8

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

MODULE IV TORSION 8

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

MODULE V BIAXIAL STRESSES 6

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

MODULE VI ANALYSIS OF PLANE TRUSS 6

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

LIST OF EXPERIMENTS:

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

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

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

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

CEC2102	SURVEYING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course aims to

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

MODULE I INTRODUCTION TO SURVEYING 7

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

MODULE II LINEAR AND ANGULAR MEASUREMENTS 8

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

MODULE III LEVELING AND CONTOURING 8

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

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

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

MODULE V EDM AND TOTAL STATION **7**

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

MODULE VI PROJECT AND ENGINEERING SURVEYS **6**

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

L- 45 ; Total Hours : 45

TEXT BOOKS:

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

REFERENCES:

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

Publishers and Distributors, New Delhi, 1983.

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

OUTCOMES:

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

CEC2103	MECHANICS OF FLUIDS	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

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

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

MODULE II FLUID STATICS **8**

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

MODULE III FLUID KINEMATICS **7**

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

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

Euler and Bernoulli's equations – Application of Bernoulli's equation – Venturimeter–Orifice meter- Laminar flow through pipes– Hagen Poiseuille equation – Turbulent flow – Darcy-Weisbach formula – Major and minor

losses of flow in pipes – Pipes in series and in parallel – Moody diagram.

MODULE V BOUNDARY LAYER 7

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

MODULE VI SIMILITUDE AND MODEL STUDY 7

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

Total Hours : 45

TEXT BOOKS:

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

REFERENCES:

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

1973.

OUTCOMES:

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

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

CEC2104	CONCRETE TECHNOLOGY	L	T	P	C
		3	0	2	4

OBJECTIVES:

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

MODULE I CONCRETE CONSTITUENT MATERIALS 7

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

MODULE II PROPERTIES OF CONCRETE 8

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

MODULE III MIX DESIGN 8

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

MODULE IV DURABILITY OF CONCRETE 8

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

MODULE V SPECIAL CONCRETE 8

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

MODULE VI CONCRETE UNDER SPECIAL CIRCUMSTANCES 6

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

LIST OF EXPERIMENTS:

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

8. Tests for assessing the performance of hardened concrete to find its stress - strain relationship and Young's Modulus.
9. Non-destructive Testing on existing beams, columns & slabs.

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

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

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

CEC2105	SURVEYING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

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

MODULE I THEODOLITE SURVEYING 9

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

MODULE II HEIGHTS AND DISTANCES 9

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

MODULE III SETTING OUT WORKS 4

1. Foundation Marking

2. Simple Curve

MODULE IV TRIANGULATION **4**

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

MODULE V TOTAL STATION AND GPS **4**

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

Total Hours : 30

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

- To measure horizontal and vertical angles using a theodolite by different methods.

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

IV SEMESTER

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

OBJECTIVES:

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

MODULE I **4**

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

MODULE II **4**

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

Writing Instructions and recommendations

MODULE III **6**

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

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

MODULE IV **6**

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

Writing Functional résumé and letter of application using Edmodo,

MODULE V **6**

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

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

specific reports

MODULE VI **4**

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

P – 30; Total Hours –30

REFERENCES:

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

OUTCOMES:

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

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

CEC2211 HYDRAULIC AND HYDRAULIC MACHINERY L T P C
3 0 2 4

OBJECTIVES:

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

MODULE I FLOW MEASUREMENTS 8

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

MODULE II FLOW IN OPEN CHANNELS 8

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

MODULE III VARIED FLOW 8

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

MODULE IV IMPACT OF JET ON VANES 7

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

MODULE V PUMPS 7

Centrifugal pump –work done and efficiency- minimum speed to start the pump –

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

MODULE VI TURBINES 7

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

L – 45; P – 30;Total Hours : 75

LIST OF EXPERIMENTS:

1. FLOW MEASUREMENTS:

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

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

iii) Determination of coefficient of discharge for notches.

2.MEASUREMENT OF LOSSES IN PIPES:

i) Study on friction in pipes

ii) Study on minor losses in pipes.

3.PERFORMANCE CHARACTERISTICS OF PUMPS:

i) Performance characteristics of Jet Pump

ii) Performance characteristics of Centrifugal Pump

iii) Performance characteristics of Reciprocating Pump

iv) Performance characteristics of Submersible Pump

4.PERFORMENCE CHARACTERISTICS OF TURBINES:

i) Performance characteristics of Pelton turbine

ii) Performance characteristics of Francis turbine.

TEXT BOOKS:

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

Publishing Company, New Delhi, 2009.

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

REFERENCES:

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

OUTCOMES:

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

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

CEC2212 WATER AND WASTEWATER ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I WATER SUPPLY SCHEME & SOURCES OF WATER 7

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

MODULE II WATER QUALITY & TREATMENT 8

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

MODULE III ADVANCED WATER TREATMENT, STORAGE & DISTRIBUTION 7

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

MODULE IV WASTEWATER SCHEME & PRIMARY TREATMENT 7

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

MODULE V SECONDARY & ADVANCED WASTEWATER TREATMENT 8

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

MODULE VI WASTEWATER DISPOSAL & SLUDGE HANDLING 8

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

Total Hours : 45

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

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

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

OBJECTIVES:

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

MODULE I ENERGY PRINCIPLES 8

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

MODULE II INDETERMINATE BEAMS 8

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

MODULE III COLUMNS AND STRUTS 7

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

MODULE IV THEORIES OF FAILURE 7

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

MODULE V BENDING OF CURVED BARS AND UNSYMMETRICAL BENDING 8

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

MODULE VI THICK CYLINDERS AND SPHERICAL SHELLS 7

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

Total Hours : 45

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

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

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

CEC2214 TRANSPORTATION ENGINEERING I

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION TO HIGHWAY ENGINEERING 7

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

MODULE II GEOMETRIC DESIGN OF HIGHWAYS 8

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

MODULE III HIGHWAY MATERIALS AND PAVEMENTS 7

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

MODULE IV HIGHWAY CONSTRUCTION AND MAINTENANCE 7

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

MODULE V AIRPORT PLANNING 8

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

MODULE VI RUNWAY, TAXIWAYS AND APRON GEOMETRIC DESIGN STANDARDS 8

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

Total Hours : 45

TEXT BOOKS:

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

REFERENCES:

1. Jotin Khisty, C., Kent Lall, B., “Transportation Engineering: An Introduction”,Prentice Hall, 2003.

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

OUTCOMES:

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

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

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

OBJECTIVES:

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

MODULE I WATER QUALITY STANDARDS & SAMPLING TECHNIQUES 6

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

MODULE II PHYSICAL ANALYSIS 6

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

MODULE III INORGANIC OR CHEMICAL ANALYSIS 6

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

MODULE IV ORGANIC ANALYSIS 6

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

MODULE V TOXIC METALS 3

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

MODULE VI BACTERIOLOGICAL ANALYSIS (DEMO) 3

Total Coliform, Feacal Coliform.

Total Hours : 30

TEXT BOOKS:

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

2001.
2. Birdie.G.S., “Water Supply and Sanitary Engineering”, Dhanpet Rai and sons, 1991.

REFERENCES:

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

OUTCOMES:

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

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

V SEMESTER

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

OBJECTIVES:

The course aims at

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

MODULE I INTRODUCTION TO LEADERSHIP 12

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

MODULE II LEADERSHIP STYLE AND COMMUNICATION 08

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

MODULE III LEADERSHIP ROLES 08

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. Leader as a relationship builder-

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

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 09

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

MODULE V LEADERSHIP AND CEO TRAINING 08

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

Teaching Pedagogy:

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

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

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

L – 45; Total Hours – 45

REFERENCES:

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

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

Recommended Readings:

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

OUTCOMES:

The students will be able to

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

MSC 3182 SOCIAL ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 07

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

MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 07

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

MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 07

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

MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 08

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

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

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

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

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

L – 45; Total Hours – 45

REFERENCES:

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

OUTCOMES:

The students can able to

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

to commitment

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

OBJECTIVES:

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

MODULE I **6**

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

MODULE II **6**

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

MODULE III **4**

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

MODULE IV **6**

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

MODULE V **8**

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

Total Hours – 30

REFERENCES:

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

OUTCOMES:

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

- Speak about their career choice.

- Self evaluate their strengths and weaknesses and speak about it.
- Make effective presentations on case studies or relating to projects.
- Write the statement of purpose relating to their career choice.

CEC3101	STRUCTURAL ANALYSIS – I	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamental concepts of structures and analyse the structure for deflection.
- To impart in-depth knowledge on analysis of determinate and indeterminate structures by using classical methods.
- To enable the students to understand and anlayse the various forms of arches.
- To provide knowledge on the analysis of beams using moving loads and influence lines.

MODULE I DEFLECTION OF DETERMINATE STRUCTURES 8

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

MODULE II SLOPE DEFLECTION METHOD 8

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

MODULE III MOMENT DISTRIBUTION METHOD 8

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

MODULE IV ARCHES 8

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

MODULE V MOVING LOADS AND INFLUENCE LINES 8

Influence lines for reactions in statically determinate structures – Influence lines for member forces in pin jointed frames – Influence lines for shear force and bending moment in beam sections – Calculation of critical stress

resultants due to concentrated and distributed moving loads.

MODULE VI INFLUENCE LINES FOR INDETERMINATE STRUCTURES **5**

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

Total Hours : 45

TEXT BOOKS:

1. Devadas Menon, "Structural Analysis", Narosa Publishing House, 2010.
2. Pandit, G.S. and Gupta, S.P., "Structural Analysis – A Matrix Approach", Tata McGraw Hill Publishing Company Ltd., 2nd Edition, 2006.
3. Ashok K. Jain., "Advanced Structural Analysis", Nem Chand & Sons, Roorkee, 3rd Edition, 2015.
4. Vaidhiyanathan, R. and Perumal, P., "Structural Analysis - I", Lakshmi Publications, New Delhi, 4th Edition 2016.

REFERENCES:

1. Bhavikatti, S. S., "Structural Analysis", Vol. I & II, Vikas Publishing House Pvt.Ltd., New Delhi, 4th Edition 2010.
2. Punmia, B.C., Ashok Kumar Jain & Arun Kumar Jain, "Theory of structures", Laxmi Publications, New Delhi, 13th Edition 2017.
3. Reddy, C.S., "Basic Structural Analysis", Tata McGraw Hill Publishing Company, New Delhi, 3rd Edition, 2010.

OUTCOMES:

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

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

the influence lines.

- generate influence line diagram for continuous beam using Muller Breslau's Principle.

CEC3102 DESIGN OF REINFORCED CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the fundamental concepts of reinforced concrete materials with an emphasis on the various methods of design.
- To impart knowledge to students about the design of reinforced concrete structural members under bending, shear, and/or axial loads as per Indian Standards.
- To provide knowledge on the various types of footings for structures and design as per the standards.
- To enable the students to understand and design the various types of staircases.

MODULE I DESIGN CONCEPTS **5**

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

MODULE II DESIGN OF BEAMS **8**

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

MODULE III DESIGN OF SLABS **8**

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

MODULE IV DESIGN OF COMPRESSION MEMBERS **8**

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

MODULE V DESIGN OF FOOTINGS 8

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

MODULE VI DESIGN OF STAIRCASES 8

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

Total Hours : 45

TEXT BOOKS:

1. Unnikrishna Pillai and Devadas Menon., “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.
2. Varghese, P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, New Delhi, 2008.
3. Gambhir, M.L., “Design Of Reinforced Concrete Structures”, PHI Learning Pvt. Ltd., New Delhi, 2008.
4. Krishna Raju, N., “Design of RC Structures”, CBS Publishers and Distributors, New Delhi, 2008.
5. Subramanian, N., “Design of Reinforced Concrete Structures”, Oxford University Press, New Delhi, 2014.

REFERENCES:

1. Punmia, B.C., “Limit State Design of Reinforced Concrete Structures”, Laxmi Publications (P) Limited, New Delhi, 2007.
2. Syal, I.C. and Goel, A.K., “Reinforced Concrete Structures”, A.H. Wheelers & Co. Pvt. Ltd., New Delhi, 2008.
3. Nawy, E.G., “Reinforced Concrete: A Fundamental Approach”, Prentice Hall, United States of America, 2009.
4. Bandyopadhyay. J.N., "Design of Concrete Structures”, Prentice Hall of India Pvt. Ltd., New Delhi, 2008.

OUTCOMES:

Students will be able to

- identify concrete material properties relevant to design and demonstrate on various design philosophies in concrete structures.
- describe the behaviour and design the beams for flexure and shear as per Indian standards.
- apply the IS codal provisions for the design of slab.
- employ the Indian code of practice for the design of reinforced concrete columns.
- identify suitable type of footing for structures and design as per standards.
- design and construct an appropriate staircase for RC buildings.

CEC3103 TRANSPORTATION ENGINEERING II

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION TO RAILWAY ENGINEERING 7

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

MODULE II GEOMETRIC DESIGN OF RAILWAYS 7

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

MODULE III RAILWAY SIGNALS & MAINTENANCE 7

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

MODULE IV HARBOUR ENGINEERING 8

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

types, dredging.

MODULE V URBAN TRANSPORTATION PLANNING 8

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

MODULE VI MODERN URBAN TRANSPORTATION 8

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

Total Hours : 45

TEXT BOOKS:

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

REFERENCES:

1. Vassilios Profillidis, “Railway Management and Engineering”, Ash gate Publishing Ltd., Surrey U.K. & Burlington U.S, 2006.
2. Srinivasan, R., "Harbour, Dock and Tunnel Engineering”, Charotar Publishing House Pvt. Limited, Anand, Gujarat, 2009.
3. Sigurd Grava, “Urban Transportation Systems”, McGraw Hill Professional, 2003.

4. Vukan R. Vuchic, “Urban Transit Systems and Technology”, John Wiley & Sons, New Jersey, 2007.

OUTCOMES:

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

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

CEC3104 GEOTECHNICAL ENGINEERING I

L	T	P	C
3	0	2	4

OBJECTIVE:

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

MODULE I INTRODUCTION TO SOIL 7

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

MODULE II SOIL WATER AND WATER FLOW 7

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

MODULE III STRESS DISTRIBUTION IN SOIL 7

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

MODULE IV COMPACTION AND CONSOLIDATION 8

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

MODULE V SHEAR STRENGTH 8

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

shear tests-types of shear tests based on drainage and their applicability.

MODULE VI SLOPE STABILITY 8

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

LIST OF EXPERIMENTS:

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

L – 45; P – 30; Total Hours : 75

TEXTBOOKS:

1. Punmia, B.C, Ashok Kumar Jain and Arun Kumar Jain., “Soil Mechanics and Foundations”, Laxmi Publications Pvt. Ltd., New Delhi, 17th edition, 2017.
2. Gopal Ranjan and Rao, A.S.R., “Basic and Applied Soil Mechanics”, New Age International Publishers, New Delhi, 3rd edition, 2016.
3. Venkatramaiah, C., “Geotechnical Engineering”, New Age International Publishers, New Delhi,6th edition, 2018.
4. Iqbal H Khan., “A text book of Geotechnical Engineering”, Prentice Hall of India, New Delhi, 3rd edition, 2012.

REFERENCES:

1. Coduto, D.P, Man-chu Ronald Yeung and William A Kitch., “Geotechnical Engineering Principles and Practices”, Prentice Hall of India Private Limited, New Delhi, 2010.

2. McCarthy, D.F., “Essentials of Soil Mechanics and Foundations - Basic Geotechniques”, 7th Edition, Prentice-Hall, New Jersey, 2014.
3. Das, B.M. and Khaled Shoban., “Principles of Geotechnical Engineering”, 9th Edition, Thomas Brooks/ Cole Publishing Company, 2016.
4. Muni Budhu., “Soil Mechanics and Foundations”, 3rd edition, John Willey & Sons, Inc., New York, 2010.
5. I.S.2720 (Part I – XIV), “Methods of test for Soils”, Bureau of Indian Standards, New Delhi.
6. Head, K.H, “Manual of Soil Laboratory Testing”, 3rd edition, John Wiley & Sons, Chichester, 2006.
7. Vasanthi, P., “Soil Laboratory Manual”, B.S. Abdur Rahman University, Chennai, 2012.

OUTCOMES:

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

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

VI SEMESTER

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

OBJECTIVES:

The course aims at

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

MODULE I INTRODUCTION TO LEADERSHIP 12

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

MODULE II LEADERSHIP STYLE AND COMMUNICATION 08

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

MODULE III LEADERSHIP ROLES 08

Facets of leadership- Leader as an individual – personality and leadership, values, attitudes and ethics of a leader. **Leader as a relationship builder**-

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

MODULE IV LEADERSHIP CHALLENGES AND STRATEGIES 09

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

MODULE V LEADERSHIP AND CEO TRAINING 08

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

Teaching Pedagogy:

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

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

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

L – 45; Total Hours – 45

REFERENCES:

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

2012.
4. Stephen P. Robbins and Timothy A. Judge. “Organizational Behaviour”, 15th Edition, New Delhi: Pearson, 2013.
5. Fred Luthans, “Organizational Behavior, An Evidence Based Approach”, 12th Edition, New Delhi: McGraw Hill Education, 2013.
6. Emotional Intelligence, Why it can matter no more than IQ by Daniel Goleman (include a book) Publisher: Bloomsbury Publishing India Private Limited; Latest edition (2017)
7. Primal Leadership: Unleashing the Power of Emotional Intelligence by Prof Daniel Goleman , Richard Boyatzis and McKee ,Harvard Business Review Press

Recommended Readings:

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

OUTCOMES:

The students will be able to

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

MSC 3182 SOCIAL ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION TO SOCIAL ENTREPRENEURSHIP 07

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

MODULE II SOCIAL ENTREPRENEURSHIP: DRIVERS AND CHALLENGES 07

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

MODULE III SOCIAL ENTREPRENEURSHIP: OPPORTUNITY RECOGNITION 07

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

MODULE IV RESOURCE MOBILIZATION FOR SOCIAL VENTURE 08

Resources at Initial Stage. Social Network as a role of Social Capital. Team and Collective Efforts. Need and Determination of Important Resources.

Resource of Knowledge, Skills and Abilities. overview of venture capital and angel investment. Cases

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

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

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

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

L – 45; Total Hours – 45

REFERENCES:

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

OUTCOMES:

Students will be able to

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

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

OBJECTIVES:

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

MODULE I **6**

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

MODULE II **6**

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

MODULE III **4**

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

MODULE IV **6**

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

MODULE V **8**

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

Total Hours – 30

REFERENCES:

1. Covey,S.R. (2004). The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change. Free Press.UK
2. Fine, P.M.& Alice Olins. (2016).Step up: Confidence, Success and Your Stellar

Career in 10 Minutes a Day. Vermilion.UK
3. Pai, A. (1993).How to Develop Self-Confidence. Amazon.com
4. Wentz,F.H.(2012). Soft skills training: A Workbook to Develop Skills for Employment. Amazon.com

OUTCOMES:

After completing the course students would be able to

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

CEC3211 STRUCTURAL ANALYSIS - II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide in-depth knowledge on the matrix methods for analysis of beams and framed structures.
- To enable the students to analyse the curved beams and various types of suspension bridges.
- To provide knowledge on the concepts of plastic theory to analyse the beams and rigid frames.
- To understand the fundamental concepts of finite element analysis.

MODULE I FLEXIBLITY MATRIX METHOD 8

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

MODULE II MATRIX STIFFNESS METHOD 8

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

MODULE III BEAMS CURVED IN PLAN 8

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

MODULE IV SUSPENSION BRIDGES 8

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

MODULE V PLASTIC ANALYSIS OF STRUCTURES 8

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

MODULE VI BASICS OF FINITE ELEMENT METHOD 5

Introduction - Discretisation of a structure - Displacement functions – Truss element - Beam element - Triangular elements.

Total Hours : 45

TEXTBOOKS:

1. Devadas Menon, "Advanced Structural Analysis", Narosa Publishing House, 2015.
2. Vaidhiyanathan, R. and Perumal, P., "Structural Analysis II", Lakshmi Publications, New Delhi, 3rd Edition, 2016.
3. Bhavikatti, S. S., "Structural Analysis", Vol.1 and 2, Vikas Publishing House Pvt. Ltd., New Delhi, 4th Edition, 2010.
4. Pandit, G.S. and Gupta, S.P., "Structural Analysis – A Matrix Approach", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition, 2008.

REFERENCES:

1. Ashok K. Jain, "Advanced Structural Analysis", Nem Chand & Sons, New Delhi, 3rd Edition, 2015.
2. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain, "Theory of structures", Laxmi Publications, New Delhi, 13th Edition, 2017
3. Reddy, C.S., "Basic Structural Analysis", Tata McGraw Hill Publishing Company, New Delhi, 3rd Edition, 2010.

OUTCOMES:

Students will be able to:

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

CEC3212 GEOTECHNICAL ENGINEERING II

L	T	P	C
3	0	0	3

OBJECTIVES:

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

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

Scope and objectives- Methods of exploration-auguring and boring- Wash boring and rotary drilling-Depth of boring-Spacing of bore hole- Sampling- Disturbed and undisturbed sampling - Sampling techniques- Split spoon sampler, Thin tube sampler, Stationary piston sampler-Bore log report - Penetration tests (SPT and SCPT)- Data interpretation (Strength parameters)

MODULE II SHALLOW FOUNDATION **7**

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

MODULE III FOOTINGS AND RAFTS **7**

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

MODULE IV SETTLEMENT OF FOUNDATIONS **8**

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

MODULE V PILES 8

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

MODULE VI RETAINING WALLS 8

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

Total Hours : 45

TEXTBOOKS:

1. Punmia, B.C, Ashok Kumar Jain and Arun Kumar Jain., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 17th edition, 2017.
2. Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers, New Delhi, 3rd edition, 2016.
3. Venkatramaiah, C., "Geotechnical Engineering", New Age International Publishers, New Delhi,6th edition, 2018.
4. Iqbal H Khan., "A text book of Geotechnical Engineering", Prentice Hall of India, New Delhi, 3rd edition, 2012.

REFERENCES:

1. Coduto, D.P, Man-chu Ronald Yeung and William A Kitch., "Geotechnical Engineering Principles and Practices", Prentice Hall of India Private Limited, New Delhi, 2010.
2. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations - Basic Geotechniques", 7th Edition, Prentice-Hall, New Jersey, 2014.
3. Das, B.M. and Khaled Shoban., "Principles of Geotechnical Engineering", 9th Edition, Thomas Brooks/ Cole Publishing Company, 2016.
4. Muni Budhu., "Soil Mechanics and Foundations", 3rd edition, John Willey &

Sons, Inc., New York, 2010.

OUTCOMES:

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

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

CEC3213 DESIGN OF STEEL STRUCTURES L T P C
3 0 0 3

OBJECTIVES:

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

MODULE I INTRODUCTION TO STEEL STRUCTURES 4

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

MODULE II BOLTED AND WELDED CONNECTION 9

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

MODULE III DESIGN OF TENSION MEMBERS 9

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

MODULE IV DESIGN OF COMPRESSION MEMBERS 8

Types of members and forms - short column, long column and buckling phenomenon - slenderness ratio - effective length – buckling class - IS 800 : 2007

codal provisions for design - Design of simple column - Design of laced and battened columns - Column bases - Design of slab base and gusseted base - connection details.

MODULE V DESIGN OF BEAMS 8

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

MODULE VI ROOF TRUSSES 7

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

Total Hours : 45

TEXTBOOKS:

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

REFERENCES:

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

OUTCOMES:

Students will be able to

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

codal provisions.

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

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

OBJECTIVES:

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

MODULE I BEAMS **6**

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

MODULE II PLANE FRAMES **6**

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

MODULE III SPACE FRAMES **6**

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

MODULE IV FOUNDATION AND STAIRCASE **6**

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

MODULE V TRUSSES **6**

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

Total Hours : 30

TEXT BOOKS:

1. Krishna Raju, N., “Structural Design & Drawing (Concrete & Steel)”, CBS Publishers, New Delhi, 3rd Edition, 2009.
2. Krishnamurthy, D., “Elementary Structural Design & Drawing, Volume 2 (Concrete Structures)”, CBS Publishers & Distributors, New Delhi, 2008.
3. Krishnamurthy, D., “Elementary Structural Design & Drawing, Volume 3 (Steel Structures)”, CBS Publishers & Distributors, New Delhi, 2008.

REFERENCES:

1. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain, “Design of steel

structures", Lakshmi publications Pvt. Ltd., Chennai, 2008
2. Duggal, S.K., "Design of Steel Structures", Tata McGraw-Hill Publishers, New Delhi, 2009.
3. Unnikrishna Pillai and Devdas Menon., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2003.
4. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, New Delhi, 2004.

OUTCOMES:

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

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

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

OBJECTIVE:

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

MODULE I TOPOGRAPHY & CONTOURING **4**

Preparation of Elevation Contour Map & Digital Elevation Model.

MODULE II PROFILE LEVELING **5**

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

MODULE III CARTOGRAPHY **5**

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

MODULE IV TACHOMETRIC TRAVERSING **5**

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

MODULE V SETTING OUT WORKS **5**

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

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

MODULE VI SOIL INVESTIGATION **6**

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

Total Hours : 30

OUTCOMES:

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

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

embankment and excavation.

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

VII SEMESTER

		L	T	P	C
CEC4101	**ESTIMATION AND COSTING OF INFRASTRUCTURE PROJECTS**	**2**	**0**	**2**	**3**

OBJECTIVES:

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

MODULE I METHODS OF ESTIMATION 4+3

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

MODULE II ESTIMATION OF BUILDINGS 7+7

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

MODULE III ESTIMATION OF WATER SUPPLY, SANITARY INSTALLATIONS AND IRRIGATION STRUCTURES 5+5

Sanitary and water supply installations- Estimating of septic tank, soak pit - Water supply pipe line - Sewer line - Tube well - Open well. Irrigation structures – Channels – Estimate of a distributary.

MODULE IV ESTIMATION OF INFRASTRUCTURE PROJECTS 4+5

Estimate of bituminous and cement concrete roads - Estimate of retaining walls – Culverts – Planning of residential building – size of rooms, floor area, height and thickness of walls – Planning and laying out of residential colony.

MODULE V RATE ANALYSIS AND TENDERS 5+5

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

MODULE VI VALUATION & REPORT PREPARATION 5+5

Necessity - Basics of value engineering - Capitalized value – Depreciation- Escalation - Value of building - Calculation of Standard rent - Mortgage - Lease - Principles for report preparation -Report preparation for residential buildings.

L – 30; P – 30; Total Hours : 60

TEXTBOOKS:

1. Dutta, B.N., “Estimating and Costing in Civil Engineering”, UBS Publishers & Distributors Pvt Ltd; 28th Revised Edition edition, New Delhi, 2016.
2. Chakraborti.M., “Estimating, Costing, Specification & Valuation In Civil Engineering, 2006.

REFERENCES:

1. Kohli, D.D and Kohli, R.C., “A Text Book of Estimating and Costing (Civil)”, S Chand Publishing; Thirteenth edition., New Delhi, 2013.

OUTCOMES:

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

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

CEC4104	CONSTRUCTION MANAGEMENT FOR INFRASTRUCTURE PROJECTS	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart knowledge on planning of construction projects.
- To get the exposure of scheduling of activities using network diagrams.
- To impart the skill of resource planning for a project.
- To get the knowledge on estimating cost and controlling the cost of project.
- To create cash flows and budgeting.
- To understand the concept of quality control and safety during construction.

MODULE I CONSTRUCTION PLANNING 7

Basic concepts in the development of construction plans-Choice of technology and construction method- Development of project network - AOA and AON diagrams - defining precedence relationships among activities - estimating activity durations - estimating resource requirements for work activities -Coding systems – Infrastructure projects.

MODULE II SCHEDULING PROCEDURES AND TECHNIQUES 8

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

MODULE III RESOURCE PLANNING 8

Materials: Inventory control - terms and definitions - types of inventory -EOQ – ABC Analysis - reasons for maintain inventory - different tools for inventory.

Equipment: Classification of major construction equipment- planning and selecting of equipment- Equipment productivity – Fleet management.

Labor: labor schedule - leveling resources - resource leveling strategies- scheduling with resource constraints.

MODULE IV COST CONTROL MONITORING 7

Cost – Types of Cost - crashing and time/cost tradeoffs - Control of project - Cost control problem-Project budget-Forecasting for activity cost control – Earned Value Analysis – Terms & Definitions - Schedule and budget updates-Relating cost and schedule information.

MODULE V CASH FLOW & ACCOUNTING 8

Cash Flow - Financial accounting systems and cost accounts- Construction Project Costs – S curve – Project Income – Calculating Contract Cash flow – Minimizing Contractor negative cash flow – Return of Investment – Project Profitability Indicators.

MODULE VI QUALITY CONTROL & SAFETY DURING CONSTRUCTION 7

Quality and safety concerns in construction-Organizing for quality and safety-Work and material specifications-Total quality control-Quality control by statistical methods -Statistical quality control with sampling by attributes-Statistical quality control by sampling and variables- Safety and health on project sites: accidents; their causes and effects, costs of accidents, occupational health problems in construction, organizing for safety and health.

Total Hours : 45

TEXTBOOKS:

1. Chitkara, K.K., “Construction Project Management, Planning, Scheduling and Control”, Tata McGraw-Hill Publishing Co., New Delhi, 2000.
2 Deodhar, S.V. “Construction Equipment and Job Planning”, Khanna Publishers, New Delhi, 2012.
3. Chris Hendrickson and Tung Au, “Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders”, Prentice Hall, Pitsburgh, 2000.
4. Willis, E.M., “Scheduling Construction Projects”, John Wiley and Sons, New York, 2000.

REFERENCES:

1. Moder, J., Phillips, C. and Davis, “Project Management with CPM, PERT and Precedence Diagramming”, 3rd Edition, Van Nostrand Reinhold Co., 2000.
2. Frank Harris & Ronald McCaffer with Francis Edum – Fotwe, “Modern Construction Management”, Sixth Edition, Blackwell Publishing, 2006

3. Halpin, D.W., “Financial and Cost Concepts for Construction Management”, John Wiley and Sons, New York, 2000.

OUTCOMES:

After completion of the course, students will be able to

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

CEC4105	INDUSTRIAL INTERNSHIP	L	T	P	C
		0	0	0	1

OBJECTIVES:

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

GENERAL GUIDELINES:

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

Total Hours : 15

OUTCOME:

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

SEMESTER VIII

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

OBJECTIVE:

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

GENERAL GUIDELINES:

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

- The project co-ordinator shall arrange for final viva-voce examination to ascertain the overall performance in Project work.

OUTCOME:

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

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

PROFESSIONAL ELECTIVES
SEMESTER IV

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

OBJECTIVE:

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

MODULE I STRUCTURAL MATERIALS 6

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

MODULE II NON - STRUCTURAL MATERIALS 9

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

MODULE III SMART MATERIALS 9

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

MODULE IV INNOVATIVE MATERIALS 6

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

Total Hours : 30

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

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

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

OBJECTIVE:

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

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

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

MODULE II OTHER CONSTRUCTION EQUIPMENTS **8**

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

MODULE III AGGREGATE AND CONCRETING EQUIPMENT **7**

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

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

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

Total Hours : 30

TEXT BOOKS:

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

Methods, Prentice Hall, 1994.
3. Richard. C, Ringwalk, Heavy Construction Handbook, Caterpillar Inc., 2015.

REFERENCES:

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

OUTCOMES:

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

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

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

OBJECTIVES:

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

MODULE I ELEMENTS OF DESIGN IN NATURE 8

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

MODULE II PRINCIPLES OF ORGANIZATION FROM NATURE 8

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

MODULE III DESIGN COMMUNICATION AND GRAPHICS 7

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

MODULE IV LANDSCAPING OF FUNCTIONAL AREAS 7

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

Total Hours : 30

TEXT BOOKS:

1. Francis D.K.Ching, Architecture-Form, Space and Order, Van Nostrand Reinhold Company, New York, 2007.
2. Simon Unwin, Analysing Architecture, Routledge, London, 2003.

3. V.S.Pramar, Design Fundamentals in Architecture, Somaiya Publications Pvt. Ltd., New Delhi, 1973.

REFERENCES:

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

OUTCOMES:

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

CECX04	SAFETY IN CONSTRUCTION	L	T	P	C
		1	0	0	1

OBJECTIVES:

To impart knowledge in

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

MODULE I SITE SAFETY 7

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

MODULE II ACCIDENT, AWARENESS & POLICY IN SAFETY 8

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

Total Hours : 15

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

At the end of the course student will be able to

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

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

OBJECTIVE:

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

MODULE I INTRODUCTION **7**

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

MODULE II REAL ESTATE ZONING AND BYE LAWS **8**

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

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

Total Hours : 15

TEXT BOOKS:

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

REFERENCES:

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

New York, U.S.A, 2002.
3. Tanya Davis, “Real estate developer’s handbook”, Atlantic pub company, Ocala, USA, 2007.
4. Mike .E. Miles, “Real estate development – Principles & Process 3rd edition, Urban Land Institute, ULI – Washington DC, 2000.

OUTCOMES:

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

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

CECX06	VASTU SASTRA AND ARCHITECTURAL DESIGN	L	T	P	C
		1	0	0	1

OBJECTIVES:

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

MODULE I INTRODUCTION TO VAASTU **5**

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

MODULE II ORIENTATION OF HOME **10**

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

Total Hours : 15

TEXT BOOKS:

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

REFERENCES:

1. . Anand Bhardwaj “Scientific approach to Vastu Shastra” Abhinav Publications;

First edition, 2013.

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

OUTCOMES:

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

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

SEMESTER V

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

OBJECTIVES:

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

MODULE I PRECIPITATION **7**

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

MODULE II ABSTRACTION FROM PRECIPITATION **8**

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

MODULE III HYDROGRAPHS **9**

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

MODULE IV RUNOFF ESTIMATION **7**

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

MODULE V FLOODS AND FLOOD ROUTING **7**

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

MODULE VI GROUND WATER HYDROLOGY **7**

Types of aquifers – Darcy's law – Dupuit's assumptions – Confined Aquifer –

Unconfined Aquifer – aquifer yield- Recuperation test – Transmissibility – Specific capacity – Pumping test – Steady flow analysis only.

Total Hours : 45

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

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

CECX11 AIR & NOISE POLLUTION AND CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on

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

MODULE I SOURCES AND EFFECTS OF AIR POLLUTANTS 8

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

MODULE II SAMPLING & ANALYSIS 7

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

MODULE III DISPERSION OF POLLUTANTS 8

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

MODULE IV AIR POLLUTION CONTROL 8

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

MODULE V AIR QUALITY MANAGEMENT 7

Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality.

MODULE VI NOISE POLLUTION 7

Sources of noise pollution – Effects – Assessment - Standards – Control methods – Prevention - Psychoacoustics-Noise criteria-Noise indices.

Total Hours : 45

TEXT BOOKS:

1. Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2002.
2. Rao, C.S., "Environmental Pollution Control Engineering", New age International (P) Ltd., Revised 2nd Edition, 2006.
3. Chandrappa, R., Kulshrestha, U.K., "Sustainable Air Pollution Management: Theory and Practice", Springer International Publishing House, AG Switzerland, 2015.
4. Surampalli, R., Zhang,T.C., Brar, S.K., Hegde,K., Pulicharla, R., Verma, M., "Handbook of Environmental Engineering", McGraw Hill Professional, 2018.

REFERENCES:

1. Wang, L.K., Pereira,N.C., "Hung,Y.T., "Advanced Air and Noise Pollution Control" Hand book of Engineering", Vol-II, The Humana Press, Springer Science &Business Media New Jersey, 2007.
2. Vallero, D., "Fundamentals of Air Pollution", Elsevier Publishers, 5th Edition, 2014.

OUTCOMES:

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

- Classify the sources of air pollution and list its effects on living and non-living environment
- Sample and analyse the various air pollutants
- Demonstrate the procedure for simulation of transport of air pollutants with the help of dispersion models.
- Identify and describe features of devices or equipments available for control of air pollutants

- Suggest air pollution control methods through legislation and regulations
- Describe sources, characteristics, effects and control of noise pollution

CECX12 TRAFFIC ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

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

MODULE I INTRODUCTION **7**

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

MODULE II TRAFFIC SURVEYS AND ANALYSIS **7**

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

MODULE III TRAFFIC CONTROL **8**

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

MODULE IV DESIGN OF GEOMETRIC INTERSECTIONS **8**

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

MODULE V TRAFFIC MANAGEMENT **8**

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

MODULE VI TRAFFIC STUDIES **7**

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

Total Hours : 45

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

- understand the characteristics of vehicles and road users and determine skid Resistance and Braking Efficiency
- prepare traffic study report after conducting different types of surveys.
- design the traffic signals and traffic simulation models.
- identify the intersection elements and design a rotary intersection
- regulate traffic of particular area by intelligent transportation system and other modern methods.
- execute traffic studies like traffic congestion, fuel emission etc

CECX12 TRAFFIC ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

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

MODULE I INTRODUCTION **7**

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

MODULE II TRAFFIC SURVEYS AND ANALYSIS **7**

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

MODULE III TRAFFIC CONTROL **8**

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

MODULE IV DESIGN OF GEOMETRIC INTERSECTIONS **8**

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

MODULE V TRAFFIC MANAGEMENT **8**

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

MODULE VI TRAFFIC STUDIES **7**

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

Total Hours : 45

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

- understand the characteristics of vehicles and road users and determine skid Resistance and Braking Efficiency
- prepare traffic study report after conducting different types of surveys.
- design the traffic signals and traffic simulation models.
- identify the intersection elements and design a rotary intersection
- regulate traffic of particular area by intelligent transportation system and other modern methods.
- execute traffic studies like traffic congestion, fuel emission etc

CECX14	ROCK MECHANICS	L	T	P	C
		2	0	0	2

OBJECTIVES:

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

MODULE I INTRODUCTION 6

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

MODULE II CLASSIFICATION AND PROPERTIES OF ROCKS 8

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

MODULE III STRENGTH CRITERIA OF ROCKS 9

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

MODULE IV SLOPE STABILITY OF ROCKS 7

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

Total Hours : 30

TEXT BOOKS:

1. Goodman, R.E., Introduction to rock mechanics, Wiley India, 2 editions, 2010.
2. Hudson, A. and Harrison, P., Engineering Rock mechanics – An introduction to the principles, Elsevier science, 2000.

REFERENCES:

1. Hoek, E and Bray, J., Rock slope Engineering, CRC press, 4th edition, 2004.
2. Wittke, W., Rock Mechanics. Theory and Applications with case Histories, Springer, Berlin, 2014.
3. Waltham, T, Foundations of Engineering Geology, Second Edition, Spon Press, Taylor & Francis Group, London and New York, 2002.
4. Jaeger J.C., Cook N.G.W., Zimmerman R.W., Fundamentals of Rock Mechanics, Wiley India, 2012.

OUTCOMES:

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

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

CECX15	DESIGN OF FORMWORK	L	T	P	C
		2	0	0	2

OBJECTIVES:

To impart knowledge on

- Planning of formwork, plant and site equipments required for formwork.
- Various materials and accessories required for formwork
- Design of forms for various elements such as slabs, beams, columns and walls.
- Erection of forms and prevention of form failures

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

Introduction - forms for foundations, columns, beams and walls - general objectives of formwork building - planning for safety - development of a basic system – key areas of cost reduction - Overall planning - detailed planning - labour requirement - costing - planning crane arrangements - site layout plan -transporting plant Economy of formwork - Economy in Making, Erecting, and Stripping Forms – Method of removing formwork

MODULE II MATERIALS & ACCESSORIES **7**

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

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

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

MODULE IV BUILDING AND ERECTING THE FORMWORK **7**

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

Total Hours –30

TEXT BOOKS:

1. Robert L. Peurifoy and Garold D. Oberlender, Formwork For Concrete Structures, McGraw - Hill, 2010.

REFERENCES:

1. Love, T.W., "Construction Manual: Concrete & Formwork", Craftsman Book Company., CA, 2001.
2. Hurd, M.K., "Formwork for Concrete", Special Publication No.4, American Concrete Institute, Detroit, 2005.
3. Kumar Neeraj Jha , "Formwork for Concrete Structures", Tata Mc Graw Hill, 2012.

OUTCOMES:

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

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

CECX16 INDUSTRIAL WASTE WATER TREATMENT

L	T	P	C
2	0	0	2

OBJECTIVE:

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

MODULE I INTRODUCTION **6**

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

MODULE II WASTE AUDIT **6**

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

MODULE III WASTEWATER TREATMENT TECHNIQUES **9**

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

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

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

Total Hours : 30

TEXT BOOKS:

1. Patwardhan, A. D, “Industrial WasteWater Treatment”, PHI Learning (P) Ltd., New Delhi, 2017.
2. Arceivala, S.J., “Wastewater Treatment for Pollution Control & Reuse”, McGraw-Hill, New Delhi, 3rd Edition, 2006

REFERENCES:

1. Frank Woodard, "Industrial Waste Treatment Handbook", Butterworth Heinemann, New Delhi, 2001.
2. Metcalf and Eddy, “Wastewater Engineering: Treatment and Reuse,” McGraw – Hill, New Delhi, 2002.

OUTCOMES:

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

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

CECX17 HAZARDOUS WASTE MANAGEMENT

L	T	P	C
2	0	0	2

OBJECTIVES:

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

MODULE I INTRODUCTION **6**

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

MODULE II WASTE COLLECTION **7**

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

MODULE III LAND DISPOSAL AND THERMAL TREATMENT OF WASTE **9**

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

MODULE IV RECLAMATION AND REMEDIATION **8**

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

Total Hours : 30

TEXT BOOKS:

1. Blackman, W.C “Basic Hazardous Waste Management”, CRC Press, New Delhi, 2001
2. Stanley E. Manahan, “Industrial Ecology: Environmental Chemistry and Hazardous Waste”, Routledge, 2017.

REFERENCES:

1. Michael D. Lagrega, Phillip L. Buckingham and Jeffrey C. Evans., “Hazardous Waste Management” 2nd Edition, McGraw Hill International, London, 2010.
2. Rules and Regulation of Hazardous substance management”, Ministry of Environment, Forest and Climate change, 2015.

OUTCOMES:

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

- Identify the various sources of hazardous waste and will be able to explain about its legal provision.
- Describe about the different steps involved in waste collection and treatment process.
- Specify the basic requirements needed for land disposal and its management techniques.
- Assess the various treatment methods of hazardous waste and air pollutants and summarize the various remediation techniques based on case studies

CECX18 ENVIRONMENTAL GEOTECHNOLOGY

L	T	P	C
2	0	0	2

OBJECTIVES:

To impart knowledge about the

- Environmental cycles, soil water interaction relating to geotechnical problems
- Site selection criteria for waste disposal and disposal methods
- Transport of contaminants and hydrological design for ground water pollution control
- Safe disposal techniques of hazardous waste and remediation of contaminated soil.

MODULE I INTRODUCTION 7

Introduction to Environmental Geo techniques-Environmental cycles and their interaction-Soil water environment interaction relating to geotechnical problems, Sources, production and classification of wastes. Environmental regulations in India

MODULE II SITE SELECTION AND METHOD OF DISPOSAL **8**

Criteria for selection of sites for waste disposal facilities-parameters controlling the selection of wastes disposal sites-current practices for waste disposal, subsurface disposal techniques-Passive contaminant systems- Leachate contaminationapplications of geo membrane and other techniques in solid and liquid waste disposal-rigid or flexible membrane liners.

MODULE III HYDROLOGY OF CONTAMINANTS **8**

Transport phenomena in saturated and partially saturated porous media contaminant migration and contaminant hydrology-Hydrological design for ground water pollution control-Ground water pollution downstream for landfills - pollution of aquifers by mining and liquid wastes-protection of aquifers.

MODULE IV HAZARDOUS WASTE MANAGEMENT& REMEDIAL MEASURES 7

Hazardous waste control and storage system-Stabilization - Processes and Environmentally safe disposal of solid and liquid wastes - Ground modification techniques in waste fill, Remedial measures for contaminated grounds -Remediation technology - Bio-remediation.

Total Hours : 30

TEXT BOOKS:

1. Fang, H.Y., Chaney, R.C., "Introduction to Environmental Geotechnology", Taylor and Francis, CRC Press, 2nd Edition, 2017.
2. Rowe, R.K., "Geotechnical and Geoenvironmental Engineering Handbook", Kluwer Academic Publications, London, 2000.
3. Hillel. D., "Introduction to Environmental soil physics", Academic press, New York, 2003.
4. Young, R.N., "Geoenvironmental Engineering contaminated soils, pollutants fate and Mitigation CRC press, New York, 2001.

REFERENCES:

1. Yong, R.N., Nakano, M., Pusch,R., "Environmental Soil Properties and Behaviour", Taylor and Francis, CRC Press, 2012.
2. Fetter, C. W., Boving, T., Kreamer, D., "Contaminant Hydrogeology", Waveland Press, USA, 3rd Edition, 2017.
3. Westlake, K., "Landfill Waste Pollution and Control", Woodhead Publishing India Private limited, 2013.

OUTCOMES:

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

- Identify the soil water interactions, the problems associated with the release of the wastes into soil water environment and Implement the various environmental regulations
- Select appropriate and safe sites and methods of disposal of wastes by analyzing the various parameters in the soil water environment
- Model the transport of contaminants in the soil water environment by the applying the principles of hydrology
- Apply the safe techniques of control and storage systems for hazardous waste and also suggest remediation techniques in soil water environment

CECX19 DURABILITY OF CONCRETE STRUCTURES

L	T	P	C
2	0	0	2

OBJECTIVES:

- To impart knowledge on the physical and chemical mechanisms of concrete degradation.
- To provide in-depth knowledge on the design of durable concrete
- To enable the students to understand the various types of durability tests for concrete.
- To provide a clear understanding on the construction & maintenance of concrete structures

MODULE I MECHANISMS OF CONCRETE DEGRADATION 6

Physical Mechanism - Shrinkage – Plastic and drying shrinkage – Thermal cracking – Freeze – thaw attack – Abrasion & erosion Chemical Mechanism – Sulphate attack, Alkali-aggregate reactions – Acid Attack - Corrosion of steel reinforcement in concrete – chloride ingress into concrete – Carbonation.

MODULE II SPECIFICATIONS & DESIGN OF DURABLE CONCRETE 5

Concrete as a permeable medium – cement – Aggregates – Admixtures - Fibres, Specifying durable concrete - Concrete mix design - Special concrete.

MODULE III DURABILITY TESTS FOR CONCRETE 9

Penetration tests – Penetration tests based on transport of water and nonreactive gaseous fluids – chloride penetration – Penetration of CO2 and carbonation – Alkali –aggregate reaction tests – sulfate resistance tests – Freeze-thaw resistance – electrochemical corrosion – half- cell potential method – concrete resistivity – linear polarization resistance – electrochemical impedance spectroscopy.

MODULE IV CONSTRUCTION & MAINTENANCE OF CONCRETE STRUCTURES 10

Surface of concrete – Curing - Surface protection systems - Cathodic protection - Serviceability of structures - Appraisal of structures - In situ testing - laboratory testing -concrete repair products - repair methods - rehabilitation of concrete structures

Total Hours : 30

TEXT BOOKS:

1. Dyer, T., “Concrete Durability”, CRC Press, 2014.
2. Alexander M., Bentur, A., Sidney Mindess, S., “Durability of Concrete: Design and Construction”, CRC Press, 2017.

REFERENCES:

1. Mehta, P.K., Monteiro, P.J.M., “Concrete micro structure properties and materials”, Mc Graw Hill Education (India) Private Limited, New Delhi, 2013.
2. Emmons, P.H., “Concrete Repair and Maintenance Illustrated”, Galgotia Publications Private Limited, 2001.
3. Santhakumar, A.R. ;”Concrete Technology”, Oxford University Press, 2007.
4. Neville.A.M., “Properties of Concrete”, 5th Edition, Pearson Education Limited, 2013.

OUTCOMES:

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

- Assess all the physical and chemical mechanisms that affects the durability of concrete
- Make a durable concrete with an emphasis on the approaches addressed by the standards.
- Investigate the durability of concrete by conducting different tests.
- Construct durable concrete structures and provide solution to repair and maintenance of concrete structures.

CECX 20	INDUSTRIAL HEALTH AND SAFETY	L	T	P	C
		2	0	0	2

OBJECTIVE:

To make students conversant with the

- Health hazards and the safety measures to be followed in the industrial environment.
- Categories & Exposure pathways of health hazards
- Methods of prevention and control of Health diseases, accidents/emergencies and other hazards from the workplace.
- Concept of Environmental health & safety management.

MODULE I INTRODUCTION **7**

Need for developing Environment, Health and Safety systems in workplaces - Accident Case Studies - Status and relationship of Acts - Regulations and Codes of Practice - Role of trade union safety representatives. International initiatives - Ergonomics and workplace.

MODULE II OCCUPATIONAL HEALTH AND HYGIENE **8**

Definition of the term occupational health and hygiene - Categories of health hazards – Exposure pathways and human responses to hazardous and toxic substances - Advantages and limitations of environmental monitoring and occupational exposure limits - Hierarchy of control measures for occupational health risks - Role of personal protective equipment

MODULE III WORKPLACE SAFETY AND SAFETY SYSTEMS **7**

Features of Satisfactory and Safe design of work premises – good housekeeping - lighting and colour, Ventilation and Heat Control – Electrical Safety – Fire Safety – Safe Systems of work for manual handling operations – Machine guarding – Working at different levels – Process and System Safety.

MODULE IV ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT **8**

Concept of Environmental Health and Safety Management – Elements of Environmental Health and Safety Management Policy and methods of its effective implementation and review – Elements of Management Principles – Education and

Training – Employee Participation.

Total Hours : 30

TEXT BOOKS:

1. Bill Taylor, Wiley “Effective Environmental, Health, and Safety Management Using the Team Approach”, Interscience, 2005.
2. Dr.K.U.Mistry, Siddharth Prakashan,”Fundamentals of Industrial Safety and Health” , Siddharth Prakashan Publication, 2012.
3. The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ., 2007.

REFERENCES:

1. Charles D. Reese,”Occupational Health and Safety Management: A Practical Approach”, CRC Press, NY , 2016.
2. Taylor, “Culinary and Hospitality Industry “Publications Services, 2005.

OUTCOMES:

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

- Understand the regulations and code of practice related to Industrial Health & Safety.
- Interpret the health hazards present in a work place and a way to prevent it from occurring.
- Identify the various workplace safety and safety systems
- Describe the concept of Environmental Health and safety management

CECX21	URBAN DESIGN	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the scope and nature of urban design as a discipline.
- To introduce the components of a city and their interdependent roles.
- To learn to interpret the city in different ways and layers.
- To have a broad knowledge of various techniques to read a city

MODULE I INTRODUCTION TO URBAN DESIGN 7

Introduction to cities, Components of urban space such as blocks, density, neighborhood, Streets etc and their interdependencies - outline of issues/ aspects of urban space and Articulation of need for urban design - scope and objectives of urban design as a discipline.

MODULE II TRENDS IN URBAN DESIGN 7

Trend of Urbanization at International, National, State and District levels. National and regional Development Policies and Strategies – Urbanization, Housing and Transportation sustainable Urban Development- Definition and Principles.

MODULE III PLANNING PROCESS 8

Types of Urban and Regional Plans, Stages in the Planning Process – Delineation of Planning Areas, Goals and Objectives of Plans, Surveys and Analysis, Formulation of Plans, Evaluation of Alternative Plans, Plan Implementation

MODULE IV URBAN ANALYSIS 8

Understanding various tools through which an urban setting could be perceived - maps, sketches, photo documentations, reading, data collections, transects etc.. The various aspects of urban growth -. in Asian cities, city limits/boundaries, urban structure, urban architecture, typologies as well as infrastructural planning, The critical role that transportation plays in structuring the city will also be examined.

Total Hours : 30

TEXT BOOKS:

1. Rithchie. A, “Sustainable Urban Design: An Environmental Approach”, Taylor & Francis, 2000.
2. Donald Natson, “Time Saver Standards for Urban Design”, McGraw Hill, 2003.
3. A.E.J. Morris, “History of Urban Form before the Industrial Revolution”, Prentice Michelle Provoost et al., Dutchtown, NAI Publishers, Rotterdam, 1999.
4. Gallian B Arthur, Simon Eisner, The Urban Pattern, City Planning and Design, Affiliated Press Pvt. Ltd., New Delhi, 1995.
5. Margaret Roberts, “An Introduction to Town Planning and Planning Techniques”, Hutchinson, London, 1990.

REFERENCES:

1. Gary Hack, “Local Planning: Contemporary Principles and Practice”, International City/County Management Association, 2009.
2. Sam bass Warner Andrew H. Whittemore, “American Urban Form: A Representative History”, MIT Press, Cambridge, MA, 2012
3. Malcolm Moor, “Urban Design Futures”, Routledge, 2006.
4. Geoffrey Broadbent, “Emerging Concepts in Urban Space Design”, Taylor & Francis, 2003.

OUTCOMES:

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

- Explain the role of Urban design as blocks, density, neighborhood, Streets etc and their interdependencies
- Identify the trend of Urbanization at International, National, State and District levels
- Address the types of Urban and Regional Plans, Stages in the Planning Process.
- Recognise the various tools through which an urban setting could be perceived.

CECX22 WATER PROOFING OF R.C.C STRUCTURES

L	T	P	C
1	0	0	1

OBJECTIVE:

- To expose students to various materials and techniques for waterproofing building elements.

MODULE I INTRODUCTION **7**

Structural waterproofing industry - Background and source of a waterproofing design(BS8102:2009), water in the ground - natural and perched water tables, soil types and ground conditions, sources of water entering a structure, dampness in basements - sources and types.

MODULE II TYPES OF WATERPROOFING **8**

Effect on water movement on building components, Types of waterproofing- Barrier forms, integral forms and cavity forms – Materials used, preparation, application and aftercare of barrier, integral and drained cavity forms of waterproofing.

Total Hours : 15

TEXT BOOKS:

1. Santha Kumar, A.R., “Concrete Technology”, Oxford University Press, New Delhi, 2007.
2. Philip Perkins, H., "Repair, Protection and Waterproofing of Concrete Structures", Elsevier Applied Science Publishers, 2001.
3. Ransom, W.H., "Building Failures - Diagnosis and Avoidnce", E.& F.N. Spon Publishers, 2002.

REFERENCES:

1. Michael T. Kubal, "Waterproofing the Building Envelope", Mc-Graw Hill Inc., New Delhi, second edition, 2008.

OUTCOMES:

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

- predict the causes of dampness in structures.
- identify the suitable techniques and materials for waterproofing.

CECX23 CONSTRUCTION CHEMICALS FOR REPAIR WORKS

L	T	P	C
1	0	0	1

OBJECTIVES:

- To impart knowledge to students on various chemicals used in construction industry.
- To give exposure to the application of chemicals for different repair works.

MODULE I CHEMICAL ADMIXTURES 8

Types of chemical admixtures - air entrainers - water reducers - set retarders - set accelerators – super plasticizers – Applications of admixtures for repair works - Grouts and grouting compounds – its applications.

MODULE II PROTECTIVE COATINGS AND MEMBRANES 7

Floor hardener and Coatings – epoxy and cement base mortars, anticorrosive protective coatings for rebar, micro concrete etc. – Applications.

Total Hours : 15

TEXT BOOKS:

1. Santha Kumar, A.R., “Concrete Technology”, Oxford University Press, New Delhi, 2007.
2. Shetty, M.S., “Concrete Technology – Theory and Practice”, S. Chand & Company Limited, New Delhi, 2008.

REFERENCES:

1. Philip Perkins, H., "Repair, Protection and Waterproofing of Concrete Structures", Elsevier Applied Science Publishers, 2001.
2. Yoshihiko Ohama, “Hand Book of Polymer – Modified Concrete and Mortars”, Noyes Publications, U.K., 3rd Edition, 2013.

OUTCOMES:

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

- Classify the construction chemicals with their end use and its application procedures.
- Identify appropriate chemical for the intended repair works.

CECX24	GEOSYNTHETICS	L	T	P	C
		1	0	0	1

OBJECTIVE:

- To provide an understanding on various types of Geosynthethic materials.
- To impart knowledge on the properties of Geosythetics and various applications of Geosynthetics materials.

MODULE I AN OVERVIEW 5

Historical Development – Types of Geosynthetics – Geotextiles – Geogrids- Geonets – Geomembranes – Geocomposites – Functions – Reinforcement – Separation – Filtration – Drainage – Barrier Functions.

MODULE II PROPERTIES AND APPLICATIONS OF GEOSYNTHETICS 10

Physical properties : Mass per unit area – Thickness – Specific gravity; Hydraulic properties :Apparent open size – Permittivity – Transmissivity. Mechanical Properties : Uniaxial Tensile Strength – Burst and Puncture Strength – Soil Geosynthetic friction tests - Use of geosynthetics for filtration and drainage – Use of geosynthetics in roads – Improvement of bearing capacity – Geosynthetics in landfills.

Total Hours : 15

TEXT BOOKS:

1. Sanjay Kumar Shukla,Jian-Hua Yin.,"Fundamentals of Geosynthetic Engineering" CRC Press; 2006
2. Robert M. Koerner, "Designing with Geosynthetics ", Prentice Hall, New Jersey, USA, 2005.

REFERENCES:

1. Sivakumar Babu, G.L., An Introduction to Soil Reinforcement and Geosynthetics, University Press (India), Pvt. Ltd., Hyderabad, 2006.
2. Hoe I. Ling, Dov Leshchinsky, Fumio Tatsuoka.,"Reinforced Soil engineering" CRC Press; 2003

OUTCOMES:

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

- identify different types of geosynthetics required based on their functions.
- analyze the properties of geosynthetics by lab testing method and its

applications for various functions in Civil engineering.

SEMESTER VI

CECX30	DYNAMICS OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart knowledge about theory of vibrations and vibration parameters to analyse the dynamic forces caused by an earthquake.
- To introduce the design of buildings for blast and impact forces as per BIS codes of practice.

MODULE I SINGLE DEGREE OF FREEDOM SYSTEMS 8

Formulation of equations of motion by different methods, Free and forced vibrations, Effect of damping.

MODULE II MULTI DEGREE OF FREEDOM SYSTEMS 8

Formulation of structure property matrices, Eigen value problems, Mode shapes and orthonormality of modes, Approximate methods of extraction of Eigen values.

MODULE III CONTINUOUS SYSTEMS 8

Modeling - free and forced vibration of bars and beams. Rayleigh –Ritz method –Formulation using Conservation of Energy –Formulation using Virtual Work

MODULE IV DIRECT INTEGRATION METHODS FOR DYNAMIC RESPONSE 8

Damping in MDOF systems, Nonlinear MDOF systems, Wilson Theta method, Newmark beta method, step-by-step numerical integration techniques.

MODULE V DESIGN AGAINST BLAST 7

Characteristics of internal and external blast - Pressure distribution on buildings above ground due to external blast - underground explosion - Design of buildings for blast as per BIS codes of practice.

MODULE VI DESIGN AGAINST IMPACT 6

Impact and impulse loads - underground explosion - Design of buildings for impact as per BIS codes of practice.

Total Hours : 45

TEXTBOOKS:

1. Chopra, A.K., "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson, 5th Edition, 2017.
2. Clough R.W, and Penzien J, "Dynamics of Structures", 2nd Edition, McGraw-Hill International Edition, 2003.
3. Mario Paz, "Structural Dynamics – Theory and Computations", 5th Edition, CBS Publishers, 2012.

REFERENCES:

1. Kappos, A., "Dynamic Loading and Design of Structures", CRC Press, 2014
2. Craig, R.R., Kurdila, A.J., "Fundamentals of Structural Dynamics", John Wiley and Sons, 2nd Edition, 2011.
3. Bollinger, G.A., "Blast Vibration Analysis", Courier Dover Publications, 2018

OUTCOMES:

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

- develop the equation of motion for single degree of freedom
- analyse the dynamic response of multi degree of freedom systems
- analyse the free and forced vibration of bars and beams
- find the dynamic response of structures using numerical integration procedure
- design the buildings for blast forces using BIS codes of practice.
- design the buildings for impact forces using BIS codes of practice.

CECX31 ADVANCED CONCRETE DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic concepts on the limit state of serviceability and estimate the serviceability conditions of a structural member as per Indian codal provisions.
- To impart knowledge to design the water retaining structures.
- To provide in-depth knowledge to analyse and design the multistoreyed structure under gravity and lateral loads.
- To give an exposure on the design of flat slab and design the slab as per yiled line analysis.

MODULE I SERVICEABILITY LIMIT STATES : DEFLECTION AND CRACKING **8**

Limit state of Deflection - factors affecting deflection - Short and long term deflections- control of deflection - computation of deflection as per IS code – Limit state of Cracking – reasons and effects of cracking - limiting criteria on cracking - Estimation of crack width.

MODULE II RETAINING WALLS **8**

Types of Retaining walls - Design of cantilever and counterfort retaining walls.

MODULE III WATER TANKS **8**

Underground rectangular tanks - Overhead circular and rectangular tanks – Domes for water tanks - Design of staging and foundations.

MODULE IV BUILDING FRAMES **7**

Analysis of multistorey framed structure -method of substitute frames –Analysis for vertical loads- Analysis of frames subjected to horizontal forces-portal method & cantilever method.

MODULE V FLAT SLABS **7**

Types of flat slabs – Direct design method - Equivalent frame method – Shear in flat slab – Design of flat slab

MODULE VI YIELD LINE THEORY **7**

Introduction to yield line theory – Yield line patterns – Characteristic features of yield lines – Load on slabs – Yield line analysis by virtual work method to square, rectangular, circular and triangular slabs.

Total Hours : 45

TEXT BOOKS:

1. Krishna Raju, N., "Design of RC Structures", CBS Publishers and Distributors, New Delhi, 2008.
2. Unikrishnana Pillai, S. and Devdas menon, “Reinforced Concrete Design” Tata McGraw-Hill Book Company, New Delhi, 2003.
3. Varghese, P.C., “Advanced Reinforced Concrete Design”, PHI Learning Ltd., New Delhi, 2005.
4. Krishna Raju, N., “Advanced Reinforced Concrete Design”, CBS Publishers and Distributors, New Delhi, 2008.

REFERENCES:

1. Punmia, B.C., “Limit State Design of Reinforced Concrete Structures”, Laxmi Publications (P) Limited, New Delhi, 2007.
2. Ram Chandra, "Limit State Design of Concrete Structure", Standard Book House, New Delhi, 2007.

OUTCOMES:

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

- evaluate the deflection and crack width of RC members as per IS codal provisions.
- classify and design the various types of retaining walls.
- categorise the various types of water tanks and design the water tank as per standards.
- analyse the multistory frames for vertical and horizontal loading using various methods.
- employ the Indian code of practice for the design of flat slab.
- establish appropriate approaches to design the slab by yield line theory.

CECX32	REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on quality assurance in construction, durability of concrete and deteriorating mechanisms and damage assessment of distressed structures.
- To expose students to various materials and techniques for repairing and rehabilitation of distressed structures with real time case studies and engineered demolition techniques

MODULE I QUALITY ASSURANCE AND DURABILITY 8

Introduction to Repair, Rehabilitation and maintenance.Importance of quality assurance - influencing parameters.Durability of concrete - strength and permeability. Deteriorating mechanisms : Corrosion of steel rebar -effects due to climate, chemical action, wear and erosion

MODULE II DAMAGE ASSESSMENT OF DISTRESSED STRUCTURES 8

Distress in structures, Damage assessment of distressed structures - Importance - Assessment procedure : preliminary inspection, planning, visual inspection, field and laboratory tests, report preparation. Non destructive testing techniques for damage assessment : Rebound hammer, Ultrasonic pulse velocity, half cell potential measurements.

MODULE III MATERIALS FOR DURABILITY AND REPAIR 8

Construction chemicals, Plasticizers, corrosion inhibitors, protective coatings for steel and concrete, rust convertors, fibre reinforced concrete, micro concrete, polymer concrete composites

MODULE IV REPAIR TECHNIQUES 9

Significance of repair material and repair techniques. Repair techniques : Mortar and dry pack, vacuum concrete, Ferrocement, guniting and shotcrete, epoxy injection, grouting, plate bonding, sacrificial anode cathodic protection, prestressing, FRP jacketing and laminates.

MODULE V REHABILITATION OF DISTRESSED STRUCTURAL 9e

ELEMENTS

Procedure for repairing structural and non-structural cracks. Rehabilitation procedure for : leaky sunken slabs, water tank and terrace slab, dampness in buildings. Case study on : Rehabilitation of distressed over head water tank due to corrosion and rehabilitation of fire damaged structure.

MODULE VI BUILDING DEMOLITION TECHNIQUES 3

Engineered demolition techniques - Water jetting, flame cutting, soundless chemical demolition etc

Total Hours : 45

TEXT BOOKS:

1. Santha Kumar, A.R., “Concrete Technology”, Oxford University Press, New Delhi, 2007
2. Shetty, M.S., “Concrete Technology – Theory and Practice”, S. Chand & Company Limited, New Delhi, 2008.
3. Yoshihiko Ohama, “Hand Book of Polymer – Modified Concrete and Mortars”, Noyes Publications, U.K., 3rd Edition, 2013.

REFERENCES:

1. Philip Perkins, H., "Repair, Protection and Waterproofing of Concrete Structures", Elsevier Applied Science Publishers, 2002.
2. Ransom, W.H., "Building Failures - Diagnosis and Avoidnce", E.& F.N. Spon Publishers, 2001.
3. Michael T. Kubal, "Construction Waterproofing Handbook ", McGraw Hill Professional, 2nd Edition, 2008.

OUTCOMES:

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

- predict the causes of distress affecting durability in structures.
- assess the damage in distressed structures
- choose the relevant materials for repair and rehabilitation
- identify the suitable techniques for repair and rehabilitation
- describe the processes used for repairing various cases such as leaky sunken slabs, water tank,fire damaged structure etc.
- suggest the suitable techniques that can be used for demolition of building.

CECX33 GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To familiarize the students with geotechnical problems in soil.
- To understand the various drainage methods available for dewatering of soil
- To impart knowledge about selection, design, and construction aspects of ground improvement techniques in problematic soils.
- To understand the application of geo-synthetics in soil reinforcement
- To study the different grouting materials and techniques
- To provide understanding on stabilization of soil by chemicals.

MODULE I INTRODUCTION **7**

Role of ground improvement in foundation engineering - methods of ground improvement - Geotechnical problems in alluvial, laterite and black cotton soils - Selection of suitable ground improvement techniques based on soil condition.

MODULE II DRAINAGE AND DEWATERING **8**

Drainage techniques - Well points - Vacuum and electro osmotic methods - Seepage analysis for two dimensional flow-fully and partially penetrating slots in homogenous deposits (Simple cases only).

MODULE III INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS **7**

Insitu densification of cohesion less and consolidation of cohesive soils - Dynamic compaction and consolidation - Vibro floatation - Sand pile compaction - Preloading with sand drains and fabric drains- Stone columns - Lime piles - Installation techniques only - relative merits of various methods and their limitations.

MODULE IV EARTH REINFORCEMENT **8**

Concept of reinforcement - Types of reinforcement material - Applications of reinforced earth - use of Geotextiles for filtration, drainage and separation in road and other works.

MODULE V GROUTING TECHNIQUES **8**

Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring.

MODULE VI STABILISATION METHODS **7**

Chemical stabilization – Mechanism – factors affecting and properties – use of additives – Lime and Bituminous stabilization - Mechanism – factors affecting and properties – types of admixtures - Stabilization of expansive soil.

Total Hours : 45

TEXT BOOKS:

1. Maity Joyanta Chattopadhyay Bikash Chandra., “Ground Improvement Techniques”, PHI Publications,2017
2. Purushothama Raj, P., “Ground Improvement Techniques”, Laxmi Publications, 2016.

REFERENCES:

1. Moseley, M.P., "Ground Improvement", CRC Press, USA and Canada, 2004.
2. Koerner, R.M., “Design with Geosynthetics”, 3rd Edition, Prentice Hall, New Jersey, 2002.
3. Das, B.M., “Principles of Foundation Engineering”, Cenage learning, USA, 2013.

OUTCOMES:

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

- explain the properties of problematic soil and necessity of different ground modification techniques.
- describe the improvement of soil by compaction, consolidation and preloading techniques suitable for specific site conditions.
- effectively utilise different earth reinforcement materials including Geo-textile for different field conditions.
- implement the grouting techniques in the field condition for soil stabilization.
- assess the suitable chemicals and admixtures for stabilization based on soil types.

CECX34	PAVEMENT DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart sufficient knowledge on various components of highway engineering such as highway planning, design of geometric elements of highways & urban roads, and rigid & flexible pavements design.
- To give an exposure to desirable properties of highway materials and construction practices.

MODULE I PRINCIPLE OF PAVEMENT DESIGN 7

Components of a road and their function – Factors affecting pavement stability – Equivalent Single wheel load – Vehicle and traffic factors, moisture, Climate and soil factors – Stress distribution in different conditions –Modulus of elasticity of various layers.

MODULE II FLEXIBLE PAVEMENT DESIGN 8

Empirical method using soil classification tests- Estimation of CBR values-method of designing pavement-plate bearing test method-asphalt institute method –AASHTO Method-bur mister design method –principles of bituminous mix design-IRC Methods.

MODULE III RIGID PAVEMENT DESIGN 8

General design consideration – Stresses in concrete pavement- Design procedure as per IRC method – Design of different joints in concrete pavement and their maintenance.

MODULE IV PAVEMENT EVALUATION 8

Method of pavement evaluation – Distress in flexible pavements – Distress in rigid pavements – Structural evaluation of flexible and rigid pavements – Evaluation by deflection measurements.

MODULE V PAVEMENT STRENGTHENING 7

Strengthening of pavement-Methods –Flexible overlays and types- Rigid overlays-

Case studies

MODULE VI HIGHWAY MAINTENANCE 7

Maintenance of Bituminous surface, concrete roads and low cost roads – maintenance of shoulders and drainage system.

Total Hours : 45

TEXT BOOKS:

1. Khanna, S.K. and Justo, C.E.G., "Highway Engineering", 8th Edition, New Chand and Brothers, Roorkee, 2001.
2. Wright, P.H., "Highway Engineering", John Wiley and Sons Inc., New York, 7th Edition, 2004.

REFERENCES:

1. Kadiyali, L.R., "Principles and Practice of Highway Engineering", Khanna Tech. Publications, New Delhi, 2000.
2. Yoder, R.J. and Witchak M.W., "Principles of Pavement Design", John Wiley, 2000.
3. IRC 37–2001, Guidelines for the Design of Flexible Pavements, The Indian roads Congress, New Delhi.
4. IRC 58-1998, Guideline for the Design of Rigid Pavements for Highways, The Indian Roads Congress, New Delhi.

OUTCOMES:

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

- explain the basic principles and factors to be considered for pavement design.
- analyze and design flexible pavement by various methods.
- analyze and design rigid pavement as per IRC method.
- describe the structural and functional evaluation for pavement performance.
- assess the overlay construction methods.
- describe the method of maintaining different roads for longer durability and serviceability.

CECX35 HOUSING, PLANNING AND MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart comprehensive knowledge on planning, design, evaluation, construction and financing of housing projects.

MODULE I INTRODUCTION TO HOUSING **7**

Definition of Basic Terms – House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of sustainable housing

MODULE II HOUSING LAWS **8**

Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels.

MODULE III HOUSING PROGRAMMES **8**

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighbourhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organizations

MODULE IV PLANNING AND DESIGN OF HOUSING **7**

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design-Problems)

MODULE V DEVELOPMENT REGULATIONS **8**

Working of building bye-laws in planning practice; Requirements for grant of building permissions; Streamlining the development control regulations; Making development control regulations work for the poor; UDPFI Guidelines; National Building Code and its implementation

MODULE VI HOUSING FINANCE AND PROJECT APPRISAL **7**

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing of Housing Units, Rents, Recovery Pattern (Problems)

Total Hours – 45

TEXT BOOKS:

1. Watson, D., Crosbie, M.J., “Time Saver Standards For Architectural Design”, Tata McGraw Hill, 8th Edition, 2011.
2. Hosack, W.M., “Land Development Calculations”, McGraw Hill, USA , 2nd Edition, 2010.

REFERENCES:

1. Development Control Rules For Chennai Metropolitan Area, CMA, Chennai, 2004.
2. Goody, J., Chandler, R., Clancy, J., Dixon, D., Wooding, G., “Building Type Basics for Housing”, John Wiley and Sons, New Jersy, 2010.

OUTCOMES:

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

- Explain the basic concepts about different types of housing and its Policies.
- Describe the housing bye laws at different administrative levels, development and control regulations..
- Analyze the various housing programmes.
- Design different types of housing units.
- Describe the various developmental regulations for housing
- Analyze and appraise the housing projects.

CECX36	BUILDING SERVICES	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To impart knowledge on various elements of services required for water supply in building.
- To provide basic knowledge on acoustics properties required for building.
- To provide basic knowledge on electrical installations and lighting requirement for building.
- To impart knowledge on ventilation provision and air conditioning system.
- To introduce the various fire safety and NBC provisions available.
- To introduce the concept of smart and intelligent buildings.

MODULE I WATER SUPPLY SYSTEMS 7

Different distribution systems, booster pumps, underground & overhead tanks, capacity of pumping plants, ferrule, water meters, stopcocks, bib cocks and pipe appurtenances. Hot water supply systems in buildings, their design, materials, joints, fittings and valves. Direct and indirect systems, special installation in multistoried buildings, municipal bye laws and regulations.

MODULE II BUILDING ACOUSTICS 8

Acoustics terminology, definitions, propagation, reflection, absorption, diffusion, velocity, characteristic intensity etc. Properties of sound, decibel, scale, directionality and sound sources, hearing noise effects, diffraction and reflection. Behaviour of sound in an enclosed space-resonance, echo and reverberation. Principles of acoustics. Acoustical problems in contemporary architectural design. Principles of room acoustics-terminology, diffusion, growth and decay of sound, reverberation, Sound absorbing and sound reflecting materials-description and characteristics. Choice of absorbers-measurement of absorption frequency dependence.

MODULE III ELECTRICITY AND LIGHTING 8

Types of wires , wiring systems and their choice -planning electrical wiring for building -main and distribution boards -transformers and switch gears –modern theory of light and colour -synthesis of light -luminous flux -candela- laws of illumination-lighting design-design for modern lighting.

MODULE IV VENTILATION AND COOLING 7

Ventilation and its importance-natural and artificial systems-Window type and packaged air-conditioners-chilled water plant -fan coil systems-water piping - cooling load -air conditioning systems for different types of buildings –protection against fire to be caused by A.C. Systems.

MODULE V FIRE SAFETY AND NBC PROVISONS IN BUILDINGS 8

Causes of fire in buildings-safety regulations-NBC-planning considerations in buildings like Non-combustible materials, construction, staircases and A.C. systems, special features required for physically handicapped and elderly in building types.

MODULE VI SMART AND INTELLIGENT BUILDINGS 7

Heat and smoke detectors-dry and wet risers - Automatic sprinklers – Capacity determination of firefighting needs. Intelligent buildings- Building automation-Smart buildings-Building services in high rise buildings.

Total Hours : 45

TEXT BOOKS:

1. Birdi, G. S, "Water Supply and Sanitary Engineering", Dhanpat Rai & Sons,6th Edition, 2002.
2. Marshall Long , "Architectural Acoustics", Academic Press,1st edition, 2005.
3. Gary Steffy, "Architectural Lighting Design", second Edition, Wiley & Sons, Inc. 2001.

REFERENCES:

1. NBC, National Building Code of India, New Delhi, Second revision, 2005 (NBC 2005).
2. Rex Miller and Mark R. Miller, "Air Conditioning and Refrigeration", Second Edition, McGraw Hill, New York, 2011.
3. V. K. Jain, "Fire Safety In Buildings", Taylor & Francis, 2007.

OUTCOMES:

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

- Describe the various water supply system and Municipal bye-laws & regulations.
- Explain the concept of acoustics properties required for buildings.
- Describe the electrical installations and lighting requirements for building.
- Explain the various techniques on ventilation and cooling, protection against fire caused by A.C. Systems.
- List and explain the various fire safety and NBC provisions in buildings.

- Explain the concept of smart and Intelligent Buildings.

CECX37	ENGINEERING ETHICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To enable the students to identify the core values that shapes the ethical behavior of an engineer.
2. To enable the students to utilize opportunities to explore one's own values in ethical issues.
3. To make the students aware of ethical concerns and conflicts.
4. To enhance familiarity with codes of conduct and increase the ability to recognize and resolve ethical dilemmas.

MODULE I ENGINEERING ETHICS 8

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

MODULE II ENGINEERING AS SOCIAL EXPERIMENTATION 8

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study.

MODULE III ENGINEER'S RESPONSIBILITY FOR SAFETY 8

Safety and Risk – Assessment of Safety and Risk – Risk Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Case Studies Chernobyl and Bhopal disasters.

MODULE IV ETHICAL RESPONSIBILITIES 7

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime

MODULE V ETHICAL RIGHTS 6

Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

MODULE VI GLOBAL ISSUES **8**

Multinational Corporations – Business Ethics - Environmental Ethics–ethics of technology– Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

Total Hours : 45

TEXT BOOKS:

1. Mike W. Martin, Roland Schinzinger, “Ethics in Engineering”, Mc graw Higher Ed, 2017.
2. M. Govindan, S. Natarajan, V.S. Senthil Kumar, “Engineering Ethics”, PHI Learning, 2009.
3. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics Concepts and Cases”, Thompson Learning, Belmont, CA, 2000.

REFERENCES:

1 John R. Boatright, “Ethics and the Conduct of Business”, Pearson Education, 2003.
2 Edmund G. Seebauer and Robert L. Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, New York, 2001.
3 Bajaj, P.S., and Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, New Delhi, 2004.
4 David Ermann and Michele S. Shauf, “Computers, Ethics and Society”, Oxford University Press, New York, 2003.

OUTCOMES:

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

- identify the core values that shape the ethical behavior of an engineer.
- explain the concepts of ethical concerns and Standards.
- handle ethical dilemmas in a better way.
- maintain loyalty confidentiality, responsibility and avoiding the areas where conflicts of interests arise.
- demonstrate the knowledge of ethical laws and intellectual rights.
- describe the ethical implications of emerging technologies.

CECX38	ENVIRONMENTAL RISK ASSESSMENT	L	T	P	C
		2	0	0	2

OBJECTIVE:

To provide knowledge related to the broad field of environmental risk assessment, important processes that control contaminant transport and tools that can be used in predicting human health risks

MODULE I INTRODUCTION TO RISK ASSESSMENT 8

Sources of Environmental hazards – Environmental and Ecological Risks – Environmental risk assessment framework – Regulatory perspectives and requirements – Risk analysis and management – Risk perception - Risk assessment in different disciplines

MODULE II ELEMENTS OF ENVIRONMENTAL RISK ASSESSMENT 7

Hazard identification – Receptor exposure to environmental contaminants - Dose Response Evaluation – Exposure Assessment – Exposure Factors, Slope factors, dose response calculations and dose conversion factors – Risk characterization – Vulnerability assessment – Uncertainty analysis

MODULE III TOOLS AND METHODS FOR RISK ASSESSMENT 8

HAZOP and FEMA methods – Cause failure analysis – Event tree and Fault tree modeling and analysis – Estimation of carcinogenic and non carcinogenic risks to human health – Methods in ecological risk assessment – Radiation risk assessment – Data sources and evaluation

MODULE IV RISK MANAGEMENT 7

Risk communication and Risk perception – Comparative Risks – Risks based decision making – Risk based environmental standard setting – Risk cost benefit optimization and tradeoffs – Emergency preparedness plans- Design of Risk management programs – Risk based remediation

Total Hours : 30

TEXT BOOKS:

1. Kasperson,J.K., Kasperson,R.E., “Global Environmental Risks”, V.N.University Press, New York, 2003.
2. Dalezio, N.R, “Environmental Hazards Methodologies for Risk Assessment and Management”, IWA Publishing, UK, 2017.

REFERENCES:

1. Theodore, L., Dupont, R.R., “Environmental Health and Hazard Risk Assessment: Principles and Calculations”, CRC Press, Taylor and Francis, 2012.
2. Gruiz, K., Meggyes, T., Fenyvesi, E., “Engineering Tools for Environmental Risk Management”, Taylor and Francis, 2014.

OUTCOMES:

At the end of the course student will able to

- Attain knowledge on Environmental Risk and its framework.
- Calculate the hazard exposure level and characterize the risk based on its vulnerability.
- Identify the risk by using various risk assessing tools and methods.
- Manage the risk situations and provide preparedness plans to that situation.

CECX39	REMOTE SENSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of the course is to

- To utilize the principles of remote sensing data acquisition and analysis of satellite data.
- To explore the spectral signatures of various earth features and electromagnetic interactions.
- To evaluate the satellite images for quality and apply enhancement techniques to improve the interpretability of satellite images.
- To process and interpret SAR data.
- To use the aerial photos for measurement of height determination.
- To explore the use of remote sensing for different applications.

MODULE I FUNDAMENTALS OF REMOTE SENSING 7

Remote sensing: definition – components of remote sensing - energy sensor, interacting body – Active and Passive remote sensing – platforms – aerial and space platforms – balloons, helicopters, aircrafts and satellites – synoptivity and repeativity – electromagnetic radiation (EMR) – EMR spectrum – visible, infrared (IR) near IR, middle IR, thermal IR and microwave – black body radiation – Wien's Displacement Law – Stefan Boltzman law.

MODULE II EMR INTERACTION WITH EARTH SURFACE FEATURES 8

Atmospheric characteristics – scattering of EMR – Rayliegh, Mie, Non-selective and Raman scattering – EMR interaction with water vapour and ozone – atmospheric windows – significance of atmospheric windows – EMR interaction with earth surface material, radiance, irradiance, incident, reflected, absorbed and transmitted energy – reflectance – specular and diffused reflection surfaces – spectral signature – spectral signature curves – EMR interaction with water, soil and earth surface.

MODULE III DIGITAL IMAGE PROCESSING 9

Digital processing of satellite images: Geometric rectification, spatial and radiometric enhancement, edge detection, band ratio, spectral domain enhancement, Supervised and unsupervised classification for thematic map generation.

MODULE IV MICROWAVE REMOTE SENSING 8

Microwave Remote Sensing: Basic principles, spatial resolution of SAR system, geometric characteristics, and signature of earth features.

MODULE V MISCELLANEOUS REMOTE SENSING TECHNIQUES 6

Aerial photography, Stereo photo interpretation, Radar transmission characteristics / Image interpretation, Passive microwave sensing / LIDAR.

MODULE VI REMOTE SENSING APPLICATIONS 7

Applications of remote sensing for Agriculture, forestry, land use/land cover, Soil, Geology, Water Resources, Urban and Coastal Zone Regulation.

Total Hours : 45

TEXT BOOKS:

1. Anji Reddy, “Remote sensing and Geographical Information systems”, BS Publications, 2008.
2. Srinivas, M.G., “Remote sensing applications”, Narosa Publishing House, New Delhi, 2001.
3. Lillesand, T.M. and Kiefer, R.W., “Remote sensing and image interpretation”, John Wiley and sons, 2001.

REFERENCES:

1. De Merse and Michael, N., “Fundamentals of Geographic Information System”, 2nd Edition, John Wiley and sons, New York, 2003.

OUTCOMES:

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

- Describe the basic principles of remote sensing data, types of remote sensing and laws related to remote sensing.
- Demonstrate the interactions of EMR with earth features and the features based on spectral signatures.
- Explain the evaluation techniques for interpretation of the satellite images.
- Descri

be the characteristic features of microwave remote sensing.

- Describe the use of aerial photos for measurement of height determination.
- Demonstrate the use of Remote Sensing for different applications.

CECX40	MODERN SURVEYING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of the course is to

- Locate the soundings in the river and to measure the depth of water in hydrographic surveying.
- Use EDM, digital theodolite, digital level, LIDAR and total station for field measurements.
- Apply the measuring principle of GPS, Total station and EDM in civil engineering projects.
- Determine the precision of the GPS measurements and the working of GPS.
- Categorize the different measurement techniques using a GPS.
- Determine the height measurement with the help of aerial photos.

MODULE I HYDROGRAPHIC SURVEYING 6

Tides – MSL – Sounding and methods – Location of Soundings and methods – Three-point problem – River Surveys – Measurement of current and discharge.

MODULE II MODERN SYSTEMS IN SURVEYING AND MAPPING 7

General – Electronic Distance Measurement (EDM) – Digital Theodolite and its accuracy – Automatic total station – Laser Theodolite – Digital level – Instrument for measuring tunnel profiles – Inertial positioning systems – Global Positioning System (GPS) – LIDAR Measurements – Modern Trends.

MODULE III TOTAL STATION 9

Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, Sources of Error, Microwave Total Station instruments. Total Station and it's inbuilt programs like Co-go, Missing Line Measurement, Remote Elevation Measurement, 3D Coordinate Measurement, Automatic Azimuth Angle Setting, Resection, Setting out measurements and Area Calculation.

MODULE IV GLOBAL POSITIONING SYSTEM 8

History of GPS, GPS design objectives and details of segments space, control and user, blocks of GPS- Block I, II/IIA, IIR Satellites, and IIF. GPS Signal Structure - Carriers, GPS codes: C/A, P, navigational message, And GPS receiver: Types and Structure of receivers, Principles of GPS position fixing: Pseudo ranging. Determination of GPS satellite coordinates, Types of ephemerides, GPS errors.

MODULE V GPS SURVEY METHODS AND APPLICATIONS 8

Single Point or Point Vs Relative, Static Vs Kinematic, Real time Vs Post mission. Practical GPS survey field procedures: Code and Carrier-based positioning, Accuracy and recording time. GPS Applications - Geodetic control surveys, Cadastral surveys, Engineering and monitoring, Military applications, Vehicle tracking and car navigation.

MODULE VI PHOTOGRAMMETRY 7

Photogrammetric terms; Applications; Type of photographs; Perspective geometry of near vertical and tilted photographs, heights and tilt distortions; Flight planning; Stereoscopy, base lining, floating marks, stereo measurements for height determination; Developments in photogrammetry: analogue, analytical and digital methods; photogrammetric instruments.

Total Hours : 45

TEXT BOOKS:

1. Punmia, B.C., “Surveying”, Vol. II, III, Laxmi Publications, New Delhi, 2007.
2. Wolf, P. R., and Ghilani, C. D., “Adjustment Computations: Statistics and Least Squares in Surveying and GIS”, John Wiley & Sons, New York, 2007.
3. Kanetkar, T.P., “Surveying and Levelling”, Vol. I and II, United Book Corporation, Pune, 2007.
4. Roy, S.K., “Fundamentals of Surveying”, 2nd Edition, Prentice - Hall of India Private Ltd., New Delhi, 2004.

REFERENCES:

1. Hofmann-Wellenhof, B., Lichtenegger, H. and Collins, J., “Global Positioning System: Theory and Practice”, Springer, Berlin, 2001.
2. Xu Guochang, “GPS: Theory, Algorithms and Applications”, Springer, Berlin, 2007.
3. Schofield, W., “Engineering Surveying”, 5th Edition, Butterworth - Heinemann, London, 2001.

OUTCOMES:

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

- Locate the soundings in the river and to measure the depth of water in hydrographic surveying.
- Map the terrain using EDM, Total Station and LIDAR.
- Use the measuring principle of GPS, Total station and EDM in civil engineering projects.
- Determine the position of the points with GPS measurements.
- Use different GPS survey methods to improve the positional accuracy.
- Measure the heights with the help of aerial photos.

CECX41	ISLAMIC ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Islamic architecture as evolving within specific cultural contexts including aspects of society, religion, politics and climate
- To gain knowledge of the development of architectural form with reference to technology, style and character in the Indian context through the evolution of the mosque and tomb in the various phases of Islamic rule in the country.
- To gain knowledge of the expertise of the Mughal rulers in city building and garden design.

MODULE I INTRODUCTION TO ISLAMIC ARCHITECTURE 7

History of Islam: birth, spread and principles - Islamic architecture as rising from Islam as a socio-cultural and political phenomenon- evolution of building types in terms of forms and functions: mosque, tomb, minaret, madarasa, palace, caravanserai, market - character of Islamic architecture: principles, structure, materials and methods of construction, elements of decoration, colour, geometry, light

MODULE II VOCABULARY OF TYPICAL ISLAMIC ARCHITECTURE 7

Dominated by Persian style — Vocabulary of typical Islamic architecture: Arcuated architecture – Mortar masonry – Pointed arches – Domes – Stalactite corbels – Arabesque – Stone grill & pierced screen —The Slave Dynasty: Study of parts of a typical mosque with reference to the Quwwat-ul-Islam Mosque, Old Delhi – Study of the Qutb Minar, Old Delhi.

MODULE III ISLAMIC ARCHITECTURE IN THE PROVINCES 7

Shift of power to the provinces and evolution of regional architecture with their own unique influences: geographic, cultural, political, etc., - Bengal, Gujarat, Jaunpur, Malwa, Kashmir, Deccan (Gulbarga, Bidar, Golconda and Bijapur) - important examples for each region

MODULE IV MUGHAL ARCHITECTURE 8

Mughals in India- political and cultural history- synthesis of Hindu-Muslim culture, Sufi movement - evolution of architecture and ouline of Mughal cities and gardens under the Mughal rulers: Babur, Humayun, Akbar, Jahangir, Shahjahan, Aurangazeb- important examples- decline of the Mughal empire.

MODULE V ISLAMIC ARCHITECTURE IN INDIA 8

Advent of Islam into the Indian subcontinent and its impact including the change in the architectural scene- overview of development based on political history and the corresponding classification of architecture - Islamic architecture in India: sources and influences . Establishment of the Delhi Sultanate- evolution of architecture under the Slave, Khalji, Tughlaq, Sayyid and Lodhi Dynasties – tombs in Punjab- important examples for each period

MODULE VI CROSS-CULTURAL INFLUENCES 8

Cross cultural influences across India and secular architecture of the princely states: Oudh, Rajput, Sikh, Vijayanagara, Mysore, Madurai- important examples

Total Hours : 45

TEXT BOOKS:

1. George Mitchell, “Architecture of the Islamic World - its history and social meaning”, Thames and Hudson, London, 2008.
2. Robert Hillenbrand, “Islamic Architecture- Form, Function and Meaning”, Edinburgh University Press, 2004.
3. Satish Grover, “Islamic Architecture in India”, CBS Publishers, New Delhi 2002.

REFRENCES:

1. Catherine Asher, Architecture of Mughal India, Cambridge University Press 2001.
2. Monica Juneja,”Architecture in Medieval India: Forms, Contexts, Histories”, New Delhi, Permanent Black, 2001.
3. Percy Brown, “Indian Architecture (Islamic Period)”, Read Books Ltd, 2013.
4. G. H. Hiraskar, “The Great Ages of World Architecture”, Dhanpat Rai, 2013.

5. Marian Moffett, Michael Fazio & Lawrence Wodehouse, “A World History of Architecture”, McGraw- Hill, 2014.

OUTCOMES:

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

- describe the principles of Islam as a socio-cultural and political phenomenon.
- explain the elements of Islamic architecture such as Pointed arches, Domes, Stalactite corbels, Arabesque, Stone grill & pierced screen.
- identify the Islamic architecture in the provinces with their own unique influences: geographic, cultural, political, etc.,
- describe the Mughal Architecture with synthesis of Hindu-Muslim culture.
- discuss the Islamic architecture In Indian subcontinent and its impact including the change in the architectural scene.
- illustrate the cross cultural influences across India and secular architecture of the princely states.

SEMESTER VII

		L	T	P	C
CECX45	**BRIDGE ENGINEERING**	**3**	**0**	**0**	**3**

OBJECTIVE:

- To impart knowledge on different types of bridges and culverts, investigation and planning procedures, design principles of various bridges using IRC Specifications, bearings, substructures and foundations.

MODULE I COMPONENTS, INVESTIGATIONS & SPECIFICATIONS 6

Components of a bridge structure - Inspection and site investigations for a bridge - Determination of linear waterway, design discharge and scour depth - Economical span - Types and choice of bridges - IRC loading for road bridges - General design considerations.

MODULE II SLAB BRIDGES & CULVERTS 7

Slab Bridge - Distribution of concentrated loads by IRC - Load distribution by Courbon's Method – Skew slab Bridge, RC box culvert (single vent only).

MODULE III REINFORCED CONCRETE BRIDGES 10

Design of tee beam bridge – design of main girder and cross girders, Single span rigid frame bridge (barrel or slab type only), Continuous girder bridges and Balanced cantilever RC bridges – Design of articulations.

MODULE IV STEEL BRIDGES 7

Design principles of Plate Girder bridges, IRC specifications.

MODULE V PRESTRESSED CONCRETE BRIDGES 7

Types of Prestressed Concrete Bridges - Types of prestressing – Pretensioning and Post-tensioning - Design principles of Post-tensioned concrete bridges.

MODULE VI BEARING, SUBSTRUCTURE & FOUNDATIONS 8

Bearings – types, functions – simple problems – Substructures – Pier and Abutment – Materials, Design - Stability requirements – Foundations – types, pile foundation, well foundation, Caissons – pneumatic and box types.

Total Hours : 45

TEXT BOOKS:

1. Krishnaraju, N., "Design of bridges", New Age International Publishing Ltd., New Delhi, 2005.
2. Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill Publishing Co., New Delhi, 2001.
3. Jhonson Victor, D., "Bridge Engineering", Oxford & IBH Publishing Co., New Delhi, 2003.
4. Raina, V.K., "Concrete Bridge Practice - Analysis, Design and Economics", 3rd Edition, Shroff Publishers, New Delhi, 2010.

REFERENCES:

1. Vazirani, V.N., Ratwani, M.M., and Vaswani, "Bridge Engineering", Khanna Publishers, New Delhi, 2000.
2. Chen, W.F. and Lian Duan, "Bridge Engineering Handbook", CRC Press, 2010.
3. Bindra, S.P., "Principles and Practice of Bridge Engineering", 9th Edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2012.
4. IRC 22-1986, Standard Specification and Code of Practice for Road Bridges, Section VI, Composite Construction, The Indian Road Congress, New Delhi.
5. IRC 83-1982, Standard Specification and Code of Practice for Road Bridges, Section IX, Bearings, part-I, Metallic Bearings, The Indian Road Congress, New Delhi.
6. IRC 83-1987, Standard Specification and Code of Practice for Road Bridges, Section IX, Bearings, Part-II, Elastomeric Bearings, The Indian Road Congress, New Delhi.
7. IRC 78-1983, Standard Specification and Code of Practice for Road Bridges, Section VII, Foundation and Substructures, The Indian Road Congress, New Delhi.
8. IRC 40-1970, Standard Specification and Code of Practice for Road Bridges, Section IV, Brick, Stone, Block Masonry, The Indian Road Congress, New Delhi.
9. IRC 18-2000, Design Criteria for Prestressed Concrete Road Bridges (Post-Tensioned Concrete), The Indian Road Congress, New Delhi.
10. IRC 5-1998, Standard Specifications and Code of Practice for Road Bridges, Section I – General Features of Design (Seventh Revision), The Indian Road Congress, New Delhi.
11. IRC 6-2010, Standard Specifications and Code of Practice for Road Bridges, Section II – Loads and Stresses (Fifth Revision), The Indian Road Congress,

New Delhi.

12. IRC 21-2000, Standard Specifications and Code of Practice for Road Bridges, Section III – Cement Concrete (Plain and Reinforced) (Third Revision), The Indian Road Congress, New Delhi.
13. IRC: 24-2010, Standard Specifications and Code of Practice for Road Bridges, Steel Road Bridges (Limit State Method) Third Revision,The Indian Road Congress, New Delhi.
14. IRC: 22-2008, Standard Specifications and Code of Practice for Road Bridges, Section VI – Composite Construction (Limit States Design) (Second Revision), The Indian Road Congress, New Delhi.

OUTCOMES:

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

- identify a suitable site, classify different types of bridges and calculate loadings as per the standards
- describe the load distribution as per IRC standards and design the slab bridge culvert
- recognize and design the various components in different types of reinforced concrete bridges.
- explain the principles involved in the design of plate girder bridges as per IRC specifications.
- identify and apply the principles, techniques for the design of prestressed concrete bridges
- classify and describe the types of bearings, piers and abutments in bridges

CECX46 EARTHQUAKE ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To provide basic understanding on the theory of vibrations, earthquake phenomena and its measurements.
- To impart knowledge pertaining to design of structures in seismic areas using IS codal provisions.
- To provide insight knowledge on the seismic retrofitting techniques of structures.

MODULE I THEORY OF VIBRATIONS 9

Concepts of vibrations – Response of the system – Simple Harmonic Motion– Damped and Undamped -Free and Forced vibration- Natural frequencies and modes shapes

MODULE II ENGINEERING SEISMOLOGY 9

Earthquake characterizations – causes of Earthquake - types of Earthquake – Seismic waves – Magnitude and Intensity – Measurement of Earthquake – Seismic zones – Architectural Features – Indian Seismic Codes– Liquefaction of soil - Indian and world seismicity.

MODULE III SEISMIC BEHAVIOUR OF RC STRUCTURES 9

Seismic design philosophy – Earthquake resistant design of RC members – Beams – Columns – Beam column joints – Slabs – Staircases – Shear wall – Seismic coefficient – Load combinations - Lateral load analysis - Response spectrum method- Importance of experimental earthquake engineering

MODULE IV SEISMIC BEHAVIOUR OF STEEL STRUCTURES 7

Behaviour of flexural members for earthquake resistance – Steel frames – Steel panel zones – Bracing members–Connection design and joint behavior.

MODULE V DUCTILE DETAILING OF STRUCTURES 6

IS 13920 codal provisions for detailing – Beams – Columns – Beam column joints – Footing – Staircases – Shear wall – Special confining reinforcements.

MODULE VI SEISMIC RETROFITTING OF STRUCTURES 5

Base isolation – Seismic dampers – Retrofitting and strengthening of structural

members – Response of Buildings – Case study

Total Hours : 45

TEXT BOOKS:

1. Duggal, S.K., “Earthquake Resistant Design of Structures”, 2nd Edition, Oxford University Press, New Delhi, India, 2013
2. Datta, T.K, “Seismic Analysis of Structures”, John Wiley & Sons, 2010.
3. Manohar S., Madhekar, S., Seismic Design of RC Buildings: Theory and Practice Springer, 2015.

REFERENCES:

1. Anil K.Chopra, “Dynamics of Structures - Theory and Applications to Earthquake Engineering” Pearson, 2017.
3. Filiatrault, A, “Elements of Earthquake Engineering and Structural Dynamics”, Presses inter Polytechnique, 2013.
4. Paulay,T. and Priestly, M.N.J., “Seismic Design of Reinforced Concrete and Masonry Building”, John Wiley and Sons, 1991.
5. BMTC, “Improving Earthquake Resistance of Housing” Building Materials and Technology Promotion Council, New Delhi, 2000.
6. Damodarasamy, S.R. and Kavitha, S., "Basics of Structural Dynamics and Aseismic Design”, PHI learning Pvt. Ltd., New Delhi, 2009.

OUTCOMES:

At the end of this course students will be able to

- describe the basic concepts on theory of vibrations and apply the principles for response of structures.
- recognize the characteristics of earthquake, dynamic behavior of soil and soil-structure interaction.
- critically describe the behaviour of various elements in a RCC structure under earthquake loading and evaluate the seismic forces using various analysis techniques.
- predict the effect of building configuration and its seismic response on steel structures.
- perform the design and detailing of various components in a structure for ductility as per codal provisions.
- identify the seismic damage evaluation for structures and suggest suitable retrofitting techniques.

CECX47 INDUSTRIAL STRUCTURES L T P C
3 0 0 3

OBJECTIVE:

- To enable the students to plan and understand the general requirements for various industrial structures.
- To impart knowledge to design the various special structures in steel and RCC.
- To give exposure on the principles involved in the design of prefabricated structures.

MODULE I PLANNING OF INDUSTRIAL STRUCTURES 5

Classification of industries and industrial structures – General requirements of various industries – Planning and layout of buildings and components.

MODULE II FUNCTIONAL REQUIREMENTS 6

Lighting – Ventilation Lighting – Illumination levels – Characteristics of Good lighting – Principles of day lighting design – Artificial lighting – Ventilation – Natural and Mechanical Ventilation – Evaporate cooling design – Measurement– Contaminant control – Installation and Operation - Acoustics – Fire safety – Guidelines from factories act.

MODULE III DESIGN OF STEEL STRUCTURES 10

Analysis and Design of Industrial buildings and bents – Industrial Roofs - Crane girders - Design of bunkers and silos.

MODULE IV POWER TRANSMISSION STRUCTURES 10

Tower configuration and bracings – Loads acting on towers – Analysis and Design of Lattice Towers – Transmission Line Towers – Tower foundations.

MODULE V DESIGN OF R.C. STRUCTURES 9

Analysis and Design of bunkers and silos – Design of Chimneys – Design of Grid floor.

MODULE VI PREFABRICATED STRUCTURES 5

Principles of Prefabrication - Prestressed precast roof trusses – Functional requirements of precast concrete units.

Total Hours : 45

TEXT BOOKS:

1. Krishna Raju, N., "Advanced Concrete Structures", McGraw Hill, New Delhi, 2000.
2. Ramchandra, "Design of Steel Structures", Vol. I & II, Scientific Publishers, 2007.
3. Santhakumar, A.R. and Murthy, S.S., “Transmission Line Structures”, McGraw-Hill, New Delhi, 2000.

REFERENCES:

1. SP 32: 1986, Handbook on Functional Requirements of Industrial buildings, Bureau of Indian Standards, New Delhi.
2. Santhakumar, A.R. and Murthy, S.S., “Transmission Line Structures”, McGraw-Hill, New Delhi, 2000.
3. Dayaratnam, P., "Design of Steel Structures", S. Chand, 2008.

OUTCOMES:

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

- plan the general requirements for various industries and prepare a layout for various industrial structures.
- make an appropriate lighting & ventilation and identify suitable measures to control fire as per factories act for an industrial structure.
- design an industrial building with bents and essential steel structures such as crane girder, bunkers, and silos for an industry.
- identify suitable tower configurations for power transmission and design a lattice tower with suitable foundations.
- analyse and design a RC structure such as bunkers, silos, chimneys and grid floor required for an industry.
- apply the principles and techniques to construct precast concrete units that are necessary for an industry.

CECX48 PREFABRICATED STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To appreciate aspects of modular construction and industrialised construction.
- To design some of the prefabricated elements and also have the knowledge of the construction methods using these elements.

MODULE I DESIGN PRINCIPLES **8**

General Civil Engineering requirements, specific requirements for planning and layout of prefabrication plant- IS Code specifications- Modular co-ordination, standardization - Disuniting of Prefabricates, production, transportation, erection, stages of loading and code provisions - safety factors-material properties- Deflection control -Lateral load resistance-Location and types of shear walls.

MODULE II REINFORCED CONCRETE **8**

Prefabricated structures - Long wall and cross-wall large panel buildings- one way and two way prefabricated slabs- Framed buildings with partial and curtain walls - Connections – Beam to column and column to column.

MODULE III FLOORS, STAIRS AND ROOFS **8**

Types of floor slabs- analysis and design example of cored and panel types and two-way systems- staircase slab design - types of roof slabs and insulation requirements- Description of joints, their behaviour and reinforcement requirements- Deflection control for short term and long term loads- Ultimate strength calculations in shear and flexure.

MODULE IV WALLS **8**

Types of wall panels- Blocks and large panels-Curtain, Partition and load bearing walls-load transfer from floor to wall panels- vertical loads- Eccentricity and stability of wall panels- Design Curves - types of wall joints, their behaviour and design- Leak prevention- joint sealants -sandwich wall panels- approximate design of shear walls.

MODULE V INDUSTRIAL BUILDINGS AND SHELL ROOFS 7

Components of single-storey industrial sheds with crane gantry systems- R.C. Roof Trusses- Roof Panels- corbels and columns- wind bracing design- Cylindrical, Folded plate and hyper-prefabricated shells- Erection and jointing- joint design- hand book based design.

MODULE VI JOINT IN STRUCTURAL MEMBERS 6

Joints for different structural connections – Dimensions and detailing – Design of expansion joints.

Total Hours : 45

REFERENCES:

1. Koncz.T.," Manual of Precast Concrete Construction", Vol.I II and III & IV Bauverlag, GMBH, 2000.
2. Laszlo Mokk, "Prefabricated Concrete for Industrial and Public Structures", Akademiai Kiado, Budapest, 2007.
3. Lewicki.B, "Building with Large Prefabricates", Elsevier Publishing Company, Amsterdam/ London/New York, 2000.
4. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precase Concrete, Netherland Betor Verlag, 2009.
5. Warszawski, A., "Industrialization and Robotics in Building - A managerial approach", Harper and Row, 2001.

OUTCOME:

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

- describe the design principles used to construct prefabricated structures.
- illustrate to create a panel and framed buildings with their connections of prefabricated RC structures.
- classify the types of floors, stairs and roofs and describe their behaviour of structures.
- critically describe the various types of wall panels of prefabricated structures.
- construct a prefabricated structural components for industrial buildings.
- detailing of various joints in structural members.

CECX49 TALL STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various problems associated with tall structures with respect to different kind of loads.
- To impart knowledge on the behaviour, analysis, design of various structural systems and stability of tall buildings including dynamic analysis.

MODULE I DESIGN CRITERIA & LOADING **7**

General - Factors affecting growth, height and structural form - Design philosophy - Loading - Gravity loading - Wind loading - Earthquake loading - Combinations of loading - Strength and Stability - Stiffness and Drift limitations - Human comfort criteria- Creep effects - Shrinkage effects - Temperature effects - Fire - Foundation settlement - Soil-structure interaction.

MODULE II STRUCTURAL FORMS **6**

Structural forms – braced frame, rigid frame, infilled frame, shear wall structures, wall- frame structures, framed tube structures, outrigger braced structures, space structures, hybrid structures, R.C. floor systems - One-way slab on beams and girders - Two-way flat slab - Two-way flat plate - Waffle flat slabs - Two-way slab and beam - Steel framing floor systems - One-way beam system - Two-way beam system - Three-way beam system - Composite steel - Concrete floor systems.

MODULE III MODELING FOR ANALYSIS **8**

Modeling for analysis - Assumptions - Modeling for approximate analysis - Modeling for accurate analysis - Reduction techniques.

MODULE IV BEHAVIOUR & ANALYSIS OF STRUCTURAL SYSTEMS **8**

Types, Behaviour and analysis methods of braced frames - Behaviour and analysis of Rigid frame structures - Behaviour, analysis & design of Infilled frame structures - Behaviour and analysis of Shear wall, Coupled shear wall and Wall-frame structures - Behaviour of Tubular structures, Core structures and Outrigger-braced structures.

MODULE V STABILITY OF TALL BUILDINGS **8**

Overall buckling analysis of frames (approximate methods) - Overall buckling

analysis of wall frames - Second order effects of gravity loading - Translational - Torsional instability - Out-of-plumb effects - Effects of foundation rotation - Creep and Shrinkage effects - Temperature effects.

MODULE VI DYNAMIC ANALYSIS 8

Response to wind loading - Along-wind response - Across-wind response - Estimation of natural frequencies & damping - Types of excitation - Design to minimise dynamic response - Response to earthquake motions - Response to ground accelerations - Response spectrum analysis - Estimation of natural frequencies and damping - Human response to building motions - Analysis of tall structures using FEM software.

Total Hours : 45

TEXT BOOKS:

1. Bryan Stafford Smith and Alex Coull, "Tall building Structures Analysis Design", John Wiley and Sons, Inc., New York, 2001.
2. Taranath, B.S., "Structural Analysis and Design of Tall Buildings", McGraw Hill Book Co., New York, 2000.

REFERENCES:

1. Lin, Y. and Burry, D., Stotes, "Structural Concepts and Systems for Architects and Engineers", John Wiley, New York, 2004.
2. Lynn S. Beedle., “Advances in Tall Buildings”, CBS Publishers and Distributors, New Delhi, 2006.
3. Angus J. MacDonald., “Wind Loading on Buildings”, Wiley, New York, 1975.
4. Lawson, T. V., “Wind Effects on Buildings”, Applied Science Publishers, London, 2001.

OUTCOMES:

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

- compute the different types of loading acting on tall structures and identify the different factors affecting the tall structures.
- classify and use appropriate types of structural systems in tall structures.
- construct modeling using various analysis techniques and describe its behaviour for various structural systems.
- interpret the behaviour of different structural systems and predict a suitable

system for tall structures.

- manipulate the second order effects of gravity loading, translational and torsional instability in the analysis of tall structures.
- analyze the response of wind and seismic motions on tall structures.

CECX50 DESIGN OF MACHINE FOUNDATION

L	T	P	C
3	0	0	3

OBJECTIVE:

- To provide sound understanding of the concepts, principles, and techniques of designing foundations for different types of machines.

MODULE I INTRODUCTION TO VIBRATION OF SYSTEMS 7

Vibration of elementary systems-vibratory motion-single degree freedom system-free and forced vibration with and without damping.

MODULE II WAVES AND WAVE PROPAGATION 8

Wave propagation in an elastic homogeneous isotropic medium- Rayleigh, shear and compression waves-waves in elastic half space.

MODULE III DYNAMIC PROPERTIES OF SOILS 7

Elastic properties of soils-coefficient of elastic, uniform and non-uniform compression - shear-effect of vibration dissipative properties of soils-determination of dynamic properties of soils- codal provisions.

MODULE IV DESIGN OF RECIPROCATING MACHINES 8

Dynamic loads - simple design procedures for foundations under reciprocating machines.

MODULE V DESIGN OF IMPACT AND ROTARY MACHINES 8

Design procedures for machines producing impact loads - rotary type machines.

MODULE VI VIBRATION ISOLATION 7

Vibration isolation techniques-mechanical isolation- foundation isolation-isolation by location-isolation by barriers- active and passive isolation tests.

Total Hours :45

TEXT BOOKS:

1. Swamisaran, “Soil Dynamics and Machine Foundations”, Galgotia Publications Pvt. Ltd., New Delhi, 2011.
2. Prakesh, S. and Puri, V.K., “Foundation for Machines”, McGraw-Hill, New York, 2008.

3. Srinivasulu, P. and Vaidyanathan, “Hand book of Machine Foundations”, McGraw-Hill, New York, 2000.
4. Kramar, S.L., “Geotechnical Earthquake Engineering”, Prentice Hall International Series, Pearson Education (Singapore) Pvt. Ltd., U.S.A., 2000.
5. Kameswara Rao, “Dynamics Soil Tests and Applications”, Wheeler Publishing, New Delhi, 2003.

REFERENCES:

1. Kameswara Rao, “Vibration Analysis and Foundation Dynamics”, Wheeler Publishing, New Delhi, 2008.
2. IS 2974 (Part V) - 1987, Code of Practice for Design and Construction of Machine Foundations, Bureau of Indian Standards, New Delhi.
3. Moore, P.J., “Analysis and Design of Foundation for Vibration”, Oxford and IBH, New Delhi, 2005.

OUTCOMES:

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

- describe the fundamentals of free and forced vibration with regard to single degree of freedom.
- examine the propagation of waves in a soil medium subjected to dynamic loading.
- explain the dynamic properties of soil and its method of determination based on codal provisions..
- design the foundation for reciprocating machines.
- design the foundation for impact and rotary machines.
- analyze the different vibration isolation systems.

CECX51 GROUND WATER ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the principles of Groundwater governing Equations and characteristics of different aquifers.
- To understand the techniques of development and management of groundwater.

MODULE I HYDROGEOLOGICAL PARAMETERS 8

Introduction – Water bearing Properties of Rock – Type of aquifers – Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation– Ground water table fluctuation and its interpretations – Groundwater development and Potential in India – GEC norms.

MODULE II WELL HYDRAULICS 8

Objectives of Groundwater hydraulics – Darcy's Law – Groundwater equation – steady state flow – Dupuit Forchheimer assumption – Unsteady state flow – Theis method – Jacob method -Slug tests – Image well theory – Partial penetrations of wells.

MODULE III GROUNDWATER MANAGEMENT 6

Need for Management Model – Database for groundwater management – groundwater balance study – Introduction to Mathematical model – Conjunctive use – Collector well and Infiltration gallery

MODULE IV GROUNDWATER QUALITY 8

Ground water chemistry – Origin, movement and quality – Water quality standards – Health and aesthetic aspects of water quality – Saline intrusion – Environmental concern and Regulatory requirements.

MODULE V GROUNDWATER CONSERVATION 7

Artificial recharge techniques – Remediation of Saline intrusion– Ground water management studies – Protection zone delineation - Contamination source inventory- remediation schemes –Ground water Pollution and legislation.

MODULE VI GROUNDWATER EXTRACTION **8**

Tube wells- Types and Parts- optimum capacity -silting of tube well-design of tube wells in different aquifers-Bore hole, strains - types, well pipe, casing pipe, blind pipe - Construction and working of tube wells- site selection, drilling operation, alignment of tube wells, gravel packing- Methods -cable tool method- hydraulic method- rivers Rotary Method and drilling fluids- Pumping equipment and hydraulic testing of pumps.

Total Hours : 45

TEXT BOOKS:

1. Raghunath H.M., “Ground Water Hydrology”, New Age International (P) Limited, New Delhi, 2010.
2. Todd D.K., “Ground Water Hydrology”, John Wiley and Sons, New York, 2011.

REFERENCES:

1. Fitts R Charles, “Groundwater Science”. Elsevier, Academic Press, 2012.
2. Ramakrishnan, S, “Ground Water”, K.J. Graph arts, Chennai, 2011.

OUTCOMES:

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

- understand aquifer properties and its dynamics after the completion of the course.
- give an exposure towards well design and practical problems of groundwater aquifers.
- impacts the Knowledge about the groundwater management.
- manage the quality of groundwater, exploration and saline intrusion
- understand the importance of artificial recharge and groundwater quality concepts.
- understand the application of various groundwater improvement methods.

CECX52 ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- To familiarize the students about impact of infrastructure projects on the components of environment, impact assessment methods and mitigation measures.

MODULE I INTRODUCTION **7**

Evolution of EIA - Concepts - Methodologies - Screening - Scoping – Mitigation-Matrices – Checklist- Impact of development projects – Sustainable development-Need for Environmental Impact Assessment (EIA) – Environmental Impact Statement (EIS)

MODULE II EIA PROCESS **8**

EIA capability and limitations-Stages of EIA, Types of EIA Rapid and Comprehensive EIA - Legislative and Environmental Clearance procedure in India - Prediction tools for EIA- Environmental and Social Management Frame work (ESMF).

MODULE III EIA FOR SPECIFIC PROJECTS **7**

Assessment of Impact - Air - Water - Soil - Noise – Biological - EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storey Buildings-– Water Supply and Drainage Projects.

MODULE IV PUBLIC PARTICIPATION IN EIA **8**

Socio-cultural environment - Public participation -
Addressing the issues related to
the Project - Resettlement and rehabilitation.

MODULE V MONITORING IN EIA **8**

Documentation of EIA - Environmental management plan - Plan for mitigation of adverse impact on environment -options for mitigation of impact on water, air and land, flora and fauna; Post project monitoring.

MODULE VI ENVIRONMENTAL AUDIT **7**

Environmental Audit- Life cycle assessment case studies - EMS - case studies in EIA- Industrial ecology – carbon trading.

Total Hours :45

TEXT BOOKS:

1. Canter, R. L., “Environmental Impact Assessment”, McGraw Hill, New Delhi, 2006.
2. Shukla, S. K., and Srivastava.P.R., “ Concept in Environmental Impact Analysis”, Common wealth publishers, New Delhi, 2002.

REFERENCES:

1. John G. Rau and David C. Wooten (Ed.), “Environmental Impact Analysis Hand Book”, McGraw Hill Book Company, 2000.
2. Judith Petts, “ Handbook of Environmental Impact, assessment Volume I & II “ Blackwell Science, 1999.
3. Ministry of Environmental, Forest and Climate Change, “ EIA Manual”, Impact Division, Government of India, 2001. http://www.moef.nic.in/division/eia-manual

OUTCOMES:

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

- describe the concepts and methodologies of Environmental impact assessment.
- explain the legislative and environmental clearance procedure and apply the prediction tools for EIA.
- assess the impacts of Infrastructure projects on air, water, soil and environment.
- Describe the public participation, procedure, resettlement and rehabilitation processes in EIA.
- prepare documentation of EIA and to develop environmental management plan for the same.
- Conduct environmental audit and life cycle assessment of products.

CECX54	GIS IN INFRASTRUCTURE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide fundamental concepts of GIS, its definitions, components and map making process.
- To provide information to segregate real world data, different storage procedures and database structures to store the GIS data in a database management system.
- To impart knowledge on classification of real world data into raster and vector representation, to understand data quality and handling of errors.
- To expose the students to raster and vector data analysis methods, to create raster and vector data models, create queries and solve surface to network problems.
- To provide different application scenarios available in different domains such as natural resources management, land information, water resources management, environmental engineering and monitoring and ways to solve the problems in these domains.
- To provide different application scenarios in problems related to urban, utilities, business development, web and mobile GIS and ways to solve the problems in these domains.

MODULE I FUNDAMENTALS OF GIS 7

Introduction – definitions of GIS – components of GIS – Geographic data Presentation: maps – mapping process – coordinate systems – transformations – map projection – geo referencing - data acquisition.

MODULE II GIS DATA MODELS & STRUCTURES 8

Geographic data representation, storage, quality and standards: storage: digital representation of data –data-base structures and database management systems.

MODULE III SPATIAL DATA STRUCTURES 7

Raster data representation – vector data representation – concepts and definitions of data quality – components of data quality – assessment of data quality – managing data errors – geographic data standards.

MODULE IV GIS DATA PROCESSING AND ANALYSIS 8

GIS data processing, analysis and modeling : Raster based GIS data processing – vector based GIS data processing – queries – spatial analysis – descriptive statistics – spatial autocorrelation – quadrant counts and nearest neighbour analysis – network analysis – surface modeling – DTM.

MODULE V APPLICATIONS OF GIS FOR NATURAL RESOURCES 8

Applications of GIS: Natural Resources Management, Natural hazard management, Land information, Water Resources Management, Environmental Engineering & Monitoring.

MODULE VI APPLICATIONS OF GIS IN CIVIL ENGINEERING 7

Applications of GIS: Urban planning, Transportation Engineering, Utility management, Business development, Cartography, Web GIS and Mobile GIS.

Total Hours : 45

TEXT BOOKS:

1. Anji Reddy, “Remote sensing and Geographical systems”, B.S Publications, Hyderabad, 2008.
2. Clarke, K., “Getting Started with Geographic Information Systems”, Prentice Hall, New Jersy, 2001.

REFERENCES:

1. Burrough, P.A., “Principles of Geographical Information Systems”, Oxford Publication, 2001.
2. De Mers and Michael, N., “Fundamentals of Geographic Information System”, 2nd Edition, John Wiley and sons, 2003.

OUTCOMES:

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

- describe GIS, list its different components, to identify different elements of a map.
- design a GIS database scheme, data structure for storage of data and segregate the different layers that needs to be stored for an application.
- create raster, vector layers and to generate and create error free spatial data with its attributes.
- categorize raster and vector data processing methods and to solve network and surface related problems and to generate spatial queries and to identify the outputs achieved.
- solve real world problems on environmental, water resources, natural resources and natural hazards through spatial analysis.
- solve real world problems on urban, utilities, business development, web and mobile GIS through spatial analysis.

CECX55	GEODESY	L	T	P	C
		2	0	0	2

OBJECTIVE:

- To provide students comprehensive understanding of the various concepts of geodetic surveying and to solve geodetic problems.

MODULE I FUNDAMENTALS **7**

Definitions, Classifications, and Problem of Geodesy- Historical development and Organization of Geodesy- Reference Surfaces and their relationship- Applications-Engineering- Lunar and Planetary Geodesy.

MODULE II GEOMETRIC GEODESY **9**

Geodetic, Geocentric and Reduced latitudes and their relationship- Coordinates in terms of Reduced, Geodetic and geocentric latitude-Radius of curvature in the meridian & prime vertical and their relationship-Radius of curvature in any azimuth- Length of the meridian arcs and arcs of parallel- Area of trapezium on the ellipsoid-Curves on the ellipsoid- properties of Geodesic and Everest ellipsoid.

MODULE III PHYSICAL GEODESY **8**

Gravity field of earth- Concept of equipotential, Geopotential and Spheropotential Surface - Normal gravity-The Significance of gravity measurements- Measurements of Absolute and Relative gravity- Reduction of gravity measurements- Isostasy- Gravity networks- Gravity anomaly and Gravity disturbance - Fundamental equation of Physical Geodesy- Determination of Geoid - Deflection of Vertical, Orthometric height, Normal height, Dynamic height and their corrections- Ellipsoidal height and geoidal height.

MODULE IV GEODETIC COMPUTATION **6**

Rectangular and Polar Co – ordinates - First and Second geodetic problem - Similarity and Helmert's transformation- Point determination by Intersection - Resection and Arc Section.

Total Hours : 30

TEXT BOOKS:

1. James R. Smith, "Introduction to Geodesy", John wiley & Sons Inc., New York, 2001.

REFERENCES:

1. Wolfgang Torge, “Geodesy”, Walter De Gruyter Inc., Berlin, 2001.
2. Bomford, G., “Geodesy”, Clarendon press, Oxford, 2004
3. Petr Vanicek and Edward J. Krakiwsky, “Geodesy : The Concepts”, North-Holland Publications Co., Amsterdam, 1991
4. Heribert kahmen and Wolfgang Faig, “Surveying”, Walter De Gruyter, Berlin, 2003.
5. Schwarze, V.S., “Geodesy: The challenge of the 3rd Millennium”, Springer verlag, 2002
6. Howard gore, J., “Elements of Geodesy”, Kessinger Publishing, 2007.
7. George I. Hosmer, “Geodesy”, Kessinger Publishing, 2007.

OUTCOMES:

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

- categorize the classification of geodesy, to describe the problem of geodesy and to list the reference surfaces with their relationship.
- sort the various types of the latitude with their relationship and to explore the radius of curvature in the meridian, prime vertical, azimuth and ellipsoid.
- justify the significance of gravity and to sort the various types of gravity, to solve the fundamental equation of physical geodesy and to categorize the different height involved in physical geodesy.
- solve the rectangular and polar coordinates, to conclude first and second geodetic problem, to determine the coordinates of point by Intersection, Resection and Arc Section.

CECX56	BUILDING INFORMATION MODELING	L	T	P	C
		2	0	0	2

OBJECTIVES:

To provide knowledge on

- the basics of Building Information modeling
- the BIM principles that are applied to the Construction industry to improve the ease of project delivery.

MODULE I AN OVERVIEW OF BIM 6

Introduction to BIM Software – Back ground and History of BIM – Purpose and objectives of BIM – BIM benefits.

MODULE II INCORPORATING AND MANAGING BIM 8

To build a building virtually prior to building it physically - work out problems, simulate and analyze potential impacts - anticipation and ease of project delivery, the overall safety of the project – Introduction to Navis work- Demo.

MODULE III BIM THROUGHOUT PROJECT LIFE CYCLE 9

Programming – Conceptual design – Detailed design – Analysis – Documentation – Fabrication – Construction 4D/5D – Construction Logistics – Operation and Maintenance – Demolition – Renovation.

MODULE IV APPLICATIONS OF BIM 7

Application to enhance efficiency during and post construction phases, and facility management - Applications like determination of quantities of items and material inventory – Application like Building energy performance analysis

Total Hours –30

TEXT BOOKS:

1. Peter Thomas Barnes and Nigel Davies “BIM and Construction Management: Proven Tools, Methods and Workflows” ICE Publishing; First edition 2013.

2. Brad Hardin and Dave Mccool “BIM and Construction Management: Proven

tools, methods and work force" Wiley; Second edition, 2015.

REFERENCES:

1. BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors, John Wiley & Sons; 2nd Revised edition, 2011.
2. BIM and Construction Management: Proven Tools, Methods, and Workflows / Hardin / Sybex — A BIM reference with a focus on construction management

OUTCOMES:

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

- summarize the BIM Principles.
- understand the analyzing potential impacts using navis works.
- explain the BIM Application.
- demonstrate the construction project delivery using BIM.

CECX57	DESIGN OF COLD FORMED STEEL STRUCTURES	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To impart sufficient knowledge to students on techniques, properties and types of cold formed steel sections.
- To give exposure to students on buckling of members; codal provisions; and connection methods.
- To offer knowledge to analyse and design different structural elements i.e., columns, beams, purlins using cold formed sections.

MODULE I INTRODUCTION **5**

Manufacturing Techniques and properties of cold formed sections - Types of cross sections - Merits and demerits of cold formed sections.

MODULE II COLD FORMED STEEL SECTIONS **7**

Concepts of local buckling - effective width - Stiffened and unstiffened elements – Codal Provisions - IS 801 & IS 811 – concept of lateral buckling - Methods of connections.

MODULE III DESIGN OF COMPRESSION MEMBERS **9**

Design of axially compressed column – Analysis and design of effective section under bending and compression - Combined stresses.

MODULE IV DESIGN OF FLEXURAL MEMBERS **9**

Concept of shear lag and flange curling - Design of beams and beam webs – deflection of beams - Empirical design of Z-purlins with lips and wall studs.

Total Hours : 30

TEXT BOOKS:

1. Dayaratnam, P., “Design of Steel Structures”, Wheeler Publishing, 2000.
2. Rhodes, J, “Design of Cold-Formed Steel Members”, Elsevier Science Publishers, 2001.

3. Ramchandra, S., “Design of Steel Structures”, Vol.-II, Standard Publications, New Delhi, 2010.
4. Subramanian N, “Steel Structures - Design and practice”, Oxford University Press, 2011.

REFERENCES:

1. Teaching Resource for Structural Steel Design, INSDAG, Kolkatta, 2010.
2. BIS: 800-2007, Indian standard code of practice for general construction in steel, Bureau of Indian Standards.
3. BIS 801: 1975 - Indian standard code of practice for use of cold-formed light gauge steel structural members in general building construction, Bureau of Indian Standards.
4. SP 6 (5) -1980 – Hand book for structural Engineers.
5. Cold formed, Light gauge steel structures, Bureau of Indian Standards.

OUTCOMES:

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

- describe the manufacturing techniques, merits and demerits of cold formed steel structures
- illustrate the concepts of buckling, warping mechanisms and shear lag.
- analyse and design the cold formed compression members
- analyse and design the cold formed flexural members

CECX58	CORROSION CONTROL OF STEEL IN CONCRETE	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To impart sound knowledge on mechanism of corrosion of steel in concrete, its causes, consequences and control measures.
- To offer in depth knowledge on codal provisions for enhancing durability and corrosion rate measurement in distressed structures including rehabilitation techniques

MODULE I CORROSION MECHANISM 7

Corrosion mechanism – black rust - pits - stray current - bacterial corrosion-causes of corrosion – carbonation - chloride attack - influence of concrete cover corrosion damage – damage in conventionally reinforced concrete - corrosion cracking - hydrogen embrittlement - Types of corrosion.

MODULE II CORROSION CONTROL IN CONCRETE 8

Control of carbonation - control of chlorides - high performance concrete-corrosion inhibitors – anodic, cathodic and mixed Inhibitors

MODULE III CORROSION CONTROL IN STEEL REBARS 7

Protective coatings to steel rebars – fusion bonded epoxy coating, galvanization, cement polymer composite coating, inhibited cement slurry coating and anticorrosive polymer cementious coatings - stainless steel reinforcement - sealers and membranes – cathodic protection.

MODULE IV CORROSION RATE MEASUREMENT 8

half cell potential measurements - carbonation depth measurement – chloride determination and resistivity measurement - corrosion rate measurement – linear polarization resistance techniques.

Total Hours : 30

TEXT BOOKS:

1. Arnon Bentur, Sidney Diamond and Neal S. Berke, “Steel Corrosion in

Concrete – Fundamentals and Civil Engineering Practice", E & FN SPON Publications, Madras,2007

2. John P.Broomfield, "Corrosion of steel in concrete - Understanding, investigation and repair", E & FN SPON Publications, Madras,2007.

REFERENCES:

1. Mars G. Fontana, "Corrosion Engineering" Mc-Graw Hill Publishers, New Delhi, 2001.
2. Philip H. Perkins, "Repair, Protection and Waterproofing of Concrete Structures", Elsevier Applied Science Publishers, London, 2006.

OUTCOMES:

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

- identify the causes and mechanism of corrosion in reinforced concrete.
- suggest passive measures to control the corrosion in reinforced concrete.
- suggest active measures to control the corrosion in steel reinforcement.
- assess the rate at which the reinforced concrete is being corroded.

CECX59	STORM WATER AND FLOOD MANAGEMENT	L	T	P	C
		2	0	0	2

OBJECTIVE:

To impart knowledge on:

- Water shed management, rainfall- runoff process, causes & effects of floods, flood risk assessment , modeling & mapping
- Flood prevention, preparedness and mitigation measures.
- Flood damage assessment, recovery and rehabilitation measures,
- National disaster management guide lines on flood management

MODULE I RAINFALL RUNOFF PROCESS 7

Water shed - water shed management-rain fall runoff process - Criteria for sustainable water management -causes of floods-Impacts-Flood routing.

MODULE II FLOOD MODELING AND RISK ASSESSMENT 9

Basic principles and aspects of flood risk assessment - Flood Hazard Modeling – Flood Plain delineation & mapping –Software tools- Application of GIS-Community-based flood risk assessment- Case studies.

MODULE III FLOOD RISK MANAGEMENT 7

Flood plain management – Tools for flood plain management –Flood prevention, preparedness and mitigation – frame work - Structural and non structural flood mitigation measures– Integrated watershed management- Urban and Rural development planning – Public awareness and capacity building

MODULE IV FLOOD DISASTER PLANNING 7

Flood forecasting and warning–Indian context - Emergency response planning and management – Evacuation process, rescue process– Environmental health - Concepts of recovery and rehabilitation – Flood damage assessment – Management of recovery and rehabilitation activities- National disaster management guide lines on flood management.

Total Hours : 30

TEXT BOOKS:

1. Rangapathy.V. karmegam. M and Sakthivadivel.R., " Monograph in flood routing methods as applied to Indian Rivers" Anna University Publication,2000
2. Andreas H. Schumann., "Flood Risk Assessment and Management", Springer
   Science & Business Media B.V.2011

REFERENCES:

1. Ashley R., Garvin S., Pasche E. and Vassilopoulos A., Advances in Urban Flood Management, Balkema, 2007
2. Frans Klijn and Timo Schweckendiek. "Comprehensive Flood Risk Management: Research for Policy and Practice" CRC Press, 1 edition 2012.
3. Engineering hydrology by K. Subramanya, Tata McGraw-Hill Education, 2017
4. James C Y Guo. "Urban Flood Mitigation and Stormwater Management" CRC Press, 2017
5. Paul Sayer, "Flood Risk: Planning, Design and Management of Flood Defense Infrastructure" ICE Publication, 2012.

OUTCOMES:

Upon completion of the course students will be able to:

- apply the various waste shed concepts and flood routing.
- discuss the methods of flood risk assessment and mapping using geospatial techniques.
- demonstrate their knowledge on flood mitigation measures and public awareness.
- analyse the flood forecasting and flood disaster.

CECX60	URBAN AND INDOOR AIR QUALITY MANAGEMENT	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the concepts of air quality assessment methods.
- To get the knowledge on various air pollution monitoring systems, its software and modeling.
- To understand the components in indoor air quality.
- To impart knowledge on the techniques to control and prevent air pollution.

MODULE I MONITORING AND MANAGEMENT 7

Monitoring and measuring - air quality indicators - Air quality assessment methods - Monitoring objectives - Functions - Air quality assurance and air quality control

MODULE II MONITORING SYSTEMS 8

Types of monitoring systems - Monitoring levels - Critical analysis of the existing monitoring systems - Software for air quality monitoring - Quality modeling and decision-making: Air quality and pollution sources - from assessment to management

MODULE III INDOOR AIR QUALITY 7

Indoor activities of inhabitants - Levels of pollutants in indoor and outdoor air- Design and operation of buildings for improvements of public health- IAQ policy issues-sustainability. Air pollutants in indoor environments- private residences- offices-schools-public buildings- ventilation- Effect of pollutants on occupants and building materials.

MODULE IV POLLUTION & CONTROL 8

Indoor air pollution from outdoor sources- particulate matter and ozone- Combustion byproducts-Radon and its decay products- Volatile organic compounds- odours and sick-building syndrome- Humidity- Bio aerosols- infectious disease transmission-Special indoor environments- A/C units in indoor- Measurement methods- Control

technologies- Control strategies.

Total Hours –30

TEXT BOOKS:

- Griffin, R. D, “Principles of Air Quality Management”, CRC Press, ISBN 0-8493-7099-X, 2006.
- Thad Godish , “Indoor Environmental quality”, Lewis Publisher , Washington DC, 2016
- Nazaroff W.W. and L. Alvarez-Cohen, “Environmental Engineering Science”, Wiley sons, Newyork, 2001

REFERENCES:

- Robert J. H., John M. Cimbala,” Indoor Air Quality Engineering: Environmental Health and Control of Indoor”, Prentice hall, Inc, Newyork, 2003
- Richard A. Wadden, and Peter A. Scheff, "Indoor Air Pollution - Characterization, Prediction, and Control", John Wiley & Sons,2006.

OUTCOMES:

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

- explain hazardous atmospheric conditions.
- evaluate atmospheres relative to health and environmental standards.
- model air emissions to predict atmospheric concentrations and recommend appropriate controls and management strategies to reduce or eliminate pollutants and their effects.
- describe the measurement methods and control strategies.

CECX61	CONTRACT LAWS AND REGULATIONS	L	T	P	C
		2	0	0	2

OBJECTIVES:

To improve the knowledge of the students in various elements of contract, tendering procedures, arbitration, labor regulations and other laws related to it.

MODULE I CONSTRUCTION CONTRACTS **8**

Indian contracts act – elements of contracts – types of contracts – public private partnership in contract - design of contract documents – standard contract document - RFT, RFQ, BOT and BOOT.

MODULE II TENDERS **7**

Prequalification – bidding – accepting – evaluation of tender from technical, contractual and commercial points of view – contract formation and interpretation-potential contractual problems.

MODULE III LEGAL REQUIREMENTS **8**

Insurance and bonding – laws governing sale, purchase and use of urban and rural land – tax laws – income tax, sales tax, excise and custom duties and their influence on construction costs – legal requirements for planning – property law local government laws for approval – statutory regulations.

MODULE IV LABOUR REGULATIONS **7**

Laws relating to wages, bonus and industrial disputes, labour administration – insurance and safety regulations Workmen's Compensation Act – Indian Factory Act – Tamilnadu Factory Act – Child Labour Act - Other Labour Laws.

Total Hours –30

TEXT BOOKS:

1. Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India", M.M.Tripathi Private Ltd., Bombay, 2000.

2. Patil. B.S, “Civil Engineering Contracts and Estimates”, Universities Press Private Limited, India, 2006.

REFERENCES:

1. Jimmie Hinze, “Construction Contracts”, McGraw Hill, 2001.
2. Joseph T. Bockrath, “Contracts and the Legal Environment for Engineers and Architects”, McGraw Hill, 2000.
3. The Indian Contracts Act, 1872,
4. Arbitration and Conciliation Act, 1996.
5. The Tamilnadu Transparency in Tenders act, 1998.

OUTCOMES:

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

- define the various elements, types and laws related to contract.
- list the various processes involved in tendering.
- describe the various legal requirements related to construction activities.
- list the available labor regulations and its benefits to the labour.

CECX62 SMART CITIES

L	T	P	C
2	0	0	2

OBJECTIVES:

- To examine the core challenges relating to the foundation of sustainable smart cities
- To develop knowledge, understanding, and critical thinking related to smart, sustainable urban development.
- To explore issues relating to the development and deployment of new and emerging technologies, that will create a thorough understanding of smart processes and systems of the present and future.

MODULE I UNDERSTANDING SMART CITIES 7

Introduction to Smart City - How did the idea evolve - History and Evolution of Smart Cities, worldwide - barriers and benefits of smart cities - Development Perspectives - Definitions and Core Concepts - characteristics and factors of Smart cities

MODULE II SMART CITY RESPONSIBILITIES 7

Built environment – Energy – Telecommunications – Transportation - Health and human services - Water and wastewater - Public safety and Payments.

MODULE III SMART CITY ENABLERS 7

Instrumentation and control – connectivity- interoperability- security and privacy - data management - computing resources and analytics - Process of building a smart cities roadmap

MODULE IV TOWARDS SMART CITIES IN INDIA 9

ICT initiatives in Indian Cities - economic development - smart city technologies: inventory and standardization- potential of commercialization and emerging trends - e-democracy and e-governance - Case studies in India : Palava - Dombivalli, Mumbai, Lavasa- Pune.

Total Hours : 30

TEXT BOOKS:

1. Chan.D (2016) Defining smart cities seminar : A Guiding Frame work.
2. Goldsmith.S & Crawford.S " the responsive city: engaging communities

through data – smart governance"John Wiley & sons, 2014.
3. Mele.N The end of big: How the internet makes david the new Goliath, Macmillan 2013
4 Townsend, A.M., " Smart Cities: Big data, Civic Hackers, and the quest for new ww norton & company, 2013.

REFERENCES:

1. Jesse Berst, Liz Enbysk and Christopher Williams Smart Cities Readiness Guide - The planning manual for building tomorrow's cities today, Smart Cities Council, 2014.
2. Aniket Bhagwat, Suparna Bhalla, Sanjay Prakash Ashish Bhalla Destination 100 The Making of Smart Cities in India**,** Future Institute publishers, 2014,
3. Vinod kumar T. M., Geographic Information Systems for Smart Cities, Copal Publishing, New Delhi, 2014,

OUTCOMES:

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

- Understand the concept, discourse and practice of "smart cities" across the globe
- Optimize/ design the various Infrastructures for smart cities.
- Understand the role of smart data management.
- Initiate the ICT in smart city for economic development of India

CECX63	ENVIRONMENTAL MONITORING	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To understand the analytical techniques and instrumental methods in environmental monitoring.
- To impart knowledge on various air quality monitoring methods.
- To understand the concepts involved in monitoring water quality.
- To enhance their knowledge in material characterization techniques.

MODULE I ANALYTICAL METHODS 7

Classification of instrumental methods- Performance characteristics of instruments (static and dynamic)-errors and uncertainties in performance parameters- noise reduction- Sensitivity and detection limit Errors-types-expression of errors- Precision and accuracy- Calibration of instrumental methods.

MODULE II AIR QUALITY MONITORING METHOD 7

Spectophotometry - Electromagnetic radiation -Atomic absorption and emission spectrometry -Ultraviolet-visible spectrophotometry principle and instrumentation- Atomic adsorption spectroscopy principle and instrumentation- Monitoring environmental problem using remote sensing and GIS.

MODULE III WATER QUALITY MONITORING METHODS 8

Electro chemical methods- electrochemical cell- Fluorimetry- nephelometry and turbidimety- principles- Electrodes- Conductometry- electrolytic conductivity specific equivalent and molar conductance- working principles of pH, EC, TDS meters.

MODULE IV MATERIAL CHARACTERIZATION METHODS 8

Material characterization techniques- SEM, TEM, XRD, FTIR, thermal analysis-

working principles and applications.

Total Hours : 30

TEXT BOOKS:

1. Paul. R. Locontio, “Trace Environmental Quantitaive Analysis: Principles, Techniques and Applications”, 2nd Edition, 2005

2. D.A. Skoog, D.M. West and T.A. Nieman, “Principles of Instrumental Analysis”, 5th Ed. Thomson Asion (P) Ltd. Singapore, 2004.

REFERENCES:

1 Andrew N. Rencz, “Manual of Remote Sensing: Remote Sensing for Natural Resource Management and Environmental Monitoring”, John Wiley & Sons Inc, April 2004

2. Reeve R.N., “Introduction to Environmental Analysis, Analytical techniques in sciences”, John and Sons, Chichester, UK, 2002.

OUTCOMES:

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

- elaborate about the problems and errors in instruments.
- explain the principle and method of air quality monitoring techniques.
- describe the principle of water quality monitoring techniques.
- select a method for material characterization.

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.

L : 30 periods

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.

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.
4. Pillai, S.O., Solid State Physics, New Age International, New Delhi, 2005.

5. Charles P.Poole and Frank J. Owens, ”Introduction to nanotechnology”, Wiley (India),
2009.
6. Pradeep. T., “Textbook of Nanoscience and Nanotechnology”, McGraw Hill Education
(India) Private Limited, New York, 2012.

OUTCOMES:

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

- 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 TECHNOLOGY

L	T	P	C
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.

L	T	P	C
2	0	2	3

PHCX 04 LASERS AND THEIR APPLICATIONS

OBJECTIVES

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

MODULE I LASER THEORY 8

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

MODULE II DIFFERENT LASER SYSTEMS 8

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

MODULE III METROLOGICAL AND MATERIAL PROCESSING APPLICATIONS 8

CW and Pulsed laser beam characteristics and its measurements - Beam focusing effects - spot size - Power and Energy density Measurements - Distance measurement - Interferometric techniques - LIDARS - different experimental arrangements - Pollution monitoring by remote sensing - Laser gyroscope - Laser

welding, drilling, machining and cutting - Laser surface treatment - Laser vapour deposition – Biophotonic applications.

MODULE IV LASER INSTRUMENTATION 6

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. L aud.B.B., “Laser and Non-Linear Optics”, Second Edition, New Age International (p) Limited Publishers, 2011.
4. N ambiar. 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.

OUTCOME :

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.

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 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.

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.
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 NONDESTRUCTIVE TESTING	L	T	P	C
	2	0	2	3

OBJECTIVES:

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

MODULE I ELASTICITY **8**

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

MODULE II DYNAMICS OF RIGID BODIES **8**

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

MODULE III NDT TECHNIQUES **6**

Ultrasonic Testing- types of Transducers-transmission and pulse-echo method- Radiographic testing- Principle-Interaction of X-ray with matter-X-ray radiography-

method of generation-industrial radiography inspection techniques- Liquid Penetrant Testing- Inspection Procedure and Interpretation of results.

MODULE IV LOW TEMPERATURE PHYSICS 8

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

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. Baldev Raj.,Jayakumar T., Thavasimuthu M.,"Practical Non-Destructive testing", Narosa Publishing House, 2009.
5. Brijlal & Subrahmanyam., "Heat and Thermodynamics" S.Chand & Company Ltd, 2002.
6. Paul E Mix.," Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition, New Jersey, 2005.

7. Charles J., Hellier.," Handbook of Nondestructive evaluation", McGraw Hill, New York, 2001.

OUTCOMES:

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

- understand the basic of concept of elasticity of materials.
- comprehend the basic concepts of motion of rigid bodies and its applications.
- Demonstrate the various NDT techniques and its importance.
- Illustrate the low temperature systems and its applications.

PHCX 09 SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS

L	T	P	C
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.

Chemistry Elective Courses
(To be offered II Semester)

CHCX01 ANALYTICAL INSTRUMENTATION L T P C
2 0 2 3

OBJECTIVES

To make the student conversant with

- principles, instrumentation and applications of different electroanalytical techniques
- different chromatographic techniques
- principles, instrumentation and applications of various types of absorption and emission spectroscopy
- different thermal analytical methods and their applications

MODULE I ELECTROANALYTICAL TECHNIQUES 7

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

MODULE II CHROMATOGRAPHY 8

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

MODULE III SPECTROSCOPY 8

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

MODULE IV THERMAL ANALYSIS 7

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

L: 30 periods

PRACTICALS

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

P:30 periods

Total: 60 periods

REFERENCES

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

OUTCOMES

The student will be able to

- state the principle and applications of various electro-analytical techniques
- identify the right separation method for a given sample using different chromatographic techniques
- explain the principle, instrumentation & applications of various spectroscopic methods and also to interpret the data

- elaborate the principle, instrumentation and applications of various thermal analytical techniques and interpret the data.

CHCX02 CORROSION AND ITS CONTROL

L	T	P	C
2	0	2	3

OBJECTIVES

To make the student conversant with

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

MODULE I BASIC CONCEPTS OF CORROSION 8

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

MODULE II FORMS OF CORROSION 7

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

MODULE III CORROSION CONTROL AND ORGANIC COATINGS 8

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

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

MODULE IV INORGANIC COATINGS **7**

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

L : 30 periods

PRACTICALS

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

P:30 periods

Total: 60 periods

REFERENCES

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

OUTCOMES

The students will be able to

- explain the mechanism, compare and enumerate the factors affecting corrosion
- describe and identify the place and types for a given situation.
- choose and elaborate the suitable organic coating method for a given real time situation.
- apply a suitable metallic coating for a given situation

CHCX03 ELECTRICAL MATERIALS AND BATTERIES L T P C

2 0 2 3

OBJECTIVES

To make the student conversant with

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

MODULE I POLYMERS FOR ELECTRICAL AND ELECTRONIC APPLICATIONS 8

Preparation, properties and applications **:** polyethylene, polypropylene, EPDM, Nylon-6,6, PVC, PTFE, polycarbonates, ABS, phenol formaldehyde, urea formaldehyde, epoxy resins – polymer blends and alloys.

MODULE II ELECTRICAL ENGINEERING MATERIALS 7

Conductors**:** Silver, Copper, Gold, Aluminum **–** Semiconductors: Germanium, Silicon, Gallium Arsenic **–** Insulating Materials: Rubbers, Mica, Plastics, Ceramics, Insulating papers **–** Magnetic Materials**:** ferromagnetic materials, paramagnetic materials, diamagnetic materials, antiferromagnetic materials, ferrites

MODULE III BATTERIES 7

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

MODULE IV FUEL CELLS 8

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

L:30 periods

PRACTICALS

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

P:30 periods

Total: 60 periods

REFERENCES

1. Jain P.C. and Renuka Jain, Engineering Chemistry, Dhanpat Rai Publication Co. (P) Ltd., New Delhi, 2013.
2. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
3. H.F. Mark and N. Gaylord, Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV Interscience, 2nd Ed. 1988.
4. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.
5. R.K. Rajput, A Textbook of Electrical Engineering Materials, Firewall Media, 2004

6. Vladimir S. Bagotsky, Fuel Cells: Problems and Solutions, 2nd Edition, John Wiley and Sons, 2012.

7. B. Viswanathan and M. Aulice Scibioh, Fuel Cells: Principles and Applications, Taylor and Francis Group, 2007.

OUTCOMES

The student will be able to

- summarise the preparation, properties and applications of plastics used in electrical and electronic applications
- enumerate the properties and uses of electrical engineering materials
- illustrate various types of batteries with the aid of a diagram
- classify the fuel cells and elaborate the different types of fuel cells.

CHCX04 ENGINEERING MATERIALS L T P C

2 0 2 3

OBJECTIVES

To make the student conversant with

- properties and uses of different types of refractories and abrasives
- adhesives, cements and lime, setting of cements and their chemical behaviors.
- types, properties and uses of lubricants.
- various types of composite materials.

MODULE I REFRACTORIES AND ABRASIVES 8

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

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

MODULE II ADHESIVES AND BINDING MATERIALS 8

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

MODULE III LUBRICANTS 7

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

MODULE IV COMPOSITE MATERIALS 7

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

L:30 periods

PRACTICALS

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

P:30 periods

Total: 60 periods

REFERENCES

1. P.C Jain & Monica Jain, Engineering Chemistry Dhanpatrai Publishing Company (P) Ltd., New Delhi (2013).
2. B.Sivasnakar, “Engineering Chemistry”, Tata McGrow-Hill Publication Limited, New Delhi, second reprint 2008.
3. Engineering Chemistry, Wiley India Editorial Team, Willey India Publisher, New Delhi, 2011.

4. S S Umare & S S Dara, A text Book of Engineering Chemistry, S. Chand & Company Ltd, New Delhi, 2014.

OUTCOMES

The student will be able to

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

CHCX05 FUELS AND COMBUSTION **L T P C**

2 0 2 3

OBJECTIVES

To make the students conversant with the

- three types of fuels available and the different processes involved in it.
- analysis of fuel characteristics and manufacture of fuels
- calculations involved in calorific values and minimum air requirement for complete combustion.
- classification, functions, mechanism and properties of lubricants.

MODULE I SOLID FUELS **7**

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

MODULE II LIQUID AND GASEOUS FUELS **8**

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

MODULE III COMBUSTION **8**

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

MODULE IV LUBRICANTS **7**

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

L:30 periods

PRACTICALS

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

P:30 periods

Total: 60 periods

REFERENCES

1. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi, 2001.

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

OUTCOMES

The students will be able to

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

CHCX06 FUNDAMENTALS OF PHYSICAL CHEMISTRY **L T P C**

2 0 2 3

OBJECTIVES

To make the student conversant with the

- various thermodynamic terms and relate the laws of thermodynamics in chemical processes
- molecularity and order of reaction and derive the rate constant for different order of reactions
- basics of adsorption of different materials and propose mechanisms and surface area measurement
- conditions for equilibrium and learn different components at equilibrium

MODULE I BASIC THERMODYNAMICS **8**

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

MODULE II CHEMICAL KINETICS **8**

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

MODULE III SURFACE SCIENCE AND CATALYSIS **8**

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

MODULE IV PHASE RULE **6**

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

L:30 periods

PRACTICALS

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

P:30 periods
Total: 60 periods

REFERENCES

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

OUTCOMES

The student will be able to

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

CHCX07 GREEN TECHNOLOGY L T P C

2 0 2 3

OBJECTIVES

To make students conversant with the

- basic principles of green chemistry and green technology.
- wastes that causes hazards to human health
- chemicals that harms our environment
- need for green processes in various industries

MODULE I GREEN CHEMISTRY PROTOCOL 7

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

MODULE II WASTE & WASTE MINIMISATION 8

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

MODULE III GREEN SYNTHESIS 7

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

MODULE IV GREEN INDUSTRIAL PROCESSES 8

Polymer industry: biodegradable polymer - textile industry: greener approaches of dyeing, waste disposal – ecofriendly agrochemicals: biofertilizers, biopesticides – Pharmaceutical industry: atom economy, reduction of toxicity, use of biocatalyst,

zero waste disposal – Leather industry: greener process in tanning, crusting, surface coating – ecofriendly batteries & fuel cells.

L:30 periods

PRACTICALS

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

P:30 periods

Total: 60 periods

REFERENCES

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

OUTCOMES

The students will be able to

- outline the principles and implications of green chemistry.
- comprehend the potential risks of waste generated and analyse the threats to human and environment.

- integrate information into design of molecules to avoid/eliminate toxic solvents & reagents or reduce toxic products.
- identify various alternate greener technologies for various industries.

CHCX08 ORGANIC CHEMISTRY OF BIOMOLECULES L T P C

2 0 2 3

OBJECTIVES

To make students conversant with the

- basic concepts in organic chemistry
- types and structure of carbohydrates and lipids
- formation of different structures of proteins from amino acid
- structure of nucleic acids

MODULE I BASIC CONCEPTS IN ORGANIC CHEMISTRY 8

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

MODULE II CARBOHYDRATES, LIPIDS AND VITAMINS 7

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

MODULE III AMINO ACIDS, PEPTIDES AND PROTEINS 7

Aminoacids: classification, properties - peptides – polypeptides – proteins: primary, secondary, tertiary and quaternary structure – glycoproteins – lipoproteins – Enzymes: classification and functions

MODULE IV NUCLEIC ACIDS 8

Nucleic acids – importance - structure of purines and pyrimidines – nucleotides – polynucleotides - RNA – types & structure - DNA – phosphodiester bonds – chemical, helical structure and functions – DNA replication – gene modification.

L: 30 periods

PRACTICALS

1. Qualitative tests to identify carbohydrates.
2. Quantitative estimation of carbohydrates.
3. Separation of sugars – TLC and/or paper chromatography.
4. Quantitative estimation of lipids.
5. Separation of amino acids – TLC and/or paper chromatography.
6. Quantitative estimation of proteins by Lowry's method.

P:30 periods
Total: 60 periods

REFERENCES

1. V. K. Ahluwalia, Organic Reaction Mechanism, Narosa Publishers, New Delhi, 2002.
2. Johnson Arthur T., Biology for Engineers, CRC Press, Finland, 2011.
3. Jain P.C and Renuka Jain, Physical Chemistry for Engineers, Dhanpat Rai and Sons, New Delhi. 2001.
4. David L. Nelson, Michael M. Cox, Lehninger Principles of biochemistry, Macmillan press, London, 2010

OUTCOMES

The students will be able to

- classify organic compounds and explain the mechanism of various organic reactions.
- draw the structures and enumerate the functions of carbohydrate, lipids and vitamins.
- correlate the relationship among amino acids, peptides and proteins.
- recognize the role of nucleic acid in the formation of RNA & DNA and differentiate DNA & RNA using their structure and function.

CHCX09 POLYMER SCIENCE AND TECHNOLOGY L T P C

2 0 2 3

OBJECTIVES

To make the student conversant with the

- basic concepts of polymers, classification, types of polymerization and molecular weight & its distribution
- preparation, properties and applications of thermoplastics and introduction to biodegradable polymers
- properties and applications of thermosets, elastomers and FRP
- different types of moulding techniques

MODULE I BASIC CONCEPTS OF POLYMERS 8

Definitions**:** monomer, polymer, functionality, degree of polymerization – classification of polymers**:** source, structure, application, thermal processing behavior (thermoplastics and thermosets), composition and structure (addition and condensation), mechanism (chain growth and step-wise growth) – copolymer: types – Definition –nomenclature of polymers – tacticity – types of polymerization : free radical, cationic and anionic polymerization (concepts only) – average molecular weight of polymer**:** number, weight – molecular weight distribution (problems)

MODULE II THERMOPLASTICS AND BIODEGRADABLE POLYMERS 8

Preparation, properties and applications **:** LDPE, HDPE, polypropylene, PVC, PTFE, PET, polyamides (Nylon-6 and Nylon 6,6) and polycarbonates – polymer blends and alloys – basics of biodegradable polymers.

MODULE III THERMOSET RESINS, ELASTOMERS AND FRP 7

Thermoset resins **:** phenolic resins, amino resins (urea and melamine formaldehyde), epoxy resins, unsaturated polyesters – polyurethanes – elastomers **:** vulcanization of natural rubber, diene based elastomers –fibre reinforced plastics**:** glass, aramid and carbon.

MODULE IV MOULDING TECHNIQUES 7

Moulding constituents**:** functions – moulding techniques**:** compression, injection, extrusion (single screw), blow moulding, thermoforming, (mechanical and vacuum forming), lamination.

L: 30 periods

PRACTICALS

1. Determination of molecular weight and degree of polymerization using Oswald's viscometer.
2. Free radical polymerization of styrene.
3. Free radical polymerization of PMMA.
4. Preparation of phenol-formaldehyde.
5. Preparation of urea-formaldehyde.
6. Synthesis of epoxy resin.
7. Synthesis of unsaturated polyester.
8. Preparation of FRP laminates.
9. Demonstration of injection moulding, compression moulding and blow moulding.

P:30 periods

Total: 60 periods

REFERENCES

1. Billmeyer F.N., Text Book of Polymer Science, 3rd Edition, John Wiley and Sons, New York, 1994.
2. George Odian, Principles of Polymerisation, 3rd Edition, McGraw Hill Book Company, New York, 1991.
3. Michael L. Berins, Plastics Engineering Hand Book, 5th Edition, Chapman and Hall, New York, 1991.
4. Jacqueline I., Kroschwitz, Concise Encyclopedia of Polymer Science and Engineering, John Wiley and Sons, New York, 1998.
5. Encyclopedia of Polymer Science and Technology, Vol. 1 to XIV, H.F. Mark and N. Gaylord, Interscience, 2nd Ed. 1988.
6. Gowarikar V.R., Viswanathan N.V and Jayadev Sreedhar, Polymer Science, Wiley Eastern Limited, Madras, 1981.

OUTCOMES

The student will be able to

- classify various polymers, name the polymers and types of polymerization reactions, calculate molecular weight of polymers,
- summarise preparation, properties and applications of thermoplastics and give examples of biodegradable polymers
- elaborate the properties and applications of thermosets, elastomers and FRP
- select the appropriate moulding technique for a given polymer, based on the application

Maths Elective Courses

(to be offered in IV

Semester)

MACX 01	**DISCRETE MATHEMATICS AND GRAPH THEORY**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

OBJECTIVES:

The aims of this course are to

1. introduce Logical and Mathematical ability to deal with abstraction.
2. familiarize the basic mathematical ideas and terminologies used in computer science.
3. translate real life situations into diagrammatic representations.

MODULE I PROPOSITIONAL CALCULUS 8

Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – DeMorgan's Laws – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments – Validity of arguments.

MODULE II PREDICATE CALCULUS 7+3

Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.

MODULE III FUNCTIONS 7+3

Functions – Classification of functions –– Composition of functions – Inverse functions – Binary and n–ary operations – Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

MODULE IV ALGEBRAIC SYSTEMS 8+2

Groups, Cyclic Groups, Subgroups, Cosets, Lagrange's theorem, Normal subgroups – Codes and group codes – Basic notions of error correlation – Error recovery in group codes.

MODULE V GRAPH THEORY 7+3

Graphs – incidence and degree – subgraphs – isomorphism – complement of a graph – operations on graphs

MODULE VI PATH AND CIRCUIT 8+2

Walks, trails and paths – Eulerian graphs – Konigsburg bridge problem - Hamiltonian graphs

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

- Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011.
- Kenneth H.Rosen, "Discrete Mathematics and its Applications:, 7th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011.

REFERENCES:

- Ralph.P.Grimaldi, "Discrete and Combinatorial Mathematics: An Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
- Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 2006.
- C.L.Liu, D.P.Mohapatra, "Elements of Discrete Mathematics", 4th Edition, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2012.

OUTCOMES:

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

- use the concepts of propositional calculus.
- use the concepts of predicate calculus.
- identify types of functions and their importance.
- decode and encode the messages using group theory concepts.
- apply the basic concepts of graph theory.
- represent some real life situations into diagrammatic representation.

MACX 02 PROBABLITY AND STATISTICS L T P C
3 1 0 4

OBJECTIVES:

The aims of this course are to impart the

- knowledge of the theory of probability and random variables
- techniques to carry out probability calculations and identifying probability distributions
- application of statistical inference in practical data analysis

MODULE I BASICS OF PROBABILITY AND STATISTICS 8+2

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Descriptive Statistics.

MODULE II ONE DIMENSIONAL RANDOM VARIABLE AND PROBABILITY DISTRIBUTION FUNCTIONS 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III TWO DIMENSIONAL RANDOM VARIABLES 8+2

Joint, marginal, conditional probability distributions –covariance, correlation - transformation of random variables.

MODULE IV SAMPLING AND ESTIMATION 7+3

Sampling distributions – basic knowledge on Random , simple random , stratified and cluster samplings – Test of Hypotheses - concepts- Point estimation and Interval estimation.

MODULE V THEORY OF INFERENCE 8+2

Large sample tests – test for single and difference on proportions, single mean, difference of means, difference of variances – confidence intervals. Small sample tests – Student's t test, F test and Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE VI DESIGN OF EXPERIMENTS 7+3

Analysis of variance – one way classification – two way classification – Completely Randomised Block Designs – Randomised Block Design – Latin square designs - Interpretations - case studies.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

- T.Veerarajan, “Probability and Statistics”, Tata McGraw-Hill Education, 2008.
- Miller, I., Miller, M.,Freund, J. E., “Mathematical statistics”, 7th Edition, Prentice Hall International, 1999.
- S.P.Gupta, “Applied Statistics”, Sultan Chand & Sons

REFERENCES:

- S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier.
- S.C.Gupta and V.K.Kapoor, “Fundamentals of Mathematical Statistics” First edition, Sultan Chand and Sons.
- Arora and Arora, “Comphrensive Statistical Methods”, S. Chand, 2007

OUTCOMES:

On completion of the course, students will be able to

1. do basic problems on probability and descriptive statistics.
2. derive the probability mass / density function of a random variable.
3. calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
4. calculate point and interval estimates.
5. apply some large sample tests and small sample tests.
6. carry out the data collection representation analysis and implications and the importance of inferences.

MACX 03	RANDOM PROCESSES	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are to

- acquire the knowledge of the theory of probability and random variables
- study discrete and continuous probability distributions.
- demonstrate the techniques of two dimensional random variables and its distributions.
- introduce the random process, stationarity, Markov process and the study of correlation function and spectral analysis.

MODULE I Basics of Probability 7+3

Sample space, events- axioms of probability and interpretation – Addition, multiplication rules – conditional probability, Independent events - Total probability – Baye's theorem - Tchebychev's inequality.

MODULE II One dimensional Random variable and Probability Distribution functions 7+3

Discrete random variable –continuous random variable – Expectation - probability distribution - Moment generating function – Binomial, Poisson, Geometric, Uniform (continuous), Exponential and Normal distributions.

MODULE III Two dimensional random variables 7+3

Joint, marginal, conditional probability distributions - covariance, correlation and regression lines - transformation of random variables.

MODULE IV RANDOM PROCESSES 8+2

Classification of Random process - Stationary process - WSS and SSS processes - Poisson process – Markov Chain and transition probabilities.

MODULE V CORRELATION FUNCTIONS 8+2

Autocorrelation function and its properties - Cross Correlation function and its properties - Linear system with random inputs – Ergodicity.

MODULE VI SPECTRAL DENSITY 8+2

Power spectral Density Function - Properties - System in the form of convolution - Unit Impulse Response of the System – Weiner-Khinchine Theorem - Cross Power Density Spectrum.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1 Veerarajan T., “Probability, Statistics and Random Processes”, Tata McGraw Hill,3rd edition, 2008.

2 Papoulis, “Probability, Random Variables and Stochastic Processes”, 4th Edition, Tata McGraw Hill Company, 2002.

3 S.M.Ross, “Introduction to Probability and Statistics for Engineers and Scientists” Fifth Edition, Elesvier

REFERENCES:

1 Scott L. Miller,Donald G. Childers, Probability and Random Processes, Academic Press,2009.

2 Trivedi K S, “ Probability and Statistics with reliability, Queueing and Computer Science Applications”,Prentice Hall of India,New Delhi,2nd revised edition, 2002

OUTCOMES:

On completion of the course, students will be able to

- do basic problems on probability.
- derive the probability mass / density function of a random variable.
- calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- identify and study the different random processes.
- compute correlation functions and related identities.
- compute power spectral density functions and apply Weiner-Khinchine formula.

MACX 04	APPLIED NUMERICAL METHODS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aims of the course are to

- introduce basic computational methods for analyzing problems that arise in engineering and physical sciences.
- acquire knowledge about approximation theory and convergence analysis associated with numerical computation.

MODULE I NUMERICAL SOLUTIONS OF EQUATIONS 7+3

Bisection method - Regula Falsi method – Secant method - Fixed point iteration method - Newton's Raphson method –Gauss Elimination method - Gauss-Jordon method – Gauss Jacobi method - Gauss-Seidel method.

MODULE II INTERPOLATION 8+2

Finite difference operators – Gregory Newton's forward and backward interpolations – Cubic spline interpolation - Lagrange interpolation - Newton's divided difference formula.

MODULE III NUMERICAL DIFFERENTIATION AND INTEGRATION 8+2

Numerical differentiation using Newton's forward and backward formulae – Numerical integration : Trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Gaussian Two Point and Three Point Quadrature formulae – Double integrals using Trapezoidal and Simpson's 1/3 rule.

MODULE IV INITIAL VALUE PROBLEMS FOR FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 7+3

Numerical solutions by Taylor's Series method, Euler's method, Modified Euler's Method - Runge – Kutta Method of fourth order – Milne's and Adam's Bashforth Predictor and Corrector methods

MODULE V INITIAL AND BOUNDARY VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 8+2

Numerical solutions by Taylor's Series method - Runge – Kutta Method of fourth order of second order ODE. Finite difference methods.

MODULE VI BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **7+3**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace equation.

L – 45; T – 15; Total Hours –60

TEXT BOOKS:

1. Grewal, B.S., “Numerical methods in Engineering and Science”, 7th edition, Khanna
   Publishers, 2007.
2. C.F.Gerald, P.O.Wheatley, “Applied Numerical Analysis” ,Pearson Education, New Delhi, 2002.

REFERENCES:

1. Chapra S.C, Canale R.P. “Numerical Methods for Engineers”, 5th Ed., McGraw Hill, 2006.
2. M.K.Jain, S.R.K.Iyengar, R.K.Jain, “Numerical methods for Scientific and Engineering Computation”, New Age International Publishers, New Delhi, 2003

OUTCOMES:

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

1. solve algebraic, transcendental and system of equations.
2. apply interpolation techniques.
3. carry out numerical differentiation and integration using different methods.
4. solve first order ODE using single and multi step methods.
5. solve second order ODE, initial and boundary value problems.
6. solve the boundary value problems in PDE.

Maths Elective Courses
(To be offered in VI Semester)

MACX 05	MATHEMATICAL PROGRAMMING	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aims of the course are to

2. acquire knowledge and training in optimization techniques.
3. obtain knowledge about optimization in utilization of resources.
4. understand and apply operations research techniques to industrial operations.

MODULE I LINEAR PROGRAMMING PROBLEM 10

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ADVANCED LINEAR PROGRAMMING PROBLEMS 8

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships.

MODULE III TRANSPORTATION PROBLEM 7

Transportation problems – Initial basic feasible solutions, MODI method, Unbalanced transportation problem, Degeneracy in transportation models,.

MODULE IV ASSIGNMENT PROBLEM 5

Assignment problem – Minimization and Maximization type of problems by Hungarian method.

Total Hours –30

TEXT BOOKS:

1. Hamdy A Taha, “Operations Research - An introduction”, 8th edition, Phil Pearson, 2007.
2. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

1. Wayne.L. Winston, “Operations Research Applications and Algorithms”, 4th edition, Thomson learning, 2007.
2. Frederick. S. Hiller and Gerald J Lieberman, “Operations Research Concepts and Cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
3. A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research: Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
4. Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

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

1. formulate industrial problems as mathematical programming problems.
2. solve linear programming problems by different methods.
3. solve transportation problems by different methods.
4. solve assignment problems by Hungarian method.

MACX 06	STATISTICAL METHODS FOR DATA ANALYSIS	L	T	P	C
		2	0	0	2

OBJECTIVES:

The aim of the course is to

- introduce statistical quality control tools.

MODULE I TESTS OF HYPOTHESES AND STATISTICAL INFERENCES **8**

Small sample tests – Student's ' t ' test for single mean , difference of means, paired t test – F test for difference of variances – Chi square test on theory of goodness of fit and analyses of independence of attributes.

MODULE II DESIGN OF EXPERIMENTS **7**

Analysis of variance – one way classification – two way classification – Completely Randomised Block Designs – Randomised Block Design – Latin square designs - Statistical analysis -Interpretations - case studies.

MODULE III STATISTICAL QUALITY CONTROL-I **8**

Quality improvement and statistics –Statistical quality control- statistical process control – control charts – design of control charts –analysis of patterns on control charts - X bar chart, R chart and S chart.

MODULE IV STATISTICAL QUALITY CONTROL-II **7**

Process and product control – attribute charts – P, np and C charts – control charts performance.

Total Hours –30

TEXT BOOKS:

1. Douglas C.Montgomery, George C. Runger "Applied Statistics and probability for Engineers" V Edition – John Wiley & Sons Inc.
2. Miller, I., Miller, M., Freund, J. E. "Mathematical statistics" 7th Edition. Prentice Hall International, 1999.

REFERENCES:

1. Dekking, F.M., Kraaikamp, C., Lopuhaä, H.P., Meester, L.E. "A Modern Introduction to Probability and Statistics" Springer, 2nd Edition.

2. Chin Long chiang “Statistical Methods of Analysis “World Scientific Books, 2003.
3. S.C.Gupta and V.K. Kapoor, “Mathematical Statistics” , Sultan Chand publications.
4. Veerarajan “Fundamentals of Mathematical Statistics” I Edition, Yes Dee Publishing Pvt. Ltd., 2017.

OUTCOMES:

On completion of the course, students will be able to

1. develop and test hypothesis for different statistical tests
2. design an experiment and case study the experiment with different data.
3. analyze the industrial data using quality control design tools statistically.
4. analyze the industrial data using process and product control tools statistically.

MACX 07 NUMERICAL METHODS FOR INTEGRATION AND DIFFERENTIAL EQUATIONS

L	T	P	C
2	0	0	2

OBJECTIVES:

1. This course aims to solve numerically integral and differential equations.

MODULE I NUMERICAL INTEGRATION **8**

Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two Point and Three point Gaussian quadrature formulae.

MODULE II NUMERICAL DOUBLE INTEGRATION **6**

Double integrals using trapezoidal and Simpson's 1/3 rules

MODULE III NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS **8**

Milne's Predictor and Corrector Method – Adam's Predictor-Corrector Method - Finite difference methods for two – point Boundary Value problems for Ordinary Differential Equations.

MODULE IV BOUNDARY VALUE PROBLEMS FOR PARTIAL DIFFERENTIAL EQUATIONS **8**

Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations

Total Hours –30

TEXT BOOKS:

- M.K.Jain, S.R.K.Iyengar, R.K.Jain, "Numerical methods for Scientific and Engineering Computation", New Age International Publishers, New Delhi, 2003.
- Grewal, B.S., "Numerical methods in Engineering and Science" 7th edition, Khanna Publishers, 2007

REFERENCES:

1. C.F.Gerald, P.O.Wheatley, "Applied Numerical Analysis" Pearson Education, New Delhi 2002.
2. P.Dechaumphai, N. Wansophark, "Numerical Methods in Engineering", Narosa Publications, 2012.

OUTCOMES:

At the end of the course students will be able to

- solve the integration by numerical methods.
- solve the double integration by numerical methods
- find numerical solution of ordinary differential equations in engineering problems.
- find numerical solution of partial differential equations in engineering problems.

MACX 08 MATHEMATICAL MODELLING

L	T	P	C
3	0	0	3

OBJECTIVES:

The aims of the course are to

1. provide basic idea of formation and use of Mathematical models for different purposes.
2. determine the extent to which models are able to replicate real-world phenomena under different conditions

MODULE I PRINCIPLES OF MATHEMATICAL MODELING **7**

Mathematics as a modelling language - Classification of models - Building, studying, testing and using models - Black and white box models – Difference equations

MODULE II PHENOMENOLOGICAL MODELS **7**

Linear, Multiple linear and nonlinear regression - Neural networks - Fuzzy model - Stability and higher dimensional systems

MODULE III MECHANISTIC MODELS –I **8**

Setting up ODE models – Initial and Boundary value problems - Numerical solutions - Fitting ODE to data - Applications

L	T	P	C
2	0	0	2

MODULE IV MECHANISTIC MODELS –II **8**

Linear and nonlinear equations - Elliptic, parabolic and hyperbolic equations - Closed form solutions - Finite difference and finite element methods

Total Hours –30

TEXT BOOKS:

- G . Ledder , “Calculus, modelling , probability and dynamic systems”, Springer 2013
- Kei Velten, “Mathematical modelling and simulation”, J. Wiley and sons,2009

REFERENCES:

1. Michael D Alder, “An introduction to Mathematical modelling”, Heaven for Books.com
2. Alfio Quarteroni, “Mathematical models in science and engineering”, Notices of AMS

3. J.N. Kapur, “Mathematical models in Biology and Medicine”, Affiliated East-West Press Private Limited, New Delhi, 1992.

OUTCOMES:

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

- identify the relationship between real world and mathematical models
- Classify the data and choose the appropriate model
- Distinguish between linear and nonlinear models
- identify the relationship between empirical and mechanistic models

MACX 09	GRAPH THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The aims of this course are to

4. represent the real life situations diagrammatically.
5. appraise different methods to find solutions to graph theory problems.

MODULE I INTRODUCTION TO GRAPH THEORY **8**

Graphs - finite and infinite graphs - Incident and degree-isolated vertex, pendent vertex and null vertex.

MODULE II PATH AND CIRCUIT **8**

Isomorphism – sub graphs-walks, paths and circuits – connected and disconnected graphs- Euler graphs – operation on a graph.

MODULE III TREES AND FUNDAMENTAL CIRCUITS **7**

Trees- some properties of trees- pendent vertices in a tree – rooted binary tree-spanning trees-fundamental circuits.

MODULE IV CUT SETS AND CUT VERTICES

Cut sets – some properties of cut sets- fundamental circuits and cut sets-network flows.

Total Hours –30

TEXT BOOKS:

1. NARSINGH DEO, Graph theory with applications to Engineering and Computer Science, Prentice Hall INC, New Delhi,
2. J.A. Pondy and U.S.R. Murthy, North Holland, Oxford, New York Graph theory with applications

REFERENCES:

1. Trembly J.P and Manohar R, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 30th Reprint 2011
2. Kenneth H.Rosen, “Discrete Mathematics and its Applications”, 7th Edition, Tata

McGraw-Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2011

3. Md. Saidur Rahman, “Basic graph theory”, Springer, 2017

OUTCOMES:

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

- demonstrate the basic concepts of Graph theory.
- explore connected and disconnected graphs.
- identify the real life problems with trees and circuits.
- bring out the cut set properties and network flows properties.

Humanities Elective I

(To be offered in III Semester)

		L	T	P	C
SSCXO1	**FUNDAMENTALS OF ECONOMICS**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To identify and present the basic concepts of demand, supply and equilibrium.
- To explain and discuss the types and concepts of national income and inflation.
- To illustrate the fundamental concepts of money, banking and public finance.
- To apprise the students about Indian economy and the role of engineers in economic development.

MODULE I DEMAND AND SUPPLY ANALYSIS 8

Classification of economy – open and closed economy, Demand - Types of demand - Determinants of demand – Law of Demand - Demand elasticity - Supply - Determinants of Supply – Law of Supply - Supply elasticity - Pricing strategies.

MODULE II NATIONAL INCOME AND INFLATION 7

Concepts of National income and measurement – Importance and difficulties of estimating National Income in India - Aggregate demand and aggregate supply, Macroeconomic equilibrium – meaning of inflation- types - causes and preventive measures

MODULE III MONEY, BANKING AND PUBLIC FINANCE 9

Money – Meaning, types, functions, importance - Commercial Banks - Central Bank - Monetary policy – meaning, objectives, Methods of Credit Control By RBI, Government Budget – Government revenue and Expenditures – Fiscal policy - Its objectives, instruments and limitations - Deficit Financing - The Fiscal Responsibility and Budget Management Act, 2003 (FRBMA) .

MODULE IV INDIAN ECONOMY AND THE ROLE OF ENGINEERS 6

Economic reforms – Liberalization, Privatization and Globalization - challenges and opportunities, Engineers – Engineers' contributions to the economic growth.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

- Dutt and Sundharam (2013), *Indian Economy*, S. Chand & Company Pvt. Ltd, New Delhi.
- Hussain, Moon Moon (2015), *Economics for Engineers*, Himalaya Publishing House, New Delhi.

REFERENCES:

- Cleaver Tony (2004), "*Economics: The Basics*", Routledge, London.
- Mell Andrew and Walker Oliver (2014), "*The Rough Guide to Economics*", Rough Guide Ltd.

OUTCOMES:

On successful completion of this course,

- Students will have had exposure to the basic concepts of demand, supply and various pricing strategies.
- Students will have understood the macroeconomic concepts of national income and inflation.
- Students will be able to apply the knowledge of money, banking and public finance in their real life situations.
- Students will have an overview of the economic reforms introduced in Indian economy.

SSCXO2	PRINCIPLES OF SOCIOLOGY.	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To acquaint the students with Concepts and perspectives of Sociology
- To explain the reflection of society in Individuals and vice versa
- To describe the hierarchical arrangement of individuals and groups in society
- To explicate the dimensions, forms and factors of Social change.
- To examine the context, impact and agencies of Globalization

MODULE I THE FOUNDATIONAL CANON 8

Sociology-Definition, scope and importance; Major theoretical perspectives- Functionalism, Conflict Theorising and Interactionism; Elements of social formation- Society, Community, Groups and Association; Associative Social Process- Co-operation, Accommodation and Assimilation; Dissociative Social Process- Competition and Conflict.

MODULE II INDIVIDUAL AND SOCIETY 7

Culture-definition, characteristics, functions, types, cultural lag and civilization, Socialization – definition, process, stages, agencies and anticipatory socialization; Social Control- definition, characteristics, importance, types & agencies.

MODULE III SOCIAL INEQUALITY AND STRATIFICATION 7

Concepts- inequality, hierarchy, differentiation, Social Exclusion, and Social Stratification. Forms of Social Stratification- Caste, Class and Estate. Gender and Social Stratification- sex and gender, patriarchy, factors perpetuating gender stratification; Globalization and gender inequality

MODULE IV SOCIAL CHANGE AND GLOBALIZATION 8

Social Change-definition, nature, direction; Forms- evolution, development, progress and transformation; Factors of social change- demography, economy, technology, polity and culture. Globalization- definition, characteristics, historical and social context and Impact, agencies of globalization- IGOs, INGOs, Nation-State, MNEs and Media

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

- Giddens A. 1989. “Sociology” Cambridge: Polity Press.
- Heald Haralambos, R.M(2014) . ‘‘Sociology Themes and Perspectives”, Oxford, New Delhi-92
- Bhushan Vidya and D.R. Sachdeva (2012). ‘‘Fundamental of Sociology”, Pearson, Delhi.

REFERENCES:

- Das Gupta, Samir and Paulomi Saha (2012), ‘‘An Introduction to Sociology”, Pearson, Delhi
- Bottomore, T.B. 1972. *Sociology- A Guide to Literature and Problems*, New Delhi,

OUTCOMES:

On successful completion of this course,

- Students will have exposure to the fundamentals tenets of Sociology.
- Students will be trained to understand social reality with sociological perspective.
- Students will be oriented to constructively analyze human interactions, social relationship and social issues
- Students will gain exposure to the dynamics of human society with special reference to the contemporary trends of globalization.

SSCXO3	SOCIOLOGY OF INDIAN SOCIETY.	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To present a portrayal of the components of the Indian Social structure
- To describe the nature and contemporary structure of Indian social Institutions.
- To examine the causality and magnitude of social problem facing the contemporary India.
- To elucidate the processes forms and impact of change and development in Indian society

MODULE I INDIAN SOCIAL STRUCTURE 7

Unity and Diversity; Concepts of unity and diversity- racial, religious, ethnic and linguistic composition of India. Types of communities-rural, urban and tribal; Social backwardness- OBC, SC and ST; Indian minorities- religious, ethnic, linguistic and LGBT

MODULE II INDIAN SOCIAL INSTITUTIONS 7

Family- definition, types, characteristics, functions of family; Joint Family- definition features, utility, changes; Marriage- definition, characteristics, marriage as sacrament or contract. Caste- definition, principles, contemporary changes, dominant caste, caste -class interface.

MODULE III SOCIAL PROBLEMS IN INDIA 8

Social Problem-definition, nature, social disorganization; Population explosion-causes, effects, relationship with development; Child Labour- causes, magnitude and consequences; Unemployment-nature , types, causes and effects; Gender issues-social status of women, violence against women and women in work place; Contemporary issues- communalism, terrorism and corruption.

MODULE IV SOCIAL CHANGE AND DEVELOPMENT IN INDIA 8

Socio-cultural Change- Sanskritization, Westernization, Secularization, Modernization; Processes of Social change- Industrialization, Urbanization, Globalization; Development- definition, elements, role of government, industry and corporate sector. Technology and change- invention and innovation, impact of technology on social

institutions, technology and development.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

- Sharma,K.L.2008. *Indian Social Structure and Change*. Jaipur: Rawat Publications,.
- Shah, A.M. 1998. *The Family in India: Critical Essays*. New Delhi: Orient Longman,
- Ahuja Ram. 1999. *Social problems in India*, Rawat Publication: New Delhi.
- Ahuja Ram. 2014. *Society in India,*, Rawat Publication: New Delhi.

REFERENCES:

1. Jayapalan, N.(2001), **"**Indian Society and Social Institutions" Atlantic Publishers & Distri,

2. Atal, yogesh (2006), "Changing Indian Society" Rawat Publications, Jaipur

OUTCOMES:

On successful completion of this course,

1. Students will gain an in-depth understanding of the social structure and social institutions that constitute society in India.
2. Students will be sensitized to the various categories ,Inequalities and their challenges
3. Students will be exposed to the social problems encountered in contemporary India.
4. Students will gain knowledge about the various forms and trends of the social change.
5. Students will become aware about the challenges in the path of progress of Indian society and realize relevance of their role in bringing about development

Humanities Elective II

(To be offered in IV Semester)

		L	T	P	C
SSCXO4	**ECONOMICS OF SUSTAINABLE DEVELOPMENT**	**2**	**0**	**0**	**2**

OBJECTIVES:

- To have an increased awareness on the concept and components of sustainable development.
- To develop the ability to demonstrate the need of sustainable development and international responses to environmental challenges.
- To have an insight into global environmental issues and sustainable globalization.
- To establish a clear understanding of the policy instruments of sustainable development.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 7

Evolution of the Concept – Rio Summit and sustainable development - various definitions of sustainable development - Components of sustainable development: Social, environmental and economic components.

MODULE II NEED FOR SUSTAINABLE DEVELOPMENT 8

Need for sustainability – Global environmental challenges: population growth, resource depletion, pollution, energy use, climate change, pollution, growing water scarcity, other urban problems, loss of biodiversity, hazardous wastes disposal.International responses to environmental challenges - Global policy such as Kyoto Protocol, Montreal Protocol, Basel Convention.

MODULE III GLOBALIZATION AND ENVIRONMENT SUSTAINABILITY 8

Impact of Globalization on sustainable development, Co - existence of globalization and Environment sustainability, Globalization and Global Governance.Green economy - Renewable energy, sustainable transport, sustainable construction, land and water management, waste management.

MODULE IV POLICIES FOR ACHIEVING SUSTAINABLE DEVELOPMENT 7

Principles of environmental policy for achieving sustainable development: precautionary principle and polluter pays principle – Business Charter for Sustainable Development.Policy instruments for sustainable development: direct regulation – market based pollution control instruments such as pollution tax, subsidy, pollution permits.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Anderson, David A (2010), "*Environmental Economics and Natural Resource Management*", Routledge, 3rd edition.
2. Karpagam M (1999), "*Environmental Economics: A Textbook*", Sterling Publishers Pvt. Ltd, New Delhi.

REFERENCES:

1. Karpagam M and Jaikumar Geetha (2010), "*Green Management Theory and Applications*", Ane Books Pvt. Ltd, New Delhi.
2. Sengupta Ramprasad (2004), "*Ecology and Economics: An Approach to Sustainable Development*", Oxford University Press, New Delhi.

OUTCOMES:

On successful completion of this course,

- The students will have understood the concepts and components of sustainable development.
- The students will have a holistic overview on the challenges of sustainable development and International responses to environmental challenges.
- The students will have gained knowledge on the global environment issues and demonstrate responsible globalization through global governance.
- The students will have developed awareness of the ethical, economic, social and political dimensions that influence sustainable development.

SSCXO5 INDUSTRIAL SOCIOLOGY

L	T	P	C
2	0	0	2

OBJECTIVES:

- To introduce sociological approaches and perspectives to understand the social relationship in manufacturing industries and corporate sector.
- To explain the structure and functions of industrial organizations.
- To elucidate the dynamics of organizational behavior, leadership and communication.
- To inculcate professional ethics and values to equip students to work in organizational settings.

MODULE I INTRODUCTION **8**

Industrial Sociology- definition, scope and importance; Theoretical approaches- scientific management, human relations approach, theory of bureaucracy, Fordism and post-fordism; Production system- concept and characteristics of factory system, automation and rationalization; Industrial conflict- strike , lockout and trade unions.

MODULE II INDUSTRIAL ORGANIZATION **7**

Formal organization- definition, features, utility; Informal organization- definition, characteristics, types and relevance; Structure of industrial organization- features and functions of line organization, characteristics and roles of staff organization, distinction;

Industrial hierarchy-white collar, blue collar, supervisors and managers.

MODULE III DYNAMICS OF INDUSTRIAL RELATIONS **8**

Group dynamics- Definition, Group behaviour model, Group decision making process, group cohesiveness; Leadership- definitions, style and effective supervision; Communication- concepts, types, model barriers; Job satisfaction- nature, employee compensation and job satisfaction.

MODULE IV PROFESSIONAL ETHICS AND VALUES **7**

Concepts- values- morals, and ethics, Integrity, work ethics , service learning - Civic Virtue - caring - Sharing - Honesty - Courage - Valuing Time - Co-operation - commitment - empathy - Self-Confidence - Environmental Ethics, Cyber issues - computer ethics, cyber crimes, plagiarism Ethical living-concept of harmony in life.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. Narender Singh, Industrial Sociology, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.
2. Gisbert Pascal, Fundamentals of Industrial Sociology, Tata Mc. Graw Hill Publishing Co., New Delhi, 1972
3. Schneider Engeno. V, Industrial Sociology 2nd Edition, Mc. Graw Hill Publishing Co., New Delhi, 1979.

REFERENCES:

- Robbins, Stephen, Organizational Behaviour , Prentice Hall of India PVT ltd new Delhi, 1985
- Devis Keith , Human Behaviour at work place, Mc. Graw Hill Publishing Co., New Delhi,1984

OUTCOMES:

On successful completion of this course,

1. Students will have acclimatized with sociological perspectives for dealing with social relationships in production and service organizations.
2. Students will be familiar with structure of authority, roles and responsibility in organizational settings.
3. Students will imbibe leadership, communication and behavioral acumen to govern organization
4. Students will be sensitized to standards of desirable behavior to engage in industrial and corporate sector.

SSCXO6	LAW FOR ENGINEERS	L	T	P	C
		2	0	0	2

OBJECTIVES:

1. To understand the Constitution and Governance of our country.
2. To apprise the students of human rights - local and international and redressal mechanism.
3. To have an insight into the industrial, corporate and labour laws of our country.
4. To establish a clear understanding about the importance of intellectual property related laws.

MODULE I INDIAN CONSTITUTION AND GOVERNANCE 8

Constitution – salient features, Preamble, Citizenship, Fundamental rights, Fundamental duties, Directive principles, Union executive, Legislature – Union – State and union territories – Election Commission – Election for parliament and state legislature, Judiciary- basic functioning of the Supreme Court and High Courts, Right to information Act 2005 – evolution – concept – practice.

MODULE II HUMAN RIGHTS 7

Human rights – meaning and significance, Covenant on civil and political rights, Covenant on Economic, Social and Cultural rights, UN mechanism and agencies, The Protection of Human Rights Act, 1993 – watch on human rights and enforcement.

MODULE III INDUSTRIAL, CORPORATE AND LABOUR LAWS 8

Corporate laws – meaning and scope, Companies Act 1956 – Indian Contract Act 1872 - Principles of Arbitration - Industrial Employment (Standing Orders) Act 1946 - Industrial Disputes Act 1947 - Workmen's Compensation Act 1923 - The Factories Act, 1948.

MODULE IV LAWS RELATED TO IPR 7

IPR – meaning and scope, International organization – WIPO – TRIPS, Major Indian IPR Acts – Copyright laws, Patent and Design Act, Trademarks Act, Trade Secret Act, Geographical Indicator.

L – 30; T – 0; Total Hours –30

TEXT BOOKS:

1. M.P. Jain (2005) *Indian Constitutional Law*, Wadhwa & Co.
2. H. D, Agarwal (2008), *International Law and Human Rights,* Central Law Publications,
3. Rao, Meena (2006), *Fundamental Concepts in Law of Contract*, 3rd edn., Professional offset.
4. Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House.
5. Singh, Avtar (2007), *Company Law*, Eastern Book Co.
6. R.F, Rustamji (1967)*, Introduction to the Law of Industrial Disputes*, Asia Publishing House.

REFERENCES:

1. Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act.

OUTCOMES:

On successful completion of this course,

1. Students will `be able to apply the basic concepts of Indian Constitution, Governance and power in their real life situation.
2. Students will have gained knowledge in human rights, cultural, social and political rights.
3. Students will have synthesized knowledge about industrial, corporate and labour laws of our country.
4. Students will have an overview of IPRs and laws related to Intellectual Property Rights.

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

GECX101	**DISASTER MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:

- To introduce the concept of various environmental hazards and its management measures.
- To give exposure on the natural disasters causes and prevention strategies.
- To give exposure on various man-made disasters causes and prevention strategies.
- To make them understand the different segments of disaster management.
- To introduce the concept of different relief measures to be adopted in the time of disaster.
- To give exposure to various environmental policies & programs in India for disaster management

MODULE I ENVIRONMENTAL HAZARDS 7

Environmental hazards, Environmental Disasters and Environmental stress-Meaning and concepts. Vulnerability and disaster preparedness.

MODULE II NATURAL DISASTERS 7

Natural hazards and Disasters - Volcanic Eruption, Earthquakes, Tsunamis, Landslides, Cyclones, Lightning, Hailstorms, Floods, Droughts, Cold waves, Heat waves and Fire.

MODULE III MAN-MADE DISASTERS 7

Man induced hazards & Disasters - Soil Erosion, Chemical hazards, Population Explosion

MODULE IV DISASTER MANAGEMENT 8

Emerging approaches in Disaster Management- Preparing hazard zonation maps, Predictability / forecasting & warning, Preparing disaster preparedness

plan, Land use zoning, Communication. Disaster resistant house construction, Population reduction in vulnerable areas, Awareness - Rescue training for search & operation at national & regional level - Immediate relief, Assessment surveys, Political, Administrative, Social, Economic, Environmental Aspects.

MODULE V NATURAL DISASTER REDUCTION & MANAGEMENT **8**

Provision of Immediate relief measures to disaster affected people, Prediction of Hazards & Disasters, Measures of adjustment to natural hazards

MODULE VI ENVIRONMENTAL POLICIES & PROGRAMMES IN INDIA **8**

Regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster & Disaster in Hills with particular reference to India. Ecological planning for sustainability & sustainable development in India, Sustainable rural development: A Remedy to Disasters, Role of Panchayats in Disaster mitigations, Environmental policies & programmes in India- Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training.

Total Hours –45

REFERENCES:

1. Satender, “Disaster Management in Hills”, Concept Publishing Co., New Delhi, 2003.
2. Singh, R.B. (Ed.), “Environmental Geography”, Heritage Publishers, New Delhi,1990.
3. Savinder Singh, “Environmental Geography”, Prayag Pustak Bhawan,1997.
4. Kates, B.I. and White, G.F., “The Environment as Hazards”, Oxford University Press, New York, 1978.
5. Gupta, H.K., (Ed), “Disaster Management”, University Press, India, 2003.
6. Singh, R.B.,“Space Technology for Disaster Mitigation in India (INCED)”, University of Tokyo, 1994.
7. Bhandani, R.K., “An overview on Natural & Manmade Disaster & their Reduction”, IIPA Publication, CSIR, New Delhi, 1994.
8. Gupta, M.C., “Manuals on Natural Disaster management in India”, National Centre for Disaster Management, IIPA Publication, New Delhi, 2001.

OUTCOMES:

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

- describe the origin, changes and management of environmental hazards.
- Develop the knowledge on natural disasters.
- Develop the knowledge on man-made disasters.
- discuss the different segments of disaster management.
- explai the concept of different disaster relief measures.
- Achieve sufficient knowledge on the National Policy on Disaster Management.

GECX103	ENERGY STUDIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To learn the growing demand, supply of energy on global and national levels and the need for renewable energy promotion.
2. To understand the basic need for energy conservation and waste heat recovery.
3. To learn the important aspects of energy audit and management.
4. To get acquainted with the global environmental issues and carbon credits.

MODULE I GLOBAL AND NATIONAL ENERGY SCENARIO 7

Role of energy in economic development, various energy resources - overall energy demand and availability- Energy consumption in various sectors and its changing pattern - Exponential increase in energy consumption and projected future demands. Need for renewable energy.

MODULE II SOLAR ENERGY 8

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III OTHER RENEWABLE ENERGY SOURCES 8

Power from wind – wind turbine working and types, solar thermal power plants – low medium and high power generation, power from wave , tidal, geothermal sources, OTEC system. MHD power plants – working, types, merits and demerits. Energy from biomass.

MODULE IV COGENERATION, WASTE HEAT RECOVERY AND COMBINED CYCLE PLANTS 8

Cogeneration principles- topping and bottoming cycles, role in process industries. Energy from wastes- waste heat recovery- heat recovery from industrial processes. Heat exchange systems – recuperative and regenerative heat exchangers – commercially available waste heat

recovery devices. Combined cycle plants – concept, need and advantages, different combinations and practical scope.

MODULE V ENERGY CONSERVATION AND MANAGEMENT 7

Need for energy conservation – use of energy efficient equipment. Energy conservation opportunities - in educational institutions, residential, transport, municipal, industrial and commercial sectors – concept of green building. Energy audit in industries – need, principle and advantages. Case studies.

MODULE VI GLOBAL ENERGY ISSUES AND CARBON CREDITS 7

Energy crisis, fossil consumption and its impact on environmental climate change. Energy treaties – Montreal and Kyoto protocols - Transition from carbon rich and nuclear to carbon free technologies, carbon foot print – credits – clean development mechanism.

L – 45; Total Hours –45

TEXT BOOKS:

- S.S. Rao and B.B. Parulekar, “Energy Technology”, 3rd Edition, Khanna Publishers, New Delhi, 2011.
- O. Callaghn. P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.

REFERENCES:

- G.D. Rai, “Non Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
- Archie, W Culp. “Principles of Energy Conservation”, McGraw Hill, 1991.
- D Patrick and S W Fardo, “Energy Management and Conservation”, PHI,1990
- P. O’Callaghan: “Energy Management”, McGraw - Hill Book Company, 1993.
- Kenney, W. F., “Energy Conservation in Process Industries”, Academic Press, 1983.

OUTCOMES:

The student should be able to

1. Realize the global and national energy status and need to switch over to renewable energy technology.
2. Energy audit and suggest methodologies for energy savings.
1. Utilize the available resources in an optimal way.
2. Concern about the global environmental issues & promote carbon credits.

GECX104	ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To learn about the robots, various components, of Robots, programming and their applications.

MODULE I **8**

Definition- Need - Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence- basic parts - functions – specifications. of robot, degrees of freedoms, end effectors – types, selection

MODULE II ROBOT DRIVES AND CONTROL **8**

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

MODULE III ROBOT SENSORS **8**

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT PROGRAMMING & AI TECHNIQUES **7**

Types of Programming – Teach pendant programming – Basic concepts in AI techniques – Concept of knowledge representations – Expert system and its components.

MODULE V ROBOTIC WORK CELLS AND APPLICATIONS OF ROBOTS **7**

Robotic cell layouts – Inter locks – Humanoid robots – Micro robots – Application of robots in surgery, Manufacturing industries, space and underwater.

MODULE VI ROBOT KINEMATICS AND DYNAMICS 7

Forward and inverse Kinematic equations, Denvit – Hartenbers representations Fundamental problems with D-H representation, differential motion and velocity
of frames - Dynamic equations for sing, double and multiple DOF robots – static force analysis of robots.

L – 45; Total Hours –45

REFERENCES:

- Yoram Koren," Robotics for Engineers", Mc Graw-Hill, 1987.
- Kozyrey, Yu, "Industrial Robots", MIR Publishers Moscow, 1985.
- Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
- Deb, S.R. "Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.
- Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, "Industrial Robotics Technology, Programming and Applications", Mc Graw- Hill, Int. 1986.
- Timothy Jordanides et al,"Expert Systems and Robotics", Springer – Verlag, New York, May 1991.

OUTCOMES:

Students would be able to

- Understand about the robots, its various components.
- Design Robots for industrial applications.
- Do programming for robots and apply them in real time applications.

GECX105	TRANSPORT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To understand the transport fleet and their related activities for minimizing operational cost.
2. To understand the need of maintenance and its importance.
3. To understand the functions and applications of various types of transport system.

MODULE I INTRODUCTION 7

Personnel management; objectives and functions of personnel management, psychology, sociology and their relevance to organization, personality problems. Selection process: job description, employment tests, interviewing, introduction to training objectives, advantages, methods of training, training procedure, psychological tests.

MODULE II ORGANISATION AND MANAGEMENT 7

Forms of Ownership – principle of Transport Management – Staff administration – Recruitment and Training – welfare – health and safety. Basic principles of supervising. Organizing time and people. Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing - Vehicle operation and types of operations.

MODULE III TRANSPORT SYSTEMS 9

Introduction to various transport systems. Advantages of motor transport. Principal function of administrative, traffic, secretarial and engineering divisions. chain of responsibility, forms of ownership by state, municipality, public body and private undertakings.

MODULE IV SCHEDULING AND FARE STRUCTURE 8

Principal features of operating costs for transport vehicles with examples of estimating the costs. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

MODULE V MOTOR VEHICLE ACT 7

Traffic signs, fitness certificate, registration requirements, permit insurance, constructional regulations, description of vehicle-tankers, tippers, delivery vans, recovery vans, Power wagons and fire fighting vehicles. Spread over, running time, test for competence to drive.

MODULE VI MAINTENANCE 7

Preventive maintenance system in transport industry, tyre maintenance procedures. Causes for uneven tyre wear; remedies, maintenance procedure for better fuel economy, Design of bus depot layout.

L – 45; Total Hours –45

TEXT BOOKS:

1. John Duke, "Fleet Management", McGraw-Hill Co, USA, 1984.
2. Kitchin.L.D., "Bus Operation", III edition, Illiffee and Sons Co., London, 1992

REFERENCES:

1. Government Motor Vehicle Act, Publication on latest act to be used as on date.

OUTCOMES:

Upon completion of the course, students will

1. Know about different aspects related to transport system and management.
2. Features of scheduling, fixing the fares
3. Know about the motor vehicle act and maintenance aspects of transport.

GECX106	CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the system modeling and to derive their transfer function.
- To provide adequate knowledge of time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of Control systems.

MODULE I BASIC CONCEPTS AND SYSTEM REPRESENTATION **8**

Control System - Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical and thermal systems – Transfer function – Block diagram reduction techniques – Signal flow graphs.

MODULE II TIME RESPONSE ANALYSIS AND DESIGN **8**

Time response – Time domain specifications – Types of test input – First and Second order system - Type I and Type II System – Response - Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

MODULE III FREQUENCY RESPONSE ANALYSIS AND DESIGN **7**

Performance specifications - correlation to time domain specifications - bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

MODULE IV STABILITY **8**

Characteristics equation – Location of roots in s plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

MODULE V COMPENSATOR DESIGN **8**

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots and root locus technique.

MODULE VI CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS **6**

Synchros – AC servomotors - DC Servo motors - Stepper motors - AC Tacho generator - DC Tacho generator - Typical applications of control system in industry.

L – 45; Total Hours –45

REFERENCES:

- K. Ogata, "Modern Control Engineering", 4th Edition, Pearson Education, New Delhi, 2003.
- I.J. Nagrath & M. Gopal, "Control Systems Engineering", New Age International Publishers, 2003.
- C.J.Chesmond, "Basic Control System Technology", Viva student edition, 1998.
- I.J.Nagarath and M.Gopal, "Control System Engineering", Wiley Eastern Ltd., Reprint, 1995.
- R.C.Dorf and R.H.Bishop, "Modern Control Systems", Addison-Wesley (MATLAB Reference), 1995.

OUTCOMES:

At the end of the course, the student is expected to possess knowledge and achieve skills on the following:

1. Proper understanding of basics of Control Systems.
2. Ability and skill to carry-out time domain and frequency domain analysis.
3. Capable of determining stability of the system using Routh Hurwitz criterion, Root locus and Nyquist criterion.
4. Ability to design lag, lead and lag lead compensator networks.

GECX107 INTRODUCTION TO VLSI DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- Basic concepts of HDL.
- Verilog language and its syntax constructs.
- Programmable Logic Devices and FPGAs
- MOS devices theory
- CMOS based combinational and sequential circuits

PREREQUISITES:

Fundamentals of Electronics

Basics knowledge in Digital Electronics.

MODULE I REVIEW OF BASIC DIGITAL SYSTEMS 7

Boolean algebra, Building blocks of combinational logic design-Adders, multiplexer, encoder, decoder, comparator, Latches & flip-flops, counters, shift registers.

MODULE II LOGIC DESIGN USING VERILOG HDL 8

Overview of Digital Design with Verilog HDL, Levels of Design Description, Concurrency, Hierarchical Modeling Concepts, Modules and Ports, Component instantiation Data flow and RTL, structural, gate level, switch level modeling and Behavioral Modeling.

MODULE III LANGUAGE CONSTRUCTS OF VERILOG HDL 7

Identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments, conditional statements Variable types, arrays and tables, Tasks and functions, Test bench.

MODULE IV BUILDING BLOCKS OF DIGITAL VLSI SYSTEMS 8

HDL Design -Data Path Operations-Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multiplication, Shifters, Memory Elements. Programmable logic elements and AND-OR arrays, FPGAs programming methods.

MODULE V TRANSISTOR THEORY 7

Introduction to MOS Transistors-NMOS & PMOS Characteristics, Current Equations,

Complementary CMOS Inverter-DC Characteristics, Static Load MOS Inverters.

MODULE VI BASICS OF DIGITAL CMOS DESIGN 8

NMOS & PMOS Logic Gate, CMOS Logic Gate, Basic layout design of simple gate-stick diagram, CMOS Logic Structures-full adder, multiplexers.

Total Hours –45

TEXT BOOKS:

1. M.Morris Mano "Digital Design", 3rd Edition, Prentice Hall of India Pvt. Ltd New Delhi, 2003

REFERENCES:

1. Michael D. Ciletti“Advanced Digital Design with the Verilog HDL" (2nd Edition) Hardcover – January 31, 2010
2. J.Bhasker: Verilog HDL primer, BS publication, 2001.
3. J. P. Uyemura, "Introduction to VLSI Circuits and System", Wiley, 2002
4. Neil Weste and K. Eshragian, “Principles of CMOS VLSI Design: A System Perspective,” 2nd edition, Pearson Education (Asia) Pvt.Ltd., 2000
5. Douglas A Pucknell& Kamran Eshragian , “Basic VLSI Design” PHI 3rd Edition (original edition – 1994)

OUTCOMES:

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

- Create basic Register Transfer Level (RTL) models for combinational circuits & Sequential circuits using Verilog HDL.
- Create basic behavioral models for combinational circuits & Sequential circuits using Verilog HDL.
- Describe the usage of Programmable Logic Devices and FPGAs.
- Describe MOS devices theory and inverter circuit DC characteristics
- Design the basic digital building blocks using MOS circuit.
- Apply VLSI design concepts based on the requirements to conduct experiments or projects

GECX108	PLANT ENGINEERING	L	T	P	C
		3	0	0	4

OBJECTIVES:

- To provide in depth knowledge on Plant Engineering
- To introduce detail engineering and P&ID
- To learn about the support to Instrumentation from other disciplines
- To study about the Installation and commissioning

MODULE I INTRODUCTION OF PLANTS 7

General Project Cycle – Feed – Sales - Plant Description, Component / Areas of Plant, Plant Layout, Plant Interfaces, Plant Location

MODULE II ELEMENTS OF PLANT 8

Main Elements of a Plant, Process Flow Scheme (PFD – Process Flow Diagram) P&ID's, Plant Legend Finalization.

MODULE III DETAIL ENGINEERING 10

P& ID Development with PFD's, Major Discipline Involvement & Inter discipline Interaction, Major Instrumentation & Control Systems - Development Phase – Instrument List , I/O Count, Specification Sheets, Instrument Installation (Hook ups) , Control Philosophy – Detail Engineering.

MODULE IV SUPPORT FROM OTHER DISCIPLINE 8

Other Discipline Supports to Instrumentation – Plot Plan, Piping / Equipment Plan, Electrical Area Classification, Fire Hazardous Classification Telecommunication Systems - Control Network architecture.

MODULE V INSTALLATION AND COMMISSIONING 7

Plant Construction - Key Drawings for Construction Support Construction Activities, System Testing, Startup / Commissioning, Production.

MODULE VI CASE STUDIES 5

Case studies of Water Treatment Plant - Paper Industry – Power Plant etc

L – 45; Total Hours –45

REFERENCES:

1. Duncan C Richardson, Plant Equipment and Maintenance Engineering Handbook, McGraw-Hill Education: New York, Chicago, San Francisco, Athens, London, Madrid, Mexico City, Milan, New Delhi, Singapore, Sydney, Toronto, 2014 McGraw-Hill Education
2. Gabriel Salvendy, Handbook of Industrial Engineering – Technology and operations Management, John Wiley & Sons, 2001.
3. Robert C Rosaler , Standard Handbook of Plant Engineering, Mc Graw Hill third Edition, 2004
4. R. Keith Mobley, Plant Engineer's Handbook, Technology and Engineering, 2001.

OUTCOMES:

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

- Review and correct P&IDs
- Do installation and commissioning of new plants
- Apply plant engineering in design and maintenance of water treatment plant / power plant etc

GECX109	NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students should be able to

- Discuss the basic concepts of computer security, model and attacks
- Examine the major types of threats and the associated attacks
- Identify the encryption techniques in real time applications
- Understand the special requirements for wireless security and how authentication is implemented in wireless systems
- Understand the functions of Network Security Device Firewall and its types
- Interpret the various network intrusion such as computer viruses, network worms etc

MODULE I INTRODUCTION 6

Computer Security Concepts - The OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - A Model for Network Security - Standards – classical encryption techniques.

MODULE II SYMMETRIC ENCRYPTION AND MESSAGE CONFIDENTIALITY 7

Symmetric Encryption Principles - Symmetric Block Encryption Algorithms - Random and Pseudorandom Numbers - Stream Ciphers and RC4 - Cipher Block Modes of Operation

MODULE III PUBLIC KEY CRYPTOGRAPHY AND MESSAGE AUTHENTICATION 8

Approaches to Message Authentication - Secure Hash Functions - Message Authentication Codes - Public-Key Cryptography Principles - Public-Key Cryptography Algorithms - Digital Signatures

MODULE IV KEY DISTRIBUTION ,USER AUTHENTICATION AND TRANSPORT-LEVEL SECURITY 8

Symmetric Key Distribution Using Symmetric Encryption - Kerberos - Key

Distribution Using Asymmetric Encryption - X.509 Certificates - Public-Key Infrastructure -Federated Identity Management - Web Security Considerations - Secure Socket Layer and Transport Layer Security - Transport Layer Security

MODULE V WIRELESS NETWORK SECURITY, ELECTRONIC MAIL SECURITY AND IP SECURITY **8**

IEEE 802.11 Wireless LAN Overview -IEEE 802.11i Wireless LAN Security - Wireless Application Protocol Overview - Wireless Transport Layer Security - WAP End-to-End Security - Pretty Good Privacy - S/MIME – Domain Keys Identified Mail- IP Security Overview -IP Security Policy - Encapsulating Security Payload - Combining Security Associations - Internet Key Exchange - Cryptographic Suites

MODULE VI SYSTEM SECURITY **8**

Intruders -Intrusion Detection -Password Management - Types of Malicious Software - Viruses Virus Countermeasures – Worms - Distributed Denial of Service Attacks- The Need for Firewalls - Firewall Characteristics - Types of Firewalls - Firewall Basing - Firewall Location and Configurations

L – 45; Total Hours –45

REFERENCES:

- William Stallings,"Network security Essentials:Applications and standards", Prentice Hall, Fifth Edition , ISBN-13: 978-0134527338, 2013
- William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson, ISBN-13:978-0-273-79335-9,2013
- Behrouz Forouzan, Debdeep Mukhopadhyay,Cryptography and network security (sie) 2nd edition, ISBN-13: 978-0070702080, 2016
- Wikipedia, "Network Security and Management" , https://en.wikipedia.org/wiki/Book:Network Security and Management, 2014.

5. Nitesh Dhanjani, Justin Clarke, "Network Security Tools", O'Reilly Media, ISBN-13: 9780596007942, 2005.

OUTCOMES:

Students who complete this course will be able to

1. Recognize the computer security concepts, architecture attacks and model
2. Distinguish the symmetric and asymmetric encryption techniques

3. Apply the cryptographic algorithms in different applications
4. Express the network security designs using available secure solutions such as PGP,SSL, IPSec, etc.
5. Describe the firewalls principles and different types of firewalls applied in organization
6. Identify abnormalities within the network caused by worms, viruses and Network related security treats.

GECX110	KNOWLEDGE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The course

- Focuses on positioning knowledge as a valuable commodity, embedded in products and in the tacit knowledge of highly mobile individual employees.
- Presents KM as a deliberate and systematic approach to cultivating and sharing an organization's knowledge base.
- Brings out the paradigm in terms of information technology and intellectual capital.

MODULE I KNOWLEDGE MANAGEMENT 6

KM Myths – KM Life Cycle – Understanding Knowledge – Knowledge, intelligence – Experience – Common Sense – Cognition and KM – Types of Knowledge – History of Knowledge Management - From Physical assets to Knowledge Assets – Expert knowledge – Human Thinking and Learning.

MODULE II KNOWLEDGE MANAGEMENT SYSTEMS AND MODELS 9

Challenges in Building KM Systems – Conventional Vs KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – KM cycle - Different variants of KM cycle - KM models - Implications and practical implementations.

MODULE III CAPTURING KNOWLEDGE AND SHARING 9

Tacit knowledge capture - Explicit knowledge codification – Knowledge taxonomies - Knowledge sharing - Communities - Obstacles to knowledge capture and sharing.

MODULE IV KNOWLEDGE MANAGEMENT TOOLS 9

KM System tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Knowledge capture and creation tools - Content creation tools - Data mining and knowledge discovery – Content

management tools - Knowledge sharing and dissemination tools – Group ware and Collaboration tools - Intelligent filtering tools.

MODULE V KNOWLEDGE APPLICATION 6

KM at individual level - Knowledge workers - Task analysis and modeling - Knowledge application at group and organizational levels – Knowledge repositories - Knowledge reuse -Case study: e-learning.

MODULE VI VALUE OF KNOWLEDGE MANAGEMENT 6

KM return on investment and metrics - Benchmarking method – Balanced scorecard method - House of quality method - Results based assessment method - Measuring success - Future challenges for KM.

L – 45; Total Hours –45

TEXT BOOKS:

- Elias M. Awad, Hassan M. Ghaziri, “Knowledge Management”, Prentice Hall, 2nd Edition, 2010.
- Jay Liebowitz, “Handbooks on Knowledge Management”, 2nd Edition, 2012.
- Irma Becerra-Fernandez, Rajiv Sabherwal, ”Knowledge Management: Systems and Processes”, 2010.

OUTCOMES:

Students who complete this course will be able to

- Describe the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.
- Explains the core concepts, methods, techniques, and tools for computer support of knowledge management.
- Critically evaluate current trends in knowledge management and apply it for e-learning

GECX111	CYBER SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Cyber Security Standards and Policies.
- To know the legal, ethical and professional issues in Cyber security.
- To understand Cyber Frauds and Abuse and its Security Measures.
- To know the technological aspects of Cyber Security.

MODULE I FUNDAMENTALS OF CYBER SECURITY 7

Security problem in computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in Internet.

MODULE II CYBERCRIME AND CYBEROFFENSES 8

Cybercrime and Information Security – Cybercriminals – Classifications of Cybercrimes – Email Spoofing – Spamming – Cyber defamation – Internet Time Theft – Forgery – Web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyberoffenses – Categories – Planning the attacks – Cyberstalking – Cybercafe and Cybercrimes – Botnets.

MODULE III CYBERCRIME: MOBILE AND WIRELESS DEVICES 8

Proliferation of Mobile and Wireless Devices – Trends in Mobility – Credit card frauds in Mobile and Wireless Computing – Security Challenges – Authentication Service Security – Attacks on Mobile Phones.

MODULE IV TOOLS AND METHODS USED IN CYBERCRIME 8

Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Spywares – Virus and Worms – Trojan Horses and Backdoors – Steganography – DoS and DDoS Attacks.

MODULE V SECURITY POLICIES 7

Introduction - Defining User Policies – Passwords – Internet Use – Email Usage – Installing/ Uninstalling Software – Instant Messaging – Defining System Administrative Policies – Defining Access Control Developmental Policies Standards, Guidelines and Procedures – Basics of assessing a system

MODULE VI COMPUTER FORENSICS 7

General Guidelines – Finding Evidence on the PC - Finding Evidence in System Logs – Windows Logs – Linux Logs – Getting Back Deleted Files – Operating System Utilities – The Windows Registry.

L – 45; Total Hours –45

TEXT BOOKS:

1. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley, 2011.

2. Chuck Easttom, "Computer Security Fundamentals", 2nd Edition, Pearson Education, 2012.

REFERENCES:

- Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", 3rd Edition, Pearson Education, 2003.
- William Stallings, "Cryptography and Network Security – Principles and Practices", 3rd Edition, Pearson Education, 2003.
- Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill, 2000.

OUTCOMES:

Upon completion of this course, students will be able to

- Explain the general security issues.
- Discuss various cybercrimes and offenses.
- Outline the occurrence of Cybercrime in mobile and wireless environment.
- Use relevant tools and methods in cybercrime
- Apply security policies in cyber forensics.
- Outline the strategies adopted in computer forensics.

GECX112	GENETIC ENGINEERING	L	T	P	C
		4	0	0	4

OBJECTIVES:

The course aims to provide an advanced understanding of the core principles and topics of Cell and Organism reproduction and the Principles of heredity and their experimental basis, and to enable students to be able to apply these principles in assessment of pedigrees to identify genotypes and predict the mating outcomes.

MODULE I GENETICS AND ORGANISM 10

Genetics and human affairs, Genetics and Biology, Genes and Environment, Techniques of genetic analysis, The chromosome theory of heredity, Sex chromosomes, Sex linkage, The parallel behaviour of autosomal genes and chromosomes.

MODULE II MENDELISM AND LINKAGE 12

Mendel's laws of inheritance, Interaction of genes, Variations on dominance, Multiple alleles, Lethal alleles, Several genes affecting the same character, Penetrance and expressivity, Linkage- Basic eukaryotic chromosome mapping, The discovery of linkage, Recombination linkage symbolism, Linkage of genes on X chromosomes, Linkage maps, Examples of linkage maps.

MODULE III FINE STRUCTURE OF GENES 10

The concept of promoter, Coding sequence, Terminator, Induction of gene for expression. The concept of extranuclear genome in higher plants and animals, Overview of mitochondrial genome, Chloroplast genome.

MODULE IV RECOMBINATION IN BACTERIA AND VIRUSES 10

Conjugation recombination and mapping the E.coli chromosomes, Transformation, Transduction, Chromosome mapping. Population genetics: Darwin's revolution, Variation and its modulation, The effect of sexual reproduction on variation, The sources of variation, Selection quantitative genetics

MODULE V PRINCIPLES OF PLANT BREEDING 9

Objectives, Selfing and crossing techniques, Male sterility,Incompatability,

Hybrid vigour.

MODULE VI HUMAN GENOME PROJECT 9

Genetic diseases in humans, Genetics and society

L – 45; T – 15; Total Hours –60

REFERENCES:

1. In Introduction to genetic analysis, Griffiths, Miller, Suzuki, Lewontin and Gelbart, Freeman and Company.
2. Genetics, A.V.S.S. Sambamurty, Narosa Publishing House.
3. Concepts of Genetics, Klug & Cummings, Prientice Hall.
4. Molecular Cloning, Moniatisetal, Cold Spring Harbor Laboratory.

OUTCOMES:

At the end of the course students will be able to

- Describe the structure, function and replication of DNA as the genetic material
  1. Describe gene structure, expression and regulation
- Describe the chromosomal basis of inheritance and how alterations in chromosome number or structure may arise during mitosis and meiosis

GECX113	FUNDAMENTALS OF PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The students would gain knowledge on

- Technicalities attached to Project Management and Significance of Quality Consideration
- Project management methodologies – tools and techniques, supplemented with examples from case studies
- The importance of Efficient HR team and role of Communication in executing Projects.
- Managing Risks in Project Management

MODULE I INTRODUCTION TO PROJECT MANAGEMENT 9

Introduction to Project and Project Management-Project Management as a Career-Project Management Skill Sets-Project Scope Management: Project Charter, Scope Creep, Scope Validation, Scope Change Control-Type of Organization: Organization Structure-Influence of Organization Structure on Project, Project Stakeholders and Organizational Productivity.

MODULE II PROJECT MANAGEMENT PROCESS, TOOLS AND TECHNIQUES 8

Project life cycle-Initiation, Planning, Execution, Monitoring and Closing Phase; - Link between project management process, process groups and knowledge areas; Project management tools and techniques- Project Stakeholders description and mapping - Stakeholder Management Process

MODULE III PROJECT QUALITY, COST AND SCHEDULE MANAGEMENT 10

Triple constraints of project-quality, cost and schedule-Quality Planning, Quality Assurance and Quality Control, Process Control, Cost of Quality, Seven Tools of Quality Control- Cost Management: Cost Estimating Methods, Estimating Completion Cost, Earned Value Management, Budgeting, Life-Cycle Cost analysis- Project Time Management: Duration Estimation Method, FS/FF/SS/ SF Relations, Lead/Lag, Arrow Diagram Method and Precedence Diagram Method for Scheduling-Resource Allocation

MODULE IV PROJECT HR MANAGEMENT 5

Organizational Goals- (MBO/MBE/MBP)-Responsibility Assignment Matrix (RAM)-Types of Powers- Manage or Lead-Conflict management Techniques-Performance Evaluation Process-Motivation Theories and its Application for execution of Projects-Leadership Styles-Project Team Building-Project Staffing Constraints/Policies

MODULE V COMMUNICATION MANAGEMENT 5

Communication Management: Understanding Body languages of Project Personnel-Effective Communications- Interpersonal Skills for project Managers-PMIS-Communicating with the Customer-Communicating with Management- Formal vs. Informal Communications-Written, Verbal and Non-Verbal Communications.

MODULE VI PROJECT PROCUREMENT & RISK MANAGEMENT 8

Introduction to Project Procure Management: Soliciting RFQ/RFP-Contract Proposals-Contract Negotiation-Contract Closure-Risk Management: Defining risks-Risk management process-Risk identification-Qualitative and Quantitative Risk-Probability and Decision trees-Risk Response strategies / methods-Expected monetary value-Risk vs. life cycle phases

L – 45; Total Hours –45

REFERENCES:

Jack. R. Meredith, Samuel. J. Mantel & Scott. M. Shafer, Project Management in Practice, Fifth Edition, Bangalore: Wiley, 2015

Bob Hughes, Mike Cotterrel “Software Project Management”, Tata McGraw-Hill, 2009

OUTCOMES:

- Learners will be able to identify the Key Knowledge Areas and apply PM process in hypothetical project assignments given as continuous assessment.
- They would be able to suitably recognize tools and techniques required for various phases included in a project.
- They would also be able to manage scope, time, cost and other major components that would help them to execute the project efficiently.

GECX114	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

OBJECTIVES:

2. To acquire knowledge and training in optimization techniques.
3. To get knowledge about optimization in utilization of resources.
4. To understand and apply operations research techniques to industrial operations

MODULE I LINEAR PROGRAMMING PROBLEM 8

Linear programming – formulation of the problem - graphical interpretation of optimality - Simplex method – to obtain basic feasible solution – types of linear programming solution – complications and their resolution.

MODULE II ARTIFICIAL VARIABLE AND TWO PHASE METHOD, DUALITY 6

Artificial variable - Big M method – Two phase method – alternative optimal solution – unbounded solution - Duality – primal dual relationships - rules of constructing the dual from primal.

MODULE III TRANSPORTATION PROBLEM & ASSIGNMENT PROBLE 8

Transportation problems – Initial basic feasible solutions, MODI method, Unbalance in transportation, Degeneracy in transportation models, Assignment problem – Minimization and Maximization type of problems by Hungarian method.

MODULE IV NETWORK AND SEQUENCING PROBLEMS 8

PERT and CPM – Network diagram – Fulkerson's rule - CPM Probability of achieving completion date – Crash time – Cost analysis. Sequencing N jobs through 2 machines and 3 machines.

MODULE V QUEUING THEORY & SIMULATION 7

Poisson arrivals and exponential service times – characteristics of Queuing models – single channel – Introduction to multi channel models – Random number generation – Monte Carlo Simulation.

MODULE VI INVENTORY CONTROL, REPLACEMENT MODELS 8

AND GAME THEORY

Types of inventory- Inventory cost - EOQ - Deterministic inventory problems – Introduction to probabilistic models & system level inventory control - Replacement models – Replacement of items that deteriorate with time – value of money changing with time – not changing with time – Individual and group replacement policy - Game theory – simple games.

L – 45; Total Hours –45

TEXT BOOKS:

3. Hamdy ATaha, “Operations Research an introduction”, 8th edition, Phil Pearson, 2007.
4. Winston.W.L., “Operations Research”, 4th edition, Thompson-Brooks/Cole, 2003.

REFERENCES:

- Wayne.L. Winston, “Operations Research applications and algorithms”, 4th edition, Thomson learning, 2007.
- Frederick. S. Hiller and Gerald.J.Lieberman, “Operations Research concepts and cases”, 8th edition (SIE), Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2006.
- A. Ravindran, D. T. Phillips and J. J. Solberg, "Operations Research:Principles and Practice", 2nd edition, John Wiley & Sons, New York, 1992.
- Robertazzi. T.G., “Computer networks and systems-Queuing theory and performance evaluation”, 3rd edition, Springer, 2002.

OUTCOMES:

At the end of the course students will be able to

- solve linear programming problems
- solve transportation and assignment problems.
- solve network and sequencing problems.
- apply the operations research techniques to solve industrial problems.

GECX115	NANO TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To introduce the basic concepts of Nanoscience relevant to the field of engineering.
2. To provide an exposure about the importance of various synthesis method.
3. To enrich the knowledge of students in various characterisation techniques.

MODULE I INTRODUCTION & CLASSIFICATION OF NANOMATERIALS 9

Definition - Origin of nanotechnology - Difference between bulk and nanomaterials- Top-down and bottom-up processes - Size dependent properties (magnetic, electronic,transport and optical), Classification based on dimensional property - 0D, 1D, 2D and 3D nanostructures – Kubo gap.

MODULE II TYPES OF NANOMATERIALS 9

Metal oxides and metal nano particles - Ceramic nano particles - Semi conducting quantum dots - Core-shell quantum dots - Nanocomposites - Micellar nanoparticles.

MODULE III PRODUCTION OF NANOPARTICLES 7

Sol-gel, hydrothermal, solvothermal, Plasma Arcing, Electro deposition, RF sputtering, Pulsed laser deposition, Chemical vapour, deposition.

MODULE IV CARBON BASED NANOMATERIALS 6

Carbon nanotubes: Single wall nanotubes (SWNT), Multiwall nanotubes (MWNT) - structures-carbon nanofibre, Fullerenes-Application of carbon nanotubes and Fullerenes.

MODULE V NANOPHOTONICS 7

Light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, nanoparticles and nanostructures; Nanostructured polymers, Photonic Crystals, Solar cells.

MODULE VI CHARACTERISATION TECHNIQUES 7

Basic principles of scanning Electron Microscopy (SEM), Atomic force

microscopy (AFM), Scanning tunneling microscopy (STM), Scanning probe microscopy (SPM) and Transmission electron microscopy (TEM), Particle size analyzer, Luminescence techniques.

L – 45; Total Hours –45

TEXT BOOKS:

- Hari Singh Nalwa, "Handbook of Nanostructured Materials and Nanotechnology", Academic Press, 2000.
- Guozhong Cao, "Nanostructures and Nano materials-Synthesis, Properties and Applications", Imperial College Press (2011).
- Zhong Lin Wang, "Handbook of Nanophase and Nanomaterials (Vol 1 and II)", Springer, 2002.
- Mick Wilson, Kamali Kannangara, Geoff smith, "Nanotechnology: Basic Science and Emerging Technologies", Overseas press, 2005.

REFERENCES:

1. A. Nabok, "Organic and Inorganic Nanostructures", Artech House, 2005.
2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: "Nanotechnologies and Nanophysics", Springer-Verlag Berlin Heidelberg, 2007.
3. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, "Nano Technology – Basic Science and Emerging Technologies", 1st Edition, Overseas Press, New Delhi,2005.
4. M.S. Ramachandra Rao, Shubra SinghH, "Nanoscience and Nanotechnology: Fundamentals to Frontiers", Wiley, 2013.

OUTCOMES:

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

- Apply the knowledge of different types of nanomaterials for various engineering applications.
- Acquire the knowledge of various methods of production of nanomaterials.
- Familiarize with various characterization techniques.

GECX116	VEHICLE MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To know about the various methods of maintaining procedure, vehicle insurance and basic problems in a vehicle.
2. The student able to impart knowledge in maintaining of engine components and subsystems.
3. The student able to impart knowledge in maintaining of transmission, driveline, steering, suspension, braking and wheels.
4. The student able to impart **carefully maintaining their vehicle and can increase driving safety.**

MODULE I MAINTENANCE, WORKSHOP PRACTICES, SAFETY AND TOOLS **7**

Maintenance – Need, importance, primary and secondary functions, policies - classification of maintenance work - vehicle insurance - basic problem diagnosis. Automotive service procedures – workshop operations – workshop manual - vehicle identification. Safety – Personnel, machines and equipment, vehicles, fire safety - First aid. Basic tools – special service tools – measuring instruments – condition checking of seals, gaskets and sealants. Scheduled maintenance services – service intervals - Towing and recovering.

MODULE II ENGINE AND ENGINE SUBSYSTEM MAINTENANCE **8**

General Engine service- Dismantling of Engine components- Engine repair- working on the underside, front, top, ancillaries- Service of basic engine parts, cooling and lubricating system, fuel system, Intake and Exhaust system, electrical system - Electronic fuel injection and engine management service - fault diagnosis- servicing emission controls.

MODULE III TRANSMISSION AND DRIVELINE MAINTENANCE **8**

Clutch- general checks, adjustment and service- Dismantling, identifying, checking and reassembling transmission, transaxle- road testing- Removing and replacing propeller shaft, servicing of cross and yoke joint and constant velocity joints- Rear axle service points- removing axle shaft and bearings- servicing differential assemblies- fault diagnosis.

MODULE IV STEERING AND SUSPENSION MAINTENANCE 7

Maintenance and Service of Mc person strut, coil spring, leaf spring, shock absorbers. Dismantling and assembly procedures. Inspection, Maintenance and Service of steering linkage, steering column, Rack and pinion steering, Recirculating ball steering service- Worm type steering, and power steering system.

MODULE V BRAKE AND WHEEL MAINTENANCE 7

Inspection, Maintenance and Service of Hydraulic brake, Drum brake, Disc brake, parking brake. Bleeding of brakes. Wheel alignment and balance, removing and fitting of tyres, tyre wear and tyre rotation.

MODULE VI AUTO ELECTRICAL AND AIR CONDITIOING MAINTENANCE 8

Maintenance of batteries, starting system, charging system and body electrical -Fault diagnosis using Scan tools. Maintenance of air conditioning parts like compressor, condenser, expansion valve, evaporator - Replacement of hoses- Leak detection- AC Charging- Fault diagnosis Vehicle body repair like panel beating, tinkering, soldering, polishing, painting.

L – 45; Total Hours –45

TEXT BOOKS:

- Ed May, "Automotive Mechanics Volume One" , Mc Graw Hill Publications, 2003
- Ed May, "Automotive Mechanics Volume Two" , Mc Graw Hill Publications, 2003
- Vehicle Service Manuals of reputed manufacturers
- Vehicle maintenance and garage practice by Jigar A.Doshi Dhru U.Panchal,Jayesh P.Maniar. 2014
- A Practical Approach to Motor Vehicle Engineering and Maintenance 3rd Edition by Allan Bonnick.

REFERENCES:

- Bosch Automotive Handbook, Sixth Edition, 2004.
- Advanced Automotive Fault Diagnosis by Tom Denton 2011.
- Nissan Patrol Automotive Repair Manual: 1998-2014 by Haynes Manuals Inc.
- Automobile electrical manual a comprehensive guide by Haynes manual car repair.

OUTCOMES:

On completion of the course student should be able to

1. Prepare maintenance schedules and procedures with appropriate tools.
2. Demonstrate the procedure and methods to repair and calibrate the engine.
3. **Analyze the causes and remedies for fault in transmission and drive line systems.**
4. **Analyze the causes and remedies of steering and suspension systems.**
5. **Analyze the causes and remedies of brake system.**
6. **Demonstrate the procedure for wheel alignment and wheel balanced.**

GECX117	FUNDAMENTALS OF DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. Describe and explain basic principles of digital image processing
2. Design and implement algorithms that perform basic image processing
3. Design and implement algorithms for advanced image analysis
4. Assess the performance of image processing algorithms and systems

PRE-REQUISITES:

- Basic knowledge of transforms in Mathematics

MODULE I DIGITAL IMAGE FUNDAMENTALS 8

Elements of Image Processing System, Fundamentals steps in Digital Image Processing, Image Sampling & Quantization, Spatial and Gray Level Resolution.

MODULE II COLOR IMAGE PROCESSING 8

Fundamental of color image processing, color models- RGB, CMY, HIS, Pseudo color image processing

MODULE III IMAGE ENHANCEMENT 7

Basic gray level Transformations, Histogram Processing, Spatial Filtering

MODULE IV IMAGE TRANSFORMS 7

2D-DFT, DCT, Haar Transform, Fundamentals of 2D-wavelet transform, sub-band coding

MODULE V IMAGE SEGMENTATION AND RESTORATION 8

Point, line and edge detection methods ,Image Segmentation and its types, Restoration: Noise model, Inverse filter and Wiener filter.

MODULE VI IMAGE COMPRESSION 7

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, JPEG and MPEG Compression standards.

TOTAL HOURS 45

TEXT BOOKS

1. Gonzalez and Woods, "Digital Image Processing", 3rd Edition, Pearson Education, 2016.
2. Anil. K. Jain, "Fundamentals of Digital Image Processing"; 4th Edition, PHI, 2007

REFERENCES

- Pratt William, "Digital Image Processing", John Wiley & Sons, 2007.
- Arthur Weeks Jr., "Fundamentals of Digital Image Processing", PHI, 2006.

OUTCOMES:

On completion of the course, students will be able to

- Explain the fundamental concepts of digital image processing.
- Discuss about color image processing
- Recognize & apply various image enhancement techniques.
- Apply various transforms for image processing.
- Apply various techniques for image segmentation and restoration.
- Identify and use appropriate image compression techniques

Group II courses

(To be offered in VII Semester)

		L	T	P	C
GECX201	**GREEN DESIGN AND SUSTAINABILITY**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To impart knowledge on the concepts of sustainable development and fundamentals of socio economic systems.
- To understand the basics of green building and frame work for the attainment of sustainability.
- To enhance the student's interest in the design of green building and energy efficient measures in a buildings.

MODULE I CONCEPTS OF SUSTAINABLE DEVELOPMENT 7

Objectives of Sustainable Development - Need for sustainable development-Environment and development linkages - Globalisation and environment-Population, poverty and pollution- global, regional and local environment issues-Green house gases and climate change.

MODULE II SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 8

Demographic dynamics of sustainability- Policies for socio economic development- Sustainable Development through trade- Economic growth- Action Plan for implementing sustainable development- Sustainable Energy and Agriculture.

MODULE III FRAME WORK FOR ACHIEVING SUSTAINBAILITY 7

Sustainability indicators- Hurdles to sustainability- Business and Industry – Science and Technology for Sustainable Development- Performance indicators of sustainability and assessment mechanism- Constraints and barriers of Sustainable Development.

MODULE IV GREEN BUILDINGS 8

Introduction to Green Building- Energy- Water- Materials and Resources - Sustainable Sites and Land Use - Indoor Environmental Quality- Life Cycle Assessment- Energy, water and materials efficiency.

MODULE V ENERGY CONSERVATION AND EFFICIENCY 7

Energy savings- Energy Audit- Requirements- Benefits of Energy conservation-Energy conservation measures for buildings- Energy wastage- impact to the environment.

MODULE VI GREEN BUILDINGS DESIGN 8

Elements of Green Buildings Design- Foundation, Electrical, Plumbing, flooring, Decking, roofing, insulation, wall coverings, windows, siding, doors and finishing, LEED certification for Green Buildings, Green Buildings for sustainability.

Total Hours –45

TEXT BOOKS:

1. Kirby, J., Okeefe, P., and Timber lake, “Sustainable Development”, Earthscan Publication, London, 1995.

REFERENCES:

1. Charles Kibert, J., “Sustainable Construction: Green Building Design and Delivery”, 2nd Edition, John Wiley and sons, 2007.

OUTCOMES:

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

- explain the objective, need for the sustainability and also the link between the globalization and environment.
- Address the economic, environmental, and social concerns in the sustainable development.
- Acquire knowledge on the performance indicators, constraints and barrier for sustainability.
- Explain the relationship between sustainability and emergence of green building practices.
- Recommend relevant energy conservation measures in a building
- describe the elements in green building design and suggest ideas for attainting sustainability in building.

GECX202	APPROPRIATE TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of appropriate technology and expose the students to the basics of financial analysis and energy fundamentals.
- To create awareness on the appropriate technology with relevant to building design, water, sanitation and waste management.
- To enhance student's interest in energy efficient techniques and impart knowledge on relevant policies.

MODULE I BASICS CONCEPTS 7

Back ground, Tools, Choices and Implications, Appropriate Technology Movement (an overview) - Basic design process, basic financial analysis-discounted cash flow, and energy fundamentals.

MODULE II APPROPRIATE TECHNOLOGY WITH REFERENCE TO BUILDING DESIGN 7

Appropriate Building Materials, Appropriate Energy Saving Techniques, Water Conservation (Indoor), Rain Water Harvesting.

MODULE III WATER, HEALTH AND SANITATION MANAGEMENT 7

Water Storage: Designing Dams and Pipelines, Appropriate Selection for Sanitation Technique, Sewerage, Communal Health and Waste Water Recycling.

MODULE IV WASTE MANAGEMENT 8

Types of Waste - Sources - Collections and On-Site Processing -Transferring Stations - Disposal Systems - Recycling.

MODULE V ENERGY EFFICIENT TECHNIQUES 8

Green building concepts-renewable energy sources- Solar – Steam and wind-Biofuels - Biogas – Electricity.

MODULE VI TECHNOLOGY POLICY **8**

Government Policies- Energy Policy-Appropriate technology Development Centre-its function and responsibilities-Building policies-Case Studies.

Total Hours –45

TEXT BOOKS:

1. Barrett Hazeltine and Christopher Bull, “Appropriate Technology: Tools Choices and Implications”, Academic Press, Orlando, USA, 1998.
2. Ken Darrow and Mike Saxenian, “Appropriate Technology Source Book : A Guide to Practical Books for Village and Small Community Technology”, Stanford, 1986.

REFERENCES:

- Richard Heeks, “Technology and Developing Countries: Practical Applications Theoretical Issues”, 1995.
- John Pickford, “The Worth of Water : Technical Briefs on Health, Water and Sanitation”, Intermediate Technology Publications, 1998.

OUTCOMES:

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

- describe about the tools, choices of appropriate technology along with concepts of energy fundamentals
- conceptualize the techniques to be adopted in building design for saving energy and water.
- acquire knowledge about the techniques for water, health and sanitation management
- explain the classification, collection dispose and recycling systems adopted in waste management.
- elucidate the concepts of green building and renewable energy sources.
- express the polices relevant to technology and recommend an appropriate technology for an sustainable development.

GECX203 ENGINEERING SYSTEM MODELLING AND SIMULATION

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To learn the concepts, techniques, tools for modeling and simulation systems and environments through the use of computers.
2. To study the various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

MODULE I INTRODUCTION **6**

Systems – Modelling – types – systems components – Steps in model building- Simulation Algorithms and Heuristics; Simulation Languages.

MODULE II RANDOM NUMBERS / VARIATES **7**

Random numbers – methods of generation – random variates for standard distributions like uniform, exponential, Poisson, binomial, normal etc. – Testing of Random variates – Monte Carlo Simulation.

MODULE III MODELLING PROCESS **7**

Primitive Models : Establishing relationships via physical laws; Establishing relationships via curve fitting; Parameters estimation problems; Elementary state transition models.

MODULE IV DESIGN OF SIMULATION EXPERIMENTS **9**

Steps on Design of Simulation Experiments – Development of models using of Highlevel language for systems like Queuing, Inventory, Replacement, Production etc., – Model validation and verification, Output analysis.

MODULE V SIMULATION LANGUAGES **10**

Need for simulation Languages – Comparisons & Selection of Languages – GPSSARENA- EXTEND – Study of any one of the languages.

MODULE VI CASE STUDIES USING SIMULATION LANGUAGES **6**

Case Study using simulation languages

L – 45; Total Hours –45

REFERENCES:

- Law, A.M., & W.D. Kelton, “Simulation Modelling and Analysis”, McGraw Hill, Singapore, 2000.
- Harrel, C.R., et. al., “System Improvement Using Simulation”, 3rd Edition, JMI Consulting Group and ProModel Corporation, 1995.
- Harrel, C.R. & T. Kerim, “Simulation Made Easy, A Manager’s Guide”, IIE Press, 1995.
- Geoffrey Gordon, “Systems Simulation”, Prentice Hall, 2002.
- David Kelton, Rondall P Sadowski, David T Sturrock, “Simulation with Arena”, Mc Graw Hill, 2004.

OUTCOMES:

The student should be able to

- Model and simulate systems and environments through the use of computers.
- Conduct experiments with discrete dynamic, stochastic system models on a computer.

GECX204 VALUE ANALYSIS AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To get acquainted with value analysis and engineering tool for productivity improvement.
2. To understand and analyze the theory and methodology of Value Engineering.

MODULE I VALUE ENGINEERING BASICS 8

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity In Value Engineering.

MODULE II VALUE ENGINEERING JOB PLAN AND PROCESS 6

Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

MODULE III ORIENTATION AND INFORMATION PHASES 8

Launching Value Engineering project work - Objectives and Targets - VE Project work: a time-bound programme - Projects and Teams - Time Schedule - Co-ordination - Consultant. Technical data - Marketing related information - Competition profile - Cost data - Materials Management related information - Quality related information - Manufacturing data.

MODULE IV FUNCTION ANALYSIS AND CREATIVE PHASES 9

Objectives - Function definition - Classification of functions - Higher level functions – Function – Cost – Function – Worth - Value Gap - Value index - How to carry out Function Analysis? – Fast Diagraming - Cost Modelling.

Creativity - How to improve creativity of an individual? – How to promote creativity in the organisation? - Obstacles to Creativity - Mental road blocks - Creativity killer phrases. Positive thinking - Ideas stimulators - Creativity techniques - Brainstorming.

MODULE V EVALUATION, INVESTIGATION AND RECOMMENDATION 6

Paired comparison and Evaluation Matrix techniques - Criteria for selection of VE solutions. Design – Materials – Quality – Marketing – Manufacturing - Preview session. The report - presentation.

MODULE VI IMPLEMENTATION PHASE AND CASE STUDIES 8

Design department - Materials department - Production Planning & Control - Quality Control – Manufacturing – Marketing - Need for co-ordinated teams - The Action Plan. Value Engineering case studies.

L – 45; Total Hours –45

TEXT BOOKS:

1. Mudge, Arthur E. “Value Engineering- A systematic approach”, McGraw Hill, New York, 2000.
2. Kumar S, Singh R K and Jha J K (Ed), “Value Engineering”, Narosa Publishing House, 2005.

REFERENCES:

- Park RJ, “Value Engineering: A Plan for Invention”, St.Lucie Press, New York, 1999.
- Lawrence, D.M., “Techniques of Value Analysis and Engineering”, McGraw Hill 1988.
- George, E.D., “Engineering Design: a Material and Processing Approach”, McGraw Hill, 1991.
- Heller, D.E., “Value Management, Value Engineering and Cost Reduction”, Addison Wesley, 1988.

OUTCOMES:

- The student will be able to realize the value of products, processes and implement value analysis to achieve productivity improvement.

GECX205	INDUSTRIAL SAFETY	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To understand the various safety measures to be taken in different industrial environments.

MODULE I SAFETY MANAGEMENT **7**

Evolution of modern safety concept- Safety policy - Safety Organization - line and staff functions for safety- Safety Committee- budgeting for safety. safety education and training.

MODULE II SAFETY IN MANUFACTURING **7**

Safety in metal working-Machine guarding -Safety in welding and gas cutting - Safety in cold forming and hot working of metals -Safety in finishing, inspection and testing -Regulation.

MODULE III SAFETY IN CONSTRUCTION **8**

General safety consideration in Excavation, foundation and utilities – Cordoning – Demolition – Dismantling –Clearing debris – Types of foundations – Open footings.

Safety in Erection and closing operation - Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring.

MODULE IV ELECTRICAL SAFETY **8**

Electrical Hazards – Energy leakage – Clearance and insulation – Excess energy – Current surges – Electrical causes of fire and explosion – National electrical Safety code.

Selection of Environment, Protection and Interlock – Discharge rods and earthing device – Safety in the use of portable tools - Preventive maintenance.

MODULE V SAFETY IN MATERIAL HANDLING **8**

General safety consideration in material handling devices - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears – Prime movers.

Ergonomic consideration in material handling, design, installation, operation and maintenance of Conveying equipments, hoisting, traveling and slewing mechanisms.

Storage and Retrieval of common goods of shapes and sizes in a general store of a big industry.

MODULE VI SAFETY EDUCATION AND TRAINING 7

Importance of training-identification of training needs-training methods – programme, seminars, conferences, competitions – method of promoting safe practice - motivation – communication - role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.

L – 45; Total Hours –45

REFERENCES:

- Krishnan N.V, “Safety Management in Industry”, Jaico Publishing House, Bombay, 1997.
- Blake R.B., “Industrial Safety”, Prentice Hall, Inc., New Jersey, 1973.
- Fulman J.B., “Construction Safety, Security, and Loss Prevention”, John Wiley and Sons, 1979.
- Fordham Cooper W., “Electrical Safety Engineering”, Butterworths, London, 1986.
- Alexandrov M.P., “Material Handling Equipment”, Mir Publishers, Moscow, 1981.

OUTCOMES:

Students would be able to

- Acquire knowledge on various safety Hazards.
- Carry out safety measures for different industrial environments.

GECX206 ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To introduce the various advanced optimization tools.
2. To provide an understanding to deal with ill identified and fuzzy problems.

MODULE I INTRODUCTION **7**

Review of conventional optimization techniques - limitations - limitation of exhaustive search - need for artificial intelligence - bio mimicking methods

MODULE II HEURISTICS METHODS **8**

Introduction – Advanced methods of algorithm design: Greedy method, Backtracking method, Divide and Conquer method – Dynamic programming – Heuristics exploration algorithms – Greedy search - Local search – Hill climbing – Tabu search – Gradient search – Beam search – Simulated Annealing.

MODULE III GENETIC ALGORITHM **7**

Introduction - Basics of GA – Population – Reproduction – Cross over – Mutation -genetic algorithms in search, optimization and machine learning-practical genetic algorithms.

MODULE IV ANT COLONY OPTIMIZATION **8**

Introduction: Ant Colony Optimization – Meta-heuristic Optimization – History – The ACO Meta-heuristic – ACO Algorithms: Main ACO – Ant system – Ant colony system – Max-Min Ant system – Applications: Routing in telecommunication networks – Travelling salesmen – Graph Coloring – Advantages & Disadvantages

MODULE V FUZZY LOGIC AND ANN **8**

Fuzzy logic, knowledge representation and inference mechanism – Fuzzy and expert control – standard Takagi-Sugeno mathematical characterizations – Design example – Biological foundations to intelligent systems: Artificial neural networks, Back-propagation networks, Radial basis function networks,

and recurrent networks.

MODULE VI IMPLEMENTATIONS & APPLICATIONS 7

Reduction of size of an optimization problem – multilevel optimization – parallel processing – multi objective optimization – Job shop scheduling – Vehicle scheduling – Line balancing – Sensor integration.

L – 45; Total Hours –45

REFERENCES:

1. Singiresu S. Rao, “Engineering optimization – Theory and practices”, John Wiley and Sons, 1996.
2. Ravindran – Phillips –Solberg, “Operations Research – Principles and Practice, John Wiley and Sons, 1987.
3. Fredrick S.Hillier and G.J.Liberman, “Introduction to Operations Research”, McGraw Hill Inc. 1995.
4. Kalymanoy Deb, “Optimization for Engineering Design”, PHI, 2003
5. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006

OUTCOMES:

At the end of the course student will be able to

- Formulate a real life situation as an optimization the problem.
- Identify the appropriate solution methodology and provide a solution

GECX207	MATLAB SIMULINK	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION MATLAB DATA PRESENTATION 7

Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically- Least squares regression -Curve fitting.

MODULE II MATLAB PLOT FUNCTION 7

Introduction- Plot Function – Animation- 3D Plots-Customizing Plots – Plot Applications- Saving &Painting Plots.

MODULE III ROOT FINDING AND COMPUTER REPRESENTATION OF NUMBERS 7

Linearization and solving non-linear systems of equations- The Newton-Rapson method- Integers and rational numbers in different bases- Floating point numbers- Round off and errors in basic arithmetic-Significant digits when reporting results

MODULE IV ORDINARY DIFFERENTIAL EQUATIONS 8

Numerical integration and solving 1^{st} order, ordinary differential equations (Euler's method and Runge-Kutta)- Use of ODE function in MATLAB

MODULE V NON-LINEAR DIFFERENTIAL EQUATIONS 8

Converting 2^{nd} order and higher ODEs to systems of 1^{st} order ODEs- Solving systems of ODEs via Euler's method and Runge-Kutta)- Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations

MODULE VI INTRODUCTION OF SIMULINK 8

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- Modeling the solution of three equations with three unknowns- Representing a model as a subsystem-Simulink demos.

L – 45; Total Hours –45

REFERENCES:

1. Griffiths D V and Smith I M, Numerical Methods for Engineers, Blackwell, 1991.
2. Laurene Fausett, Applied Numerical Analysis Using MATLAB, Pearson 2008.
3. Moin P, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB. CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving , Mathematical Exploration with MATLAB, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab's capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.
- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECX208	EMBEDDED SYSTEMS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To provide a detailed overview of embedded system.
2. To equip students with the software development skills necessary for practitioners in the embedded systems field.
3. To understand entire software development lifecycle and examine the various issues involved in developing software for embedded systems.

MODULE I EMBEDDED SYSTEMS OVERVIEW 8

Introduction –Embedded Systems vs. General computing systems- Fundamental Components of embedded systems- Characteristics- Challenges-Examples- Embedded System design process.

MODULE II EMBEDDED COMPUTING PLATFORM 8

Overview of Processors and hardware units in an embedded system-CPU buses – Memory devices –Memory types- I/O devices – Designing with computing platforms- Consumer electronics architecture-Design example: Alarm clock.

MODULE III REAL TIME EMBEDDED SYSTEMS 8

Programming embedded systems in assembly and C – Real time systems – Hard and Soft real time systems- Need for RTOS in Embedded Systems- Multiple tasks and processes –Context switching-Scheduling policies- Interprocess communication and synchronization.

MODULE IV EMBEDDED SOFTWARE DEVELOPMENT PROCESS and TOOLS 8

Development process of an embedded system-software modules and tools for implementation of an embedded system- Integrated development environment- Host and target machines-cross compiler-cross assembler-Choosing right platform.

MODULE V PROGRAM MODELING IN EMBEDDED SYSTEMS 8

Program Models – Data Flow Graph model-control DFG model-Synchronous DFG model- Finite state machines- UML modeling – UML Diagrams.

MODULE VI EMBEDDED SYSTEMS APPLICATION 5

Application specific embedded system – case study: digital camera hardware and software architecture, embedded systems in automobile, embedded system for a smart card.

Total Hours –45

TEXT BOOKS:

1. Marilyn Wolf , "Computers as components", Elsevier 2012.
2. Shibu. K.V, “Introduction to Embedded Systems”, Tata Mcgraw Hill,2009.
3. Rajkamal, "Embedded Systems Architecture, Programming and Design",1st Reprint,Tata McGraw-Hill, 2003
4. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons, 2002.

REFERENCES:

1. Sriram V Iyer and PankajGupta ,”Embedded Realtime Systems Programming ”Tata McGraw-Hill,2008
2. Qing Li and Carolyn Yao," Real-Time Concepts for Embedded Systems", CMPBooks, 2003
3. David E.Simon, "An Embedded Software Primer", Pearson Education, 2003

OUTCOMES:

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

4. Identify the suitable processor and peripherals in embedded applications
5. Develop embedded programs in assembly and c
6. Choose the right platform for designing an embedded system
7. Explore different scheduling mechanism in rtos
8. Design the program model for embedded applications.
9. Analyze different domain specific applications in embedded systems.

GECX209	USABILITY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of this course is

- To understand the emerging concept of usability, requirements gathering and analysis.
- To learn about human computer interaction with the help of interfaces that has high usability.

MODULE I INTRODUCTION 6

Cost Savings – Usability Now – Usability Slogans – Discount Usability Engineering – Usability – Definition – Example – Trade-offs – Categories – Interaction Design – Understanding & Conceptualizing Interaction – Cognitive Aspects.

MODULE II USER INTERFACES 8

Generation of User Interfaces – Batch Systems, Line Oriented Interfaces, Full Screen Interfaces, Graphical User Interfaces, Next Generation Interfaces, Long Term Trends – Usability Engineering Life Cycle – Interfaces – Data Gathering – Data Analysis Interpretation and Presentation.

MODULE III INTERACTION DESIGN 8

Process of Interaction Design - Establishing Requirements – Design,Prototyping and Construction - Evaluation and Framework.

MODULE IV USABILITY TESTING 8

Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation – Usability Testing - Test Goals and Test Plans, Getting Test Users, Choosing Experimenters, Ethical Aspects, Test Tasks, Stages of a Test, Performance Measurement, Thinking Aloud, Usability Laboratories.

MODULE V USABILITY ASSESSMENT METHODS 8

Observation, Questionnaires and Interviews, Focus Groups, Logging Actual Use, User Feedback, Usability Methods – Interface Standards - National,

International and Vendor Standards, Producing Usable In-House Standards.

MODULE VI USER INTERFACES 7

International Graphical Interfaces, International Usability Engineering, Guidelines for Internationalization, Resource Separation, Multilocale Interfaces – Future Developments – Case Study.

L – 45; Total Hours –45

TEXT BOOKS:

1. Yvonne Rogers, Helen Sharp, Jenny Preece, "Interaction Design: Beyond Human - Computer Interaction", John Wiley & Sons, 3rd Edition, 2011 (Module I, II, III).
2. Jakob Nielsen, "Usability Engineering", Morgan Kaufmann Academic Press, 1994. (Module I – VI).

REFERENCES:

- Ben Shneiderman, Plaisant, Cohen, Jacobs, "Designing the User Interface: Strategies for Effective Human Interaction", Pearson Education, 5th Edition, 2010.
- Laura M. Leventhal, Julie A. Barnes, "Usability Engineering: Process, Products, and Examples", Pearson/Prentice Hall, 2008

OUTCOMES:

Students who complete this course will be able to

- build effective, flexible and robust user interfaces.
- translate system requirements into appropriate human/computer interaction sequences.
- choose mode, media and device for the application requirements.

GECX210	SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To understand the various decision phases in a supply chain
2. To be aware of the Supply Chain and its drivers
3. To design Supply Chain Network
4. To build a aggregate plan in supply chain
5. To understand Sourcing Decisions in Supply Chain
6. To comprehend the influence of Information technology in Supply Chain

MODULE I INTRODUCTION TO SUPPLY CHAIN 7

Understanding Supply Chain - Decision phases - Supply chain performance - Competitive and supply chain strategies - Achieving strategic fit - Expanding strategic scope

MODULE II SUPPLY CHAIN DRIVERS AND DESIGN 7

Drivers of supply chain performance – Designing distribution network - Network Design in the Supply Chain - Network design in Uncertain Environment

MODULE III AGGREGATE PLANNING AND MANAGING SUPPLY, DEMAND AND INVENTORY 8

Aggregate Planning in a Supply chain: role - Managing Supply - Managing Demand in Supply Chain – Cycle and Safety inventory in supply chain – Level of product availability.

MODULE IV MANAGING INVENTORY IN SUPPLY CHAIN 8

Managing Economies of Scale in a Supply Chain : Cycle Inventory- Managing uncertainty in a Supply Chain Safety Inventory- Determining optimal level of Product Availability

MODULE V SOURCING AND TRANSPORTATION 8

Sourcing decision in supply chain - Third and Fourth – Party Logistics providers - Supplier scoring and assessment - Transportation in a Supply Chain – Risk and Trade-offs in transportation design.

MODULE VI INFORMATION TECHNOLOGY IN A SUPPLY CHAIN 7

Information technology in a supply chain – CRM, ISCM, SRM in supply chain - Over view of recent trends in Supply Chain: e-SRM, e-LRM, e-SCM.

L – 45; Total Hours –45

REFERENCES:

1. Sunil Chopra and Peter Meindl, "Supply Chain Management-Strategy Planning and Operation", Pearson Education, 5th Indian Reprint, 2013.
2. Jananth Shah "Supply Chain Management – Text and Cases" Pearson Education, 2008.
3. Altekar Rahul V, "Supply Chain Management-Concept and Cases", Prentice Hall India, 2005.
4. Monczka et al., "Purchasing and Supply Chain Management", Thomson Learning, 2nd Edition, 2nd Reprint, 2002.

OUTCOMES:

- After taking up the course the student will be able to brighten his prospects of taking up a career on supply chain management.
- The student decision making capability specific to supply chain issues in an industry is improved.
- The student can plan a well defined execution of supply chain strategy in companies.
- The student will be able to design a optimal distribution network as per the demands of the industry.
- The student can also determine the most favorable transportation plan for a company.
- The student will also be able to bring in company from paper environment to paperless environment.

GECX211 SYSTEMS ANALYSIS AND DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To describe the phases of the systems development life cycle
2. To teach the automated tools for system development
3. To develop and evaluate system requirements.
4. To explain the organizational issues in system implementation
5. To teach the usability testing and electronic data interchange
6. To elucidate the importance of System analysis and design in electronic commerce.

MODULE I FUNDAMENTALS OF SYSTEM DEVELOPMENT 8

System Concept – Characteristics – Elements of System – Types of System – Modern Approach to System Analysis and Design – System Development Life Cycle – Approaches to Improving Development – Tools for System Development – Succeeding as a System Analyst – Skills – Managing the Project.

MODULE II AUTOMATED TOOLS FOR SYSTEMS DEVELOPMENT 7

What is requirements determination? Fact finding techniques, Tools for documenting procedure and decision-CASE Tools-Need for CASE tools-Reverse engineering and reengineering- phases of the software life cycle-Ranking projects-Value Chain Analysis- Corporate Strategic Planning vs. Information Systems Planning.

MODULE III SYSTEM ANALYSIS 8

Determining System Requirements – Traditional Methods - Modern Methods – Radical Methods – Structuring System Requirements – Process Modeling – Data Flow Diagramming – Logic Modeling – Conceptual Data Modeling – E-R Modeling.

MODULE IV SYSTEM DESIGN 8

System Implementation – Software Application Testing – Installation – Documentation – Training and Support – Organizational Issues in Systems Implementation – Maintaining Information System – Conducting System

Maintenance.

MODULE V USABILITY AND MEASURING USER SATISFACTION **7**

Usability Testing-User satisfaction test- A tool for analyzing user satisfaction – Unified Modeling Language(UML)- Case study: System Design: Application in Human Resource-Financial Applications

MODULE VI SAD IN E-COMMERCE **7**

Systems analysis and design in the era of electronic commerce: B2B, B2C and C2C e-commerce -advantages and disadvantages of e-commerce. E-commerce system architecture – physical networks, logical network, World Wide Web, web-services - HTML, XML - case studies-EI electronic data interchange: EDI standards - virtual private networks - XML and EDI

L – 45; Total Hours –45

REFERENCES:

1. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, “Modern Systems Analysis and Design”,Fifth Edition, Prentice Hall,March 2007.

2.Ned Kock, “Systems Analysis & Design Fundamentals” Sage South Asia, May 2008.

3. Joseph S. Valacich, Jeffrey A. Hoffer, Joey F. George, “Essentials Of System Analysis And Design” Prentice Hall , August 2005.

4. Rumbaugh et al, “Succeeding with Booch and Rambaugh Methods”, Addisson Wesley, second Edition, 1998.

5.Larman, C.,” Applying UML and Patterns. An introduction to Object-Oriented Analysis and Design”. Prentice-Hall PTR, 2002.

OUTCOMES:

1. List the characteristics of the system and specify the approaches in the development of the system.
2. Summarize the phases of the software life cycle
3. Differentiate Corporate Strategic Planning and Information Systems Planning.
4. Illustrate the system requirements through various modeling diagrams.
5. Use tools and techniques for process and data modeling.
6. Solve realistic systems analysis problems and perform user satisfaction test.

GECX212	ADVANCED MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To make the student conversant with

- Dielectric materials
- Magnetic materials
- Energy materials
- Nano materials
- Semi conductors
- Smart materials

MODULE I **8**

Dielectric Materials- Polarization and Mechanism-Internal or local field-Clausius-Mossotti relation- Dielectric loss- Temperature and Frequency effect-Measurement of Dielectric constant and loss using Scherring bridge- electric break down- ferro, piezo, pyroelectric materials and its application.

MODULE II **8**

Magnetic Materials- Terminology and classification of magnetic materials (Dia, Para, Ferro & Ferri) – Magnetic moments due to electrospin – Domain theory of Hysteresis – Heisenberg theory of Exchange Interaction (without derivation)-Structure and properties of Ferrites- Properties of Soft and Hard Magnetic Materials- Application: floppy disk, CD ROM, Magneto optical recording.

MODULE III **8**

Energy Materials (Nuclear) - Introduction to nuclear materials- Materials for nuclear fuel in fission and fusion reactors, Fissile and fertile materials- Control & Construction Materials for Nuclear reactors, Moderators, Heat Exchangers-Radiation proof materials- Brief discussion of safety and radioactive waste disposal.

MODULE IV **7**

Nano Materials- The nanosize range- classification of nanomaterials-processing of nanomaterials-properties of nanomaterials- mechanical, electrical, magnetic properties- other properties- carbon based nanomaterials- other nanomaterials and its application.

MODULE V **7**

Semiconductors- The energy gap in solids-Extrinsic Semiconductors- Intrinsic Semiconductors- Hall Effect in semiconductors- Application of Hall Effect- Basic ideas of compound semiconductors -Semiconductor materials- Fabrication of Integrated Circuits- Some semiconductor Devices

MODULE VI **7**

Smart materials- aerospace materials Ni and Co based super alloys, Special steels, Titanium alloys, Intermetallics, ceramics and their composites, New High strength material, Properties of Materials, Materials in Medical Applications, Stainless steel alloys,Cobalt based alloys, titanium based alloys, polymers

L – 45; Total Hours –45

REFERENCES:

- Materials science and Engineering: A first course by V. RAGHAVAN, 6th ed., Eastern Economy edition,Prentice Hall of India,2015
- Materials science and Engineering: An Introduction by William D. Callister Jr., 7th ed. John Wiley & Sons Inc. 2007
- Material science by Dr.M.Arumugam, Anurasha agencies ,third revised edition ,2002

OUTCOMES:

Students will be able to know

- significance of dielectric materials
- types and applications of magnetic materials
- applications of nuclear materials for energy harvesting
- applications of nano materials
- significance of semi conductor devices
- applications of smart materials

GECX213	NATIONAL SERVICE SCHEME	L	T	P	C
		2	0	0	2

OBJECTIVES:

Primary Objective: Personality development through community service.
To achieve the above objective, the following should be adhered:

1. To provide an understanding about the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
2. To develop certain basic skills for personality development through community development.
3. Understand the community in which they work and their relation
4. Identify the needs and problems of the community and involve them in problem-solving and
5. Practice national integration and social harmony.

MODULE I INTRODUCTION TO NSS 8

Orientation and structure of NSS,-Aims and Objectives of National Service Scheme- The history of NSS- Symbol and meaning- NSS hierarchy from national to college level – Role and responsibilities of various NSS functionaries

MODULE II PERSONALITY AND COMMUNITY DEVELOPMENT SKILLS 8

Importance of youth Leadership, Traits of Good Leadership and Personality Development. Role of youth in creating awareness through NSS Programmes on Health & Hygiene; Environmental Conservation and Enrichment for Sustainable Development; Sanitation and Swachh Bharat.

MODULE III UNDERSTANDING YOUTH 7

Definition and Profiles of youth categories, Youth Issues, Challenges and Opportunities for Youth, Youth as agent of social change & Community Mobilization .Role of Youth in Nation Building. National Youth Policy.

MODULE IV SOCIAL HARMONY AND NATIONAL INTEGRATION 7

National Integration, Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc. Role of youth in Peace

building and conflict resolution- Globalization and its Economic Social Political and Cultural impacts.

L – 30; Total Hours –30

TEXT BOOKS:

- National Service Scheme – A Youth Volunteers Programme for Under Graduate students as per UGC guidelines J.D.S.Panwar et al. Astral International. New Delhi.
- National Service Scheme Revised Manual, 2006.Govt. of India. Ministry of Youth Affairs & Sports. New Delhi.
- Social Problems in India, *Ram Ahuja.*

REFERENCES:

- National Youth Policy-2014. Ministry of Youth Affairs & Sports. .Govt. of India

OUTCOMES:

On successful completion of this course-

1. Students will have exposure to the the aims, structure and programmes and activities of National Service scheme in terms of Nation Building
2. Students will be trained to skills for personality development through community development.
3. Students will gain knowledge about national integration and social harmony.
4. Students will be exposed to the role of youths in Nation building Students will gain

GECX214	AUTOMOTIVE POLLUTION AND CONTROL	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To have a fair knowledge in automotive pollution control.
2. To understand the concept of formation and control techniques of pollutants like UBHC, CO, NOx, particulate matter and smoke for both SI and CI engine will be taught to the students.
3. To know about the instruments for measurement of pollutants
4. To get introduced about emission standards

MODULE I EMISSION FROM AUTOMOBILES 8

Sources of Air Pollution. Various emissions from Automobiles — Formation — Effects of ollutants on environment and human beings. Emission control techniques – Modification of fuel, after treatment devices. Emission standards. Automotive waste management, old vehicle disposal, recycling, tyre recycling

MODULE II SI ENGINE EMISSIONS AND CONTROL 9

Emission formation in SI Engines- Carbon monoxide & Carbon di oxide - Unburned hydrocarbon, NOx, Smoke —Effects of design and operating variables on emission formation – controlling of pollutants - Catalytic converters, Charcoal Canister, Positive Crank case ventilation system, Secondary air injection, thermal reactor

MODULE III CI ENGINE EMISSION AND CONTROL 8

Formation of White, Blue, and Black Smokes, NOx, soot, Effect of Operating variables on Emission formation — Fumigation, Split injection, Catalytic Coating, EGR, Particulate Traps, SCR, Fuel additives — Cetane number Effect.

MODULE IV NOISE POLLUTION FROM AUTOMOBILES 8

Sources of Noise — Engine Noise, Transmission Noise, vehicle structural Noise, aerodynamics noise, Exhaust Noise. Noise reduction in Automobiles — Encapsulation technique for noise reduction —Silencer Design.

MODULE V TEST PROCEDURES 6

Constant Volume Sampling I and 3 (CVSI &CVS3) Systems- Sampling Procedures — Chassis dynamometers - Seven mode and thirteen mode cycles for Emission Sampling.

MODULE VI EMISSION MEASUREMENTS 6

Emission analysers —NDIR, FID, Chemiluminesecent, Smoke meters, Dilution Tunnel, SHED Test, Sound level meters.

L – 45; Total Hours –45

TEXT BOOKS:

1. V.Ganesan, 'Internal combustion Engines', Tata McGraw Hill Book Co, Eighth Reprint, 2005.
2. Crouse and Anglin, 'Automotive Emission Control', McGraw Hill company., Newyork 1993.

REFERENCES:

- G.P.Springer ad D.J.Patterson, Engine Emissions, Pollutant formation, Plenum Press, New York. 1986.
- D.J.Patterson and N.A.Henin, 'Emission from Combustion Engine and their control', Anna Arbor Science Publication,1985.
- L.Lberanek, 'Noise Reduction', Mcgrawhill Company., Newyork1993.
- C.Duerson, 'Noise Abatment', Butterworths ltd., London1990.
- A.Alexander, J.P.Barde, C.lomure and F.J. Langdan, 'Road traffic noise', Applied science publisher ltd., London,1987.

OUTCOMES:

On completion of the course student should be able to

- Identify the sources of emission from vehicles.
- Analyse the causes and effects of emissions.
- Analyse causes and effects of noise pollution
- Bring out solutions for control of emissions.
- Demonstrate the test procedures and emission norms.
- Select suitable instruments for measurement of emissions.

GECX215	MOTOR VEHICLE ACT, INSURANCE & POLICY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about basic act and regulation followed for road vehicle
- To learn about systematic steps involved to get licence and registration of motor vehicle
- To learn arbour various types of motor vehicle polices and insurances

MODULE I BASIC RULES FOR ROAD VEHICLE 8

Display and Use of Number Plates- Attachment of number plates- Number plates in horizontal position- Removal of number plates on transfer- Hours prescribed for lighted lamps- Mounting of lamps and reflectors- Multiple beam headlamps- Daytime running lamps- Auxiliary driving lamps- Parking lamps- Brakes- Stopping distances- Emergency or parking brakes- Horn- Muffler- Mirrors- Inspection of motor vehicles- Standards of safety and repair

MODULE II LICENSING OF DRIVERS OF MOTOR VEHICLES 8

Necessity of driving licence- Age limit in connection with driving of motor vehicle-Responsibility of owners of motor vehicles-Restriction on the holding of driving licence-Grant of learner's licence-Grant of driving licence-Addition to driving licence- Renewal of driving licence-Revocation of driving licence on grounds of disease or disability-Driving licence to drive motor vehicle belonging to the central government- power of court to disqualify- suspension of driving licence in certain cases- suspension or cancellation of driving licence on convection- Endorsement.

MODULE III REGISTRATION OF MOTOR VEHICLE 7

Necessity for registration – Registration Where and how to be made- Special provision for registration of motor vehicle of diplomatic officers-Temporary registration- Production of vehicle at the time of registration- Refusal of registration- renewal of certificate of registration- effectiveness in India of registration- Change of residence or place of business-transfer of ownership- Suspension of registration – cancellation of registration suspended under section 53- certificate of fitness of transport vehicle-cancellation of registration.

MODULE IV INSURANCE OF MOTOR VEHICLE 8

Necessity for insurance against third party – Requirements of policies and limits of liability- - Duty of insurers to satisfy judgements and awards against person insured in respect of third party risks-Duty to give information as to insurance-Settlement between insurers and insured persons- transfer of certificate of insurance-production of certain certificates, licences and permit in certain cases-Special provisions as to compensation in case of hit and run motor accident – Types of motor polices

MODULE V CONTROL OF TRANSPORT VEHICLES 7

Power to State Government to control road transport- Transport authorities-General provision as to applications for permits- Application for stage carriage permit- Procedure of Regional Transport Authority in considering application for stage carriage permit- Scheme for renting of motor cabs- Application for private service vehicle permit- Procedure in applying for and granting permits- Duration and renewal of permits- Transfer of permit- Replacement of vehicles-Temporary permits

MODULE VI OFFENCES AND PUNISHMENT 7

Driving without holding an effective driving licence- Driving by an under-aged person (Minor driving vehicle)- Holding of a driving licence permitting it to be used by other person.- Driving a vehicle at an excessive speed- Driving or permitting to drive a vehicle carrying excess load- Driving dangerously / its Abetment Driving an uninsured vehicle

Rider and pillion rider failing to wear protective head gear (Helmet) -Violation of Mandatory Signs -.e-challan and spot challan

L – 45; Total Hours –45

TEXT BOOKS:

- The motor vehicle act 1988, Universal law publishing co.cpvt ltd. Newdelhi 2011
- A Commentary On The Motor Vehicles Act, 1988 by SUKHDEV AGGARWAL The Bright Law House, New Delhi

REFERENCES:

1. The Motor Vehicles Act, 1988 Along with Latest Case Law, Notifications & Table of Offences and Punishments Asia Law House; 15th edition (2014)
2. Assessment of Compensation in Accidents under Motor Vehicles Act by Karkara Delhi Law House (2013)

OUTCOMES:

On completion of the course students should be able to

- Explain the analysis of rules and regulations for road vehicles
- Analyze the procedure for getting driving license for vehicles at national and international level
- Analyze the procedure for registration of vehicles.
- Analyze the procedure for Insurance of vehicles and claims.
- Analyze the procedure for obtaining Government Permits and renewal
- Analyze the consequences of not following the rules and regulations

GECX216	PRINCIPLES OF COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

To introduce the analog and digital modulation techniques.
To elaborate the working of communication receivers in the presence of noise.
To give an overview of various communication systems.

MODULE I LINEAR MODULATION 8

Baseband signals, Amplitude Modulation – Modulation Index, Power Transmitted, Double Side Band and Single Side Band AM, AM Modulators and AM Receivers, AM Radio systems, Frequency Division Multiplexing.

MODULE II ANGLE MODULATION 8

Frequency Modulation and Phase Modulation, Frequency deviation and modulation index, Bandwidth of FM, FM Modulators and FM receivers, FM Radio and FM Stereo Systems

MODULE III SAMPLING AND PULSE MODULATION 7

Sampling, Nyquist's Sampling Theorem, Pulse Modulations - PAM, PPM and PWM, Time Division Multiplexing, Bandwidth of TDM systems.

MODULE IV DIGITAL COMMUNICATION 7

Digital baseband data, Digital Modulations – ASK, FSK, PSK and QPSK. Digital Communication Transmitters and Receivers.

MODULE V NOISE 8

Sources of Noise, Thermal Noise, shot noise, White noise, Narrow band Noise, Effect of noise in communication, SNR, Receiver Noise Temperature and Noise Equivalent Bandwidth.

MODULE VI COMMUNICATION SYSTEMS & NETWORK 7

FM Radio Systems, Cellular Mobile network, Satellite Communications, Optical Fiber Communication.

L – 45; T – 0; Total Hours – 45

TEXT BOOKS:

- A. Bruce Carlson, Paul B. Crilly, “Communication Systems”, 5th Edition, McGraw Hill Int., 2011.
- B.P. Lathi, Zhi Ding, Hari M. Gupta, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press, 2017.

REFERENCES:

- Herbert Taub, Donald L. Schilling, Goutam Saha, “Principles of Communication Systems” 4th Edition, McGraw Hill Int. 2013.
- Simon Haykin, “An Introduction To Analog And Digital Communications”, 1st Edition, Wiley India, 2010.
- Simon Haykin , “Communications Systems” 4th Edition, Wiley India, 2006.
- Hwei P. Hsu, “Analog and Digital Communications” 3rd Edition,

OUTCOMES:

On completion of the course students will be able to

1. Identify various communication systems and the corresponding modulation schemes.
2. Predict the characteristics of various analog and digital modulation schemes.
3. Interpret the effect of noise and bandwidth in a communication systems
4. Apply the Nyquist criteria for a given baseband signals.
5. Evaluate the performance of communication receivers.
6. Demonstrate the applications of common communication systems.

GECX217	LEAN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objective of the Course to make the student know about

the basics of lean production management,

how Lean principles are applied to the Construction industry to improve the operation management and product development.

MODULE I **8**

Lean production – Introduction, background, and lean thinking. Importance of philosophy, strategy, culture, alignment, focus and systems view. Discussion of Toyota Production System.

MODULE II **8**

Manufacturing systems – an overview of manufacturing strategies. Job shops, batch flow, and flexible manufacturing systems Flow production and lean production systems

MODULE III **7**

Value stream mapping in process design and product development Waste reduction - lead time reduction

Process cycle time and value-added vs. non-value added activities Optimum lot sizing

MODULE IV **8**

Lean production processes, approaches and techniques.—Importance of focusing upon flow. Tools -. Workplace organization – 5S. - Stability. - Just-In-Time – One piece flow – Pull. - . Cellular systems. - . Quick change and set-up reduction methods. f. Total productive maintenance. -. Poka-Yoke – mistake proofing, quality improvement. Standards. - . Leveling. - . Visual management. Just-in-time techniques – SMED and Takt Times - Standard work processes and line balancing Poka-yoke and pull systems material handling reduction and facilities planning

MODULE V **8**

Managing change in the lean organization Human resource management and the lean enterprise Employee involvement – Teams – Training – Supporting and encouraging involvement – Involving people in the change process -- communication -- Importance

of culture. Startup of lean processes and examples of applications. Sustaining improvement and change, auditing, follow-up actions.

7

MODULE VI

The lean enterprise and supply chain management Costs and risks of lean initiatives - Measuring lean initiatives

Total Hours –45

TEXT BOOKS:

1. The Toyota Way Field book, Jeffrey Liker and David Meier, McGraw-Hill, 2006. Lean Production Simplified, Pascal Dennis, Productivity Press, 2007.
2. Womack, James P., and Daniel T. Jones. Lean Thinking. New York, NY: Simon and Schuster, 2003. ISBN: 0743249275.
3. Murman, Earll. Lean Enterprise Value. New York, NY: Palgrave Macmillan, 2002. ISBN: 0333976975.

REFERENCES:

1. Readings at http://www.leanconstruction.org/readings.htm
2. Hopp, W. J., and Spearman, M. L. (2011). Factory Physics, Third Edition, Waveland Press, Long Grove, Il. 720 pp.

OUTCOMES:

The student will be able to

1. Describe the manufacturing approaches employed and the background and philosophy of lean production.
2. Illustrate the concept of waste reduction
3. Apply evaluation techniques that can be used in preparation for and use in learn production activities.
4. Select the tools that can be used implementing lean production in production operations.
5. Discuss the importance of workplace organization, pull production, cellular arrangement and employee involvement, need for employee creativity
6. Describe about the Methods for promoting success in implementing lean transformations

7.

GECX218	SPATIAL DATA MODELING & ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on the fundamental representation and analysis of geospatial phenomena and provides the various methods and algorithms used in GIS analysis.
- To focus in terrain modeling, geomorphometry, watershed analysis and introductory GIS-based modeling of landscape processes (water, sediment). The course includes analysis from lidar data, coastal change assessment and 3D visualization.

MODULE I INTRODUCTION TO GEOSPATIAL DATA 7

Mapping natural phenomena –Concept of continuous fields and discrete sampling – Units, projections, coordinate transformation – Georeferencing, geospatial formats, conversions, geospatial data abstraction library – Raster and vector representation, raster and vector conversions and resampling.

MODULE II DATA DISPLAY AND VISUALIZATION 7

Display of continuous and discrete data, use of color, shading, symbols, to extract the spatial pattern and relationships – 3D visualization: multiple surfaces and volumes, 3D vector objects – visualization for data analysis (lighting, scaling, transparency, cutting planes, animations) – view/create maps/post your data on-line (Google Earth/Maps, GPS visualizer)

MODULE III GEOSPATIAL ANALYSIS 7

Foundations for analysis of continuous and discrete phenomena – neighborhood operations and buffers – analysis and modeling with map algebra – cost surfaces and least cost path – spatial interpolation and approximation (gridding)

MODULE IV TERRAIN MODELING AND ANALYSIS 9

terrain and bathymetry mapping – mathematical and digital representations (point clouds, contour, raster, TIN) – DEM and DSM, working with multiple return lidar data – spatial interpolation of elevation data and topographic analysis, line of sight, view shed analysis – solar irradiation, photovoltaic energy potential, time series of elevation data, analysis of coastal change.

MODULE V FLOW TRACING, WATERSHED ANALYSIS AND 8

LANDFORMS

Methods for flow routing and flow accumulation – Extraction of stream networks – Extraction of watershed boundaries and building watershed hierarchies – feature extraction, types of landforms.

MODULE VI MODELING OF GEOSPATIAL PROCESSES 7

Model formulation, input data processing – introduction to GIS-based hydrologic, erosion and environmental modeling – Geocomputational methods, including agent-based modeling, artificial neural networks and evolutionary computing.

Total Hours –45

TEXT BOOKS:

1. Hassan A, Karimi (2017), Geospatial Data Science Techniques and Applications, CRS Press & Co.
2. Sudipto Banerjee, Bradley P, Carlin, Alan E. Gelfand (2014), Hierarchical Modeling and Analysis for Spatial Data, CRS Press & Co.

REFERENCES:

1. Maguire, D., M. Batty, and M. Goodchild. 2015. GIS, Spatial analysis, and modeling. ESRI Press (G70.212 .G584 2005)
2. Zeiler, M. 2010. Modeling Our World: The ESRI Guide to Geodatabase Design. Second Ed. ESRI Press, Redlands, California

OUTCOMES:

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

1. apply the basic concepts of Conceptualize models as representations of real life systems with inputs, outputs, and processes.
2. employ the spatial tools to make simulations and predictions of real life phenomena.
3. integrate and develop models with geospatial data through GIS.
4. evaluate models in terms of accuracy, sensitivity, and uncertainty.
5. perform a system-based approach for problem solving, with an emphasis on sustainability.
6. execute the hydrological, erosion and environmental modeling through GIS.