R.V.R. & J.C. COLLEGE OF ENGINEERING :: GUNTUR
(Autonomous)
REGULATIONS (R-18) FOR
Four Year BACHELOR OF TECHNOLOGY (B.Tech.) Degree Program

(w.e.f. the batch of candidates admitted into First Year B.Tech. from the academic year 2018-2019).

1 MINIMUM QUALIFICATIONS FOR ADMISSION

A candidate seeking admission into First Year of B.Tech. Degree Program should have passed either Intermediate examination conducted by the Board of Intermediate Education, Andhra Pradesh with Mathematics, Physics, and Chemistry as optional subjects (or any equivalent examination recognized by the Acharya Nagarjuna University) or A candidate seeking admission into Second Year of B.Tech. Degree Program should have passed either Diploma in Engineering in the relevant branch conducted by the State Board of Technical Education & Training of Andhra Pradesh (or equivalent Diploma recognized by Acharya Nagarjuna University).

The selection is based on the rank secured by the candidate at the EAMCET / ECET (FDH) examination conducted by A.P. State Council of Higher Education. The candidate shall also satisfy any other eligibility requirements stipulated by the University and / or the Government of Andhra Pradesh from time to time.

2 BRANCHES OF STUDY

The B.Tech. Course is offered in the following branches of study:

1. Computer Science & Business Systems
2. Chemical Engineering
3. Civil Engineering
4. Computer Science & Engineering
5. Electrical & Electronics Engineering
6. Electronics & Communication Engineering
7. Information Technology
8. Mechanical Engineering

3 DURATION OF THE COURSE AND MEDIUM OF INSTRUCTION

3.1 The duration of the course is Four academic years consisting of two semesters in each academic year. The medium of instruction and examination is English.

3.2 The duration of the course for the candidates (Diploma Holders) admitted under lateral entry into Second Year B.Tech. is Three academic years consisting of two semesters in each academic year. The medium of instruction and the examination is English.

4 MINIMUM INSTRUCTION DAYS

Each semester shall consist of a minimum number of 90 days of instruction excluding the days allotted for tests, examinations and preparation holidays.

5 REGISTERING THE COURSES

5.1 A candidate has to register and secure 160 credits which include laboratory courses and project work. However, the candidate admitted under lateral entry has to register and secure 122 credits, which includes laboratory courses and project work.

5.2 A candidate has to register and secure at least minimum pass grade in Mandatory Courses, for which no credits are awarded.

5.3 A candidate has to secure at least minimum pass grade in Value Added Courses offered by the individual departments, for which no credits are awarded.

5.4 MOOCS (Massive Open Online Course):

- Enrolment of MOOCs courses of 12 weeks duration (421-Professional Elective & 422-Open Elective) will be initiated from the date of commencement of class work for Semester VI [Third Year] from the list of organisations offering MOOCS course(s) announced by the respective Board of Studies / Head of Departments and courses completion certificate must be submitted on or before the last instruction day of Semester VIII [Fourth Year].

- However, a student can register and complete more no.of MOOCs course(s) of his/her interest and must submit the completion certificate(s) on or before the last instruction day of Semester VII [Fourth Year], which will be reflected in the consolidated grade sheet.

5.5 Internship / Industrial Training (6 to 8 weeks in two spells) :

- Enrollment of Internship / Industrial Training will be initiated at the end of Semester IV [Second Year] and Semester VI [Third Year].

- Internship / Industrial Training completion certificate(s) must be submitted on or before the last instruction day of Semester VII [Fourth Year].

6 EVALUATION

The performance of the candidates in each semester shall be evaluated Course wise.

6.1 The distribution of marks between Sessional Examination (based on internal assessment) and Semester End Examination is as follows:

Nature of the Courses	Sessional Marks	Semester End Exam. Marks
Theory Courses / Design and / or Drawing / Practicals	40	60
Mini Project / Term paper / Mandatory Course / Value Added Course	100	---
Project work	40	60 (Viva voce)

6.2 In each of the Semesters, there shall be two Mid Term examinations and two Assignment Tests in every theory course. The Sessional marks for the midterm examinations shall be awarded giving a weightage of 15 marks out of 18 marks (80% approx.) to that midterm examination in which the candidate scores more marks and the remaining 3 marks (20% approx.) for other midterm examination in which the candidate scores less marks. Similarly a weightage of 10 marks (80% approx.) out of 12 marks earmarked for assignment tests shall be given for the assignment in which the candidate scores more marks and remaining 2 marks (20% approx.) shall be given for the assignment test in which the candidate scores less marks.

A maximum of five marks are allotted for attendance in the respective theory courses in a graded manner as indicated in *clause 8.2.* The remaining 5 marks out of the 40 marks earmarked for the sessional marks are awarded (quiz / online examination) by the concerned teacher in the respective theory courses.

6.3 The evaluation for Laboratory class work consists of a weightage of 25 marks for day to day laboratory work including record work and 15 marks for internal laboratory examination including Viva-voce examination.

In case of Project work, the sessional marks shall be awarded based on the day-to-day progress, the performance in two Seminars and the Project Report submitted at the end of the semester. The allotment of sessional marks for Seminars and day-to-day work shall be 15 and 25 respectively.

NOTE : A candidate who is absent for any Assignment / Mid Term Exam, for any reason whatsoever, shall be deemed to have scored zero marks in that Test / Exam and no make-up test / Exam shall be conducted.

6.4 A candidate who could not secure a minimum of 50% aggregate sessional marks is not eligible to appear for the Semester End Examination and shall have to repeat that Semester.

7 LABORATORY / PRACTICAL COURSES

In any semester, a minimum of 10 experiments / exercises specified in the syllabus for laboratory course shall be completed by the candidate and get the record certified by the concerned faculty and Head of the Department, to be eligible to face the Semester End Examination in that Practical course.

8 ATTENDANCE REGULATIONS

8.1 Regular course of study means a minimum average attendance of 75% in all the courses computed by totalling the number of hours / periods of lectures, design and / or drawing, practical's and project work as the case may be, held in every course as the denominator and the total number of hours / periods actually attended by the candidate in all the courses, as the numerator.

8.2 A weightage in sessional marks up to a maximum of 5 marks out of 40 marks in each theory course shall be given for those candidates who put in a minimum of 75% attendance in the respective theory in a graded manner as indicated below:

Attendance of 75% and above but less than 80%	- 2 mark
Attendance of 80% and above but less than 85%	- 3 marks
Attendance of 85% and above but less than 90%	- 4 marks
Attendance of 90% and above	- 5 marks

8.3 Condonation of shortage in attendance may be recommended on genuine medical grounds, up to a maximum of 10% provided the candidate puts in at least 65% attendance as calculated in *clause 8.1*, provided the Principal is satisfied with the genuineness of the reasons and the conduct of the candidate. However, marks will not be awarded for condonation of shortage in attendance.

8.4 A candidate who could not satisfy the minimum attendance requirements in any semester as mentioned in *clause 8.1*, is not eligible to appear for the Semester End Examinations and shall have to repeat the same Semester.

9 DETENTION

A candidate, who fails to satisfy either the minimum attendance requirements as stipulated in *Clause-8*, or the requirement of minimum aggregate sessional marks as stipulated in *Clause-6*, shall be detained. Such candidate shall have to repeat the same semester.

10 SEMESTER END EXAMINATION

10.1 For each theory course, there shall be a comprehensive Semester End Examination at the end of each Semester.

10.2 For each Practical course the Smester End Examination shall be conducted by one internal and one external examiner appointed by the Principal of the College, the duration being that approved in the detailed Schemes of Instruction & Examination.

10.3 Viva-voce Examination in Project Work shall be conducted by one internal examiner and one external examiner appointed by the Principal.

11 CONDITIONS FOR PASS

A candidate shall be declared to have passed in individual course if he / she secures a minimum of 35% marks in theory and 50% marks in Practical courses/drawing courses/Project Viva-voce in Semester End Examination and minimum of 40% marks in both Sessional & Semester End Examination put together.

12 AWARD OF CREDITS

12.1 Credits are awarded for each Theory Course / Practical Course and Project Work.

12.2 AWARD OF GRADES

S.No.	Range of Marks	Grade	Grade Points
1	90	O	10.0
2	80 - < 90	A^+	9.0
3	70 - < 80	A	8.0
4	60 - < 70	B^+	7.0
5	50 - < 60	B	6.0
6	40 - < 50	C	5.0
7	< 40	F	0.0
8	The grade 'W' represents withdrawal / absent	W	0.0

12.3 A candidate securing 'F' grade in any course there by securing zero grade points has to reappear and secure at least 'E' grade in the subsequent examinations for that course.

12.4 A candidate who has earned 'F' grade in any course can repeat the course and can improve the internal marks by re-registering a maximum of TWO Subjects per semester. However, a student, who is not on rolls due to detention (not promoted to the next semester), can register a maximum of SIX subjects comprising of all semesters, put together.

12.5 After each semester, Grade sheet will be issued which will contain the following details:

- The list of courses for each semester and corresponding credits and grades obtained

- The Semester Grade Point Average (SGPA) for each semester and

- The Cumulative Grade Point Average (CGPA) of all courses put together up to that semester.

SGPA is calculated based on the following formula: $\dfrac{[\text{ No. of Credits X Grade Points }]}{\text{No. of Credits}}$

CGPA will be calculated in a similar manner, considering all the courses up to that semester.

12.6 A consolidated Grade Sheet shall be issued to the candidate, after completing all , indicating the CGPA of all the Four / Three years put together.

12.7 Conversion of CGPA into equivalent Percentage.: Percentage of Marks = 9.25 x CGPA

13 CONDITIONS FOR PROMOTION

13.1 A candidate shall be eligible for promotion to next semester, if he/she satisfies the minimum requirements of attendance and sessional marks as stipulated in *Clauses 6 and 8*.

13.2 A candidate shall be eligible for promotion to Third Year, if he / she secures 26 credits (70% approx.) of the total number of credits (38) of First Year by the time the classwork commences for Third Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in *Clauses 6 and 8* in Semester IV [Second Year].

13.3 A candidate shall be eligible for promotion to Fourth Year, if he / she secures a minimum of 70% of the total number of credits of First & Second Years put together, by the time the classwork commences for Fourth Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in *Clauses 6 and 8* in Semester VI [Third Year].

S. No.	Branch	Total No. of Credits First & Second Years put together	Minimum No. of Credits required for promotion (70% approximately)
1	Computer Science & Business Systems	38+40 = 78	54
2	Chemical Engineering	38+40 = 78	54
3	Civil Engineering	38+46 = 84	58
4	Computer Science & Engineering	38+44 = 82	57
5	Electrical & Electronics Engineering	38+45 = 83	58
6	Electronics & Communication Engineering	38+45 = 83	58
7	Information Technology	38+44 = 82	57
8	Mechanical Engineering	38+44 = 82	57

13.4 A candidate (Diploma Holder) admitted under lateral entry into Second Year, shall be eligible for promotion to Fourth Year, if he/she secures a minimum of 70% of the total number of credits of Second Year by the time the classwork commences for Fourth Year, in addition to satisfying the minimum requirements of attendance and sessional marks stipulated in *Clauses 6 and 8* in Semester VI [Third Year]

S. No.	Branch	Total No. of Credits in Second Year	Minimum No. of Credits required for promotion (70% approximately)
1	Computer Science & Business Systems	40	28
2	Chemical Engineering	40	28
3	Civil Engineering	46	32
4	Computer Science & Engineering	44	30
5	Electrical & Electronics Engineering	45	31
6	Electronics & Communication Engineering	45	31
7	Information Technology	44	30
8	Mechanical Engineering	44	30

14 ELIGIBILITY FOR AWARD OF B.TECH. DEGREE

The B.Tech. Degree shall be conferred on a candidate who has satisfied the following requirements:

14.1   The candidate must have satisfied the conditions for pass in all the courses of all the years as stipulated in *Clauses 11*.

14.2   **Maximum Time Limit for completion of B.Tech Degree**

A candidate, who fails to fulfil all the academic requirements for the award of the degree within eight academic years from the year of admission, shall forfeit his/her seat in B.Tech. course.

14.3   A candidate (Diploma Holder) admitted under lateral entry into Second Year B.Tech., who fails to fulfil all the academic requirements for the award of the degree within six academic years from the year of admission, shall forfeit his/her seat in B.Tech. course.

15 AWARD OF CLASS

A candidate who becomes eligible for the award of B.Tech. Degree as stipulated in *Clause 12* shall be placed in one of the following Classes.

S.No.	Class	CGPA
1	First Class With Distinction	8.0 or more
2	First Class	6.5 or more but less than 8.0
3	Second Class	5.5 or more but less than 6.5
4	Third Class	5.0 or more but less than 5.5

16 IMPROVEMENT OF CLASS

A candidate, after becoming eligible for the award of the Degree, may improve the CGPA by appearing for the Semester End Examination in any of the theory course as and when conducted. But this provision shall be within a period of two academic years after becoming eligible for the award of the Degree. However, this facility cannot be availed by a candidate who has taken the Original Degree Certificate.

17 AWARD OF RANK

The rank shall be awarded based on the following:

17.1   Ranks shall be awarded in each branch of study for the top five percent of the candidates appearing for the Regular Semester End Examinations or the top ten candidates whichever is minimum.

17.2   Only such candidates who pass the Final year examination at the end of the fourth/third academic year after admission as regular final year candidate along with others in their batch and become eligible for the award of the degree shall be eligible for the award of rank. The Rank will be awarded only to those candidates who complete their degree within four/three academic years.

17.3   For the purpose of awarding rank in each branch, only such candidates who passed all courses in the first attempt only shall be considered.

18 SUPPLEMENTARY EXAMINATIONS

18.1 In addition to the Regular semester end examinations held at the end of each semester, supplementary examinations will also be conducted during the academic year. Such candidates taking the Regular / Supplementary examinations as supplementary candidates may have to take more than one examination per day.

18.2 Instant examination will be conducted immediately after the declaration of Semester VIII [Fourth Year] results for those candidates who cleared all courses except one course in Semester VIII [Fourth Year].

19 TRANSITORY REGULATIONS

A Candidate, who is detained or discontinued in the semester, on readmission shall be required to do all the courses in the curriculum prescribed for such batch of candidates in which the candidates joins subsequently.

19.1 A candidate, studied under R-16 regulations of RVR & JCCE (Autonomous) curriculum, detained due to lack of academics/attendance at the end of the Semester II [First Year] or Semester III [Second Year], shall join in appropriate Semester of R-18 regulations. The candidate has to clear all the backlog subjects or equivalent subjects if any under R-18 curriculum by appearing the supplementary examinations, conducted by the college under R-18 curriculum. The class will be awarded based on the academic performance of the candidate as R-18 regulations.

19.2 A candidate, studied under R-16 regulations of RVR & JCCE (Autonomous) curriculum, detained due to lack of academics / attendance at the end of the Semester IV [Second Year] and also at the subsequent semesters will follow the same R-16 regulations/curriculum and he/she has to complete all the courses by appearing in the examination conducted by the college under R-16 curriculum. The class will be awarded based on the academic performance of the candidate as per R-16 regulations.

19.3 A candidate, transferred from other institutions / universities into Semester II [Second Year] and also at the subsequent semesters of B.Tech., shall join at appropriate semester of R-18 curriculum. Such candidate shall study all the courses prescribed for that batch, in which, the candidate joins. The candidate has to clear the backlog courses, if any, in the semesters which he/she has studied in the earlier institutions / universities by appearing the supplementary examinations conducted by the college in R-18 circulum courses / equivalent courses. The equivalent courses will be decided by concerned Board of Studies.

20 CONDUCT AND DISCIPLINE

20.1 Candidates shall conduct themselves within and outside the premises of the institute in a manner befitting the candidates of our institution.

20.2 As per the order of Honourable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.

20.3 The following acts of omission and / or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.

   a Lack of courtesy and decorum, indecent behaviour anywhere within or outside the campus.

   b Wilful damage of college / individual property

   c Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.

    d Mutilation or unauthorized possession of library books.

    e Noisy and unseemly behaviour, disturbing studies of fellow candidates.

    f Hacking of computer systems (such as entering into other person's areas without prior permission, manipulation and / or damage of computer hardware and software or any other cyber-crime etc.)

    g Usage of camera / cell phone in the campus

    h Plagiarism of any nature

    i Any other acts of gross indiscipline as decided by the academic council from time to time.

20.4   Commensurate with the gravity of offense, the punishment may be reprimand, fine, expulsion from the institute / hostel, debar from examination, disallowing the use of certain facilities of the institute, rustication for a specified period or even outright expulsion from the institute or even handing over the case to appropriate law enforcement or the judiciary, as required by the circumstances.

20.5   For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the chief warden, the head of the department and the principal respectively, shall have the authority to reprimand or impose fine.

20.6   Cases of adoption of unfair means and / or any malpractice in an examination shall be reported to the principal for taking appropriate action.

20.7   All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the academic council.

20.8   The institute level standing disciplinary action committee constituted by the academic council shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.

20.9   The principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the programmes committee in an appropriate manner, and subsequently such actions shall be placed before the academic council for ratification. Any emergency modification of regulation, approved by the appropriate authority, shall be reported to the academic council for ratification.

20.10 "Grievance and Redressal Committee" (General) constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters.

21 MALPRACTICES

21.1   The Principal shall refer the cases of malpractices in internal assessment tests and semester-end examinations to a malpractice enquiry committee constituted by him / her for the purpose. Such committee shall follow the approved scales of punishment. The principal shall take necessary action, against the erring candidates basing on the recommendations of the committee.

21.2   Any action on the part of a candidate during an examination trying to get undue advantage or trying to help another, or drive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the staff, who are in-charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all

concerned in the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

22 AMENDMENTS TO REGULATIONS

The College may, from time to time, revise, amend, or change the Regulations, Schemes of Examinations, and / or Syllabus.

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DEPARTMENT OF CIVIL ENGINEERING

VISION

To develop the department into a centre of excellence in Civil Engineering education.

MISSION

1. To train the students in Civil Engineering possessing Scientific and Technological Knowledge.
2. To impart Managerial and Communication Skills to the students
3. To inculcate Ethical and Environmental Values in the students

PROFILE

The Department was established in 1985. It started an U.G. course in Civil Engineering in the same year. This course had been accredited by N.B.A. and awarded 'A' Grade for three years in May, 1999, 'A' Grade for five years in May, 2002 and 'A' Grade for five years in September, 2007. The Department was well established and running successfully with an intake of 180 Students.

Civil Engineering is a challenging discipline. It encompasses all important aspects of Modern Technology. In Buildings, Airports, Railways, Irrigation Projects and Civil Engineers have been playing a leading role.

Development of STADD, STRAP, AutoCAD packages, Civil Desktop, PRIME VEERA, ANSYS and Auto Civil etc., revolutionized the way Civil Engineers tackle the problems. Design and Analysis of Modern Multi Stored Structures meeting the Architectural challenges is the order of the day for budding Civil Engineers. In the early days of the profession, most of the work of Civil Engineers consisted of Design & Construction. Now Civil Engineers need to know a lot of Principles from other disciplines of Engineering to stay ahead and keep the resources conservatively. Guest Lectures and Field visits are arranged for practical experience.

The Department has well established laboratories and students learn the concepts through Experienced and well trained Faculty. Several computing environments are available for their study and use computers is also an added advantage for problem solving in many Civil Engineering courses. As science and Engineering are rapidly changing and advancing, the courses offered by the Department take care of the needs of Prospective Civil Engineers. Civil Engineering curriculum covers the following areas:

*   Concrete Structures Design
*   Steel Structures Design
*   Hydraulics and Irrigation
*   Surveying
*   Building Materials
*   Environmental Engineering

The Department has 5 Professors all with Doctorate, 2 Associate Professors and 27 Assistant Professors. The entire faculty has Post- Graduate Degree in Civil Engineering with various specializations to provide in-depth Theoretical and Practical knowledge in all disciplines. All the faculty are research oriented and four of them are going to submit the thesis for Ph.D. Two staff members are in an advanced stage of research for their Ph.D. The doctorate holders of the department are acting as research supervises under Acharya Nagrajuna University, JNTUK...Etc. and guiding many scholars. The faculty are also the members of various professional societies at national and international level.

All the staff are passionate and dedicated towards teaching and have the welfare and prospect of the students as their main interest. Many of the staff have produced 100% result in the subjects taught by them for the last few years. The general feedback from the students on the Faculty is very good.

The Department regularly organizes various faculty development programs to update the knowledge of faculty. Most of the faculty development programs got financial support from AICTE and UGC. Our management is also give support to enrich the knowledge and to get familiar with the latest advancements. Department is having highly skilled and motivated Technicians. They have done innovative projects. Our Technicians always lend a helping hand to the final year students of all Branches in fabricating and completing their project works.

The department is having 8 well equipped laboratories and they are garnering consultancy fees over 20 lakhs annually.

A total of Rs. 30 Lakhs have been received by the department for research activities, upgradation of various laboratories and computer systems from funding agencies like AICTE and UGC.

The Department is even doing well in placements. Almost 90% eligible students got placed into Core as well as Software companies. The major recruiters are TCS, CTS, INFOSYS, BSEPL, L&T, NCC and many more. The department organizes many training programs for the benefit of students to improve the skills and knowledge.

The Department library has 750 Text Books, 50 Video Cassettes, 28 Journals, NPTEL video Lectures and 400 Project Work Reports in its stock. It caters to the needs of students for good text books and reference books in various subjects.

Every student of Civil Engineering will become a member of RVR & JC Civil Engineering Association (RAJCEA). It conducts Technical Seminars, Quizzes and Group Discussions by various students and arranges Guest Lectures by eminent persons from Industry and Academic Institutions. Short and Long Industrial Study Tours are arranged frequently to improve the knowledge base of the students.

The Department has been appreciated and adored by all the stakeholders for the successful implementation of policies. The feedback was taken at regular intervals and necessary actions were implemented for the benefit of the Department. Regular counseling and advice is also given to the students to improve their learning, ability and overall performance apart from guiding in their career.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To provide basic scientific training to the students so as to solve Civil Engineering problems with scientific outlook.

PEO2: To provide training in basic engineering sciences so that students apply the concepts of basic engineering sciences to the solution of Civil Engineering problems.

PEO3: To train the students in the broad areas of Civil Engineering and interdisciplinary areas.

PEO4: To mould the students professionally competent with managerial/communication skills and possessing ethical values.

PEO5: To make the students aware of the impact of Civil Engineering activities on the environment and contribute towards sustainable development.

PROGRAM OUTCOMES (POs)

PO1: **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: **Design/development of solutions:** 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, and environmental considerations.

PO4: **Conduct investigations of complex problems**: 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.

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

PO6: **The engineer and society**: 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.

PO7: **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **Communication**: 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.

PO11: **Project management and finance**: 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.

PO12: **Life• long learning:**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 (PSOs)

PSO1: Able to apply principles of Civil Engineering to solve problems of society and contribute towards sustainable development

PSO2: Able to plan, design and execute various infrastructure projects related to civil engineering

Scheme, Structure & Evaluation for R-18 Regulations
[w.e.f. AY 2018-19]

CIVIL ENGINEERING
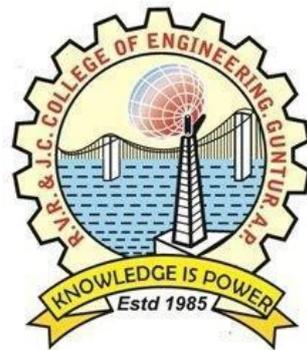
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DEPARTMENT OF CIVIL ENGINEERING

B.TECH. CIVIL ENGINEERING

Program curriculum grouping based on course components

Course Component	Curriculum Content (% of total number of credits program)	Total number of contact hours	Total number of credits
Basic Sciences (BS)	15	27	24
Engineering Sciences (ES)	15	32	24
Humanities and Social Sciences (HS)	2.5	8	4
Professional Core (PC)	45.63	85	74
Professional Electives (PE)	9.38	12	15
Open Electives (OE)	7.5	9	12
Project(s) (PR)	5	16	7
Mandatory Course(s) (MC)	--	4	--
Total number of Credits			160

Basic Sciences(BS)(15.00%) Engineering Sciences(ES)(15.00%) Humanities and Social Sciences(HS)(2.50%) Program Core (PC)(45.62%) Program Electives(PE)(9.38%) Open Electives(OE)(7.50%) Humanities Electives(OE)(0.00%) Project(s)(PR)(5.00%)
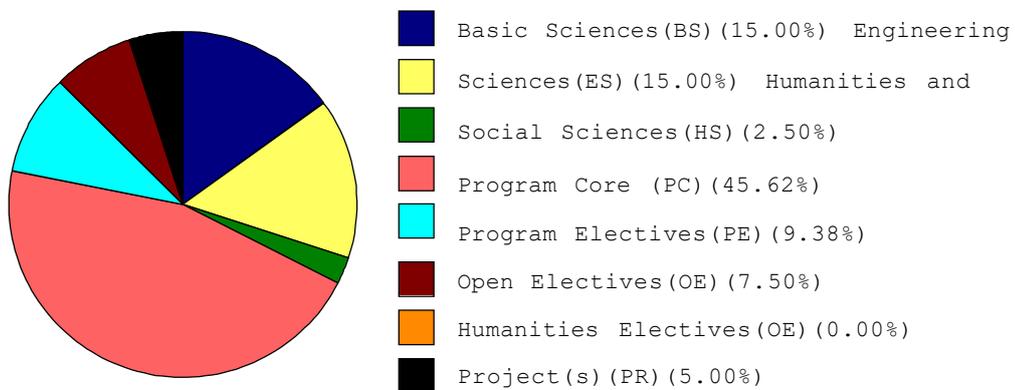
B.TECH. CIVIL ENGINEERING

(w.e.f. the batch of students admitted from the academic year 2018-2019)

Three Weeks Orientation Programme is Mandatory before starting Semester I [First Year]

B.Tech. Semester I [First Year]　　　　　COURSE STRUCTURE

SNo.	Code No.	Subject Name	L	T	P	SES	EXT	Credits	Category Code
		Course Details	**Scheme of Instruction** Periods per week			**Scheme of Examination** Maximum Marks			**Category** Code
1	CE/EC/ME111	Mathematics-I	3	1	-	40	60	4	BS
2	CE112	Engineering Physics	3	1	-	40	60	4	BS
3	CE/CH/EE/ME113	English for Communication Skills	2	-	-	40	60	2	HS
4	CE151	Physics Lab	-	-	3	40	60	1.5	BS
5	CE/CH/EE/ME152	English Language Communication Skills Lab	-	-	2	40	60	1	HS
6	CE/EE/ME153	Workshop Practice Lab	1	-	4	40	60	3	ES
		TOTAL	9	2	9	240	360	15.5	TPW-20

B.Tech. Semester II [First Year]　　　　　COURSE STRUCTURE

SNo.	Code No.	Subject Name	L	T	P	SES	EXT	Credits	Category Code
		Course Details	**Scheme of Instruction** Periods per week			**Scheme of Examination** Maximum Marks			**Category** Code
1	CE/EC/ME121	Mathematics-II	3	1	-	40	60	4	BS
2	CE/CS/IT122	Engineering Chemistry	3	1	-	40	60	4	BS
3	CE/CH/CS/EE/EC/IT/ME123	Programing for Problem Solving	3	-	-	40	60	3	ES
4	CE124	Basic Mechanical Engineering	2	-	-	40	60	3	ES
5	CE125	Engineering Mechanics	3	-	-	40	60	3	ES
6	CE/CS/IT161	Chemistry Lab	-	-	3	40	60	1.5	BS
7	CE/CH/CS/EE/EC/IT/ME162	Programing for Problem Solving Lab	-	-	4	40	60	2	ES
8	CE/EE/ME163	Engineering Graphics & Design Lab	1	-	4	40	60	3	ES
		TOTAL	15	2	11	320	480	23.5	TPW-28

B.Tech. Semester III [Second Year]　　　　　COURSE STRUCTURE

SNo.	Code No.	Subject Name	L	T	P	SES	EXT	Credits	Category Code
		Course Details	**Scheme of Instruction** Periods per week			**Scheme of Examination** Maximum Marks			**Category** Code
1	CE211	Surveying	3	1	-	40	60	4	ES
2	CE212	Solid Mechanics-I	3	1	-	40	60	4	PC
3	CE213	Fluid Mechanics	3	1	-	40	60	4	PC
4	CE214	Engineering Geology	3	-	-	40	60	3	PC
5	CE215	Building Materials and Construction	4	-	-	40	60	3	PC
6	CE251	Strength of Materials Laboratory	-	-	2	40	60	1	PC
7	CE252	Engineering Geology Laboratory	-	-	2	40	60	1	PC
8	CE253	Computer Aided Civil Engineering Drawing Laboratory	-	-	2	40	60	1	PC
9	CE254	Communicative English Lab	-	-	2	40	60	1	HS
10	MC001	Constitution of India	2	-	-	100	-	-	HS
		TOTAL	18	3	8	460	540	22	TPW-29

B.Tech. Semester IV [Second Year]   COURSE STRUCTURE

SNo.	Code No.	Course Details Subject Name	Scheme of Instruction Periods per week L	T	P	Scheme of Examination Maximum Marks SES	EXT	Credits	Category Code
1	CE221	Mathematics-III	3	-	-	40	60	3	BS
2	CE222	Life Science for Engineers	2	-	-	40	60	2	BS
3	CE223	Basic Electrical Engineering	2	-	-	40	60	2	ES
4	CE224	Solid Mechanics-II	3	-	-	40	60	3	PC
5	CE225	Concrete Technology	3	-	-	40	60	3	PC
6	CE226	Open Elective-I	3	-	-	40	60	3	OE
7	CE227	Hydraulics And Hydraulic Machines	3	-	-	40	60	3	PC
8	CE261	Basic Electrical Engineering Lab	-	-	2	40	60	1	ES
9	CE262	Concrete Technology Lab	-	-	2	40	60	1	PC
10	CE263	Fluid Mechanics Laboratory	-	-	2	40	60	1	PC
11	CE264	Surveying fieldwork	-	-	2	40	60	1	ES
		TOTAL	19	0	8	440	660	23	TPW-27

B.Tech. Semester V [Third Year]   COURSE STRUCTURE

SNo.	Code No.	Course Details Subject Name	Scheme of Instruction Periods per week L	T	P	Scheme of Examination Maximum Marks SES	EXT	Credits	Category Code
1	CE311	Structural Analysis	2	1	-	40	60	3	PC
2	CE312	Soil Mechanics	3	-	-	40	60	3	PC
3	CE313	Hydrology & Irrigation Engineering	2	1	-	40	60	3	PC
4	CE314	Environmental Engineering	3	-	-	40	60	3	PC
5	CE315	Design of Steel Structural Elements	2	1	-	40	60	3	PC
6	CE316	Design of RC Structural Elements	3	-	-	40	60	3	PC
7	MC003	Essence of Indian Traditional Knowledge	2	-	-	100	-	-	MC
8	MC004	Design thinking and Product Innovation	2	-	-	100	-	-	MC
9	CE351	Soil Mechanics Lab	-	-	2	40	60	1	PC
10	CE352	Environmental Engineering Lab	-	-	2	40	60	1	PC
		TOTAL	19	3	4	520	480	20	TPW-26

B.Tech. Semester VI [Third Year]   COURSE STRUCTURE

SNo.	Code No.	Course Details Subject Name	Scheme of Instruction Periods per week L	T	P	Scheme of Examination Maximum Marks SES	EXT	Credits	Category Code
1	CE321	Highway Engineering	3	-	-	40	60	3	PC
2	CE322	Foundation Engineering	3	-	-	40	60	3	PC
3	CE323	Irrigation Structures	3	-	-	40	60	3	PC
4	CE324	Waste Water Engineering	3	-	-	40	60	3	PC
5	CE325	Design of Steel Structures	3	-	-	40	60	3	PC
6	CE326	Open Elective-II	3	-	-	40	60	3	OE
7	CE327	Professional Elective-I	3	-	-	40	60	3	PE
8	CE361	Highway Engineering Lab	-	-	2	40	60	1	PC
9	CE362	Computer programming in Civil Engineering	-	-	2	40	60	1	PC
10	CE363	Computer Aided Design and Detailing Lab	-	-	2	40	60	1	PC
		TOTAL	21	0	6	400	600	24	TPW-27

B.Tech. Semester VII [Fourth Year]   COURSE STRUCTURE

SNo.	Code No.	Subject Name	L	T	P	SES	EXT	Credits	Category Code
		Course Details	**Scheme of Instruction**			**Scheme of Examination**			**Category**
			Periods per week			**Maximum Marks**		**Credits**	**Code**
1	CE411	Construction Management	3	-	-	40	60	3	PC
2	CE412	Estimation and Costing	3	-	-	40	60	3	PC
3	CE413	Professional Elective-II	3	-	-	40	60	3	PE
4	CE414	Professional Elective-III	3	-	-	40	60	3	PE
5	CE415	Professional Elective-IV	3	-	-	40	60	3	PE
6	CE416	Open Elective-III	3	-	-	40	60	3	OE
7	CE451	Qunantity Estimation & Project Management	-	-	2	40	60	1	PC
8	CE452	Project Stage-I	-	-	4	100	-	1	PR
9	CE453	Internship	-	-	4	100	-	2	PR
		TOTAL	18	0	12	480	420	22	TPW-26

B.Tech. Semester VIII [Fourth Year]   COURSE STRUCTURE

SNo.	Code No.	Subject Name	L	T	P	SES	EXT	Credits	Category Code
		Course Details	**Scheme of Instruction**			**Scheme of Examination**			**Category**
			Periods per week			**Maximum Marks**		**Credits**	**Code**
1	CE421	Professional Elective-V (MOOCs)	-	-	-	-	100	3	PE
2	CE422	Open Elective-IV (MOOCs)	-	-	-	-	100	3	OE
3	CE 461	Project Stage-II	-	-	10	40	60	4	PR
		TOTAL	0	0	10	40	260	10	TPW-10

Professional Elective - I

Code No.	Subject Name	Code No.	Subject Name
CEEL1A	Design of Reinforced Concrete Structures	CEEL1B	Repair and rehabilitation of Structures
CEEL1C	Pavement Materials	CEEL1D	Earth Retaining Structures

Professional Elective - II

Code No.	Subject Name	Code No.	Subject Name
CEEL2A	Advanced Structural Analysis	CEEL2B	Solid and Hazardous Waste Management
CEEL2C	Surface Hydrology	CEEL2D	Finite Element Method

Professional Elective - III

Code No.	Subject Name	Code No.	Subject Name
CEEL3A	Railway, Airport & Harbor Engineering	CEEL3B	Bridge Engineering
CEEL3C	Environment Impact Assessment	CEEL3D	Ground Improvement Techniques

Professional Elective - IV

Code No.	Subject Name	Code No.	Subject Name
CEEL4A	Pre-stressed Concrete	CEEL4B	Earthquake Resistant Design of Structures
CEEL4C	Advanced Environmental Engineering	CEEL4D	Remote Sensing and GIS

Value Added Courses

Code No.	Subject Name	Code No.	Subject Name
CEV01	English Competency Development Programme	CEV02	Professional Ethics

Open Elective Courses

Code No.	Subject Name	Code No.	Subject Name
CHOL01	Energy Engineering	CHOL02	Biofuels
CHOL03	Environmental Engineering	CHOL04	Nanoscience and Nanotechnology
CSOL01	Programming with Java	CSOL02	Relational Database Management Systems
CSOL03	Introduction to Python Programming	CSOL04	Internet of Things
ECOL01	Applied Electronics	ECOL02	Basic Communication
ECOL03	Basic Electronics & Communication Engineering	ECOL04	Microprocessors & Interfacing
ECOL05	Digital Image Processing	EEOL01	Renewable Energy Sources
EEOL02	Utilization of Electrical Energy	EEOL03	Power Converters
EEOL04	Energy Conservation	EEOL05	Electric Vehicles
ITOL01	Data Structures & Algorithms	ITOL02	Operating Systems
ITOL03	Big Data Analytics	ITOL04	Web Technologies
MEOL01	Automotive Engineering	MEOL02	Robotic Engineering
MEOL03	Introduction to Operations Research	MEOL04	Mechatronics
MEOL05	Applied Mechanics & Mechanical Engineering		

CE/EC/ME 111   **MATHEMATICS-I**   **L T P C Int Ext**

(Calculus & Matrix Theory)   **3 1 - 4 40 60**

Semester I [First Year]

COURSE OUTCOMES:

1. Evaluate certain improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.
2. Describe fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. Understand Fourier series and deal with functions of several variables.
4. Solve problems on matrices and linear algebra in a comprehensive manner.

UNIT I   [CO:1] **(15)**

Evolutes and Involutes, Evaluation of improper integrals: Integrals without infinite limits of integration, Beta function, Gamma function, Relation between beta and gamma functions (without proof), Applications of definite integrals to evaluate surface areas and volumes of revolutions.

UNIT II   [CO:2] **(15)**

Rolle's theorem (without proof), Lagrange's mean value theorem (without proof), Taylor's and Maclaurin series (without proof), Sequences, Series, Series of positive terms, Convergence tests: Comparision test (limit form) D'Alembert's ratio test, Raabe's test for convergence.

UNIT III   [CO:3] **(15)**

Fourier series: Half range sine and cosine series, Parseval's formula. Multivariable Calculus: Limit, continuity and partial derivatives, total derivative, Maxima, minima and saddle points of two variables, Method of Lagrange multipliers. Scalar and vector point functions , Gradient, directional derivative divergence and curl, del applied twice to point and product of point functions(without proofs).

UNIT IV   [CO:4] **(15)**

Rank of a matrix, Normal form, Inverse by Gauss Jordan method, System of linear equations: non homogeneous, Homogeneous systems, Rank-nullity theorem (without proof), Eigenvalues and eigenvectors, Cayley-Hamilton Theorem (without proof), Diagonalization of matrices, reduction of quadratic form to canonical form.

LEARNING RESOURCES:

TEXT BOOK:

B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 42nd edition, 2017.

REFERENCE BOOK(s):

1. G.B. Thomas and R.L. Finney - Calculus and Analytic geometry, Pearson, 2002.
2. N.P. Bali and Manish Goyal - A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2010.

3. Erwin Kreyszig - Advanced Engineering Mathematics, John Wiley & Sons, 2006.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

CE 112	ENGINEERING PHYSICS	L T P C Int Ext
	(Mechanics)	3 1 - 4 40 60
	Semester I [First Year]	

COURSE OUTCOMES:

1. Understand the vector mechanics for a classical system.
2. Describe the basics of Harmonic oscillators
3. Analyze the planar rigid body dynamics and 3-Dimensional rigid body motion.
4. Acquire the knowledge of basic concepts of mechanics of solids.

UNIT I   *Text Book - 1*   **(15)**

Vector mechanics of particles: Transformation of scalars and vectors under rotation, Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law. Introduction to Cartesian, spherical and cylindrical coordinate system. Conservative and non-conservative forces, Central forces (basic definition with some examples); Potential energy function; F=-GradV, equipotential surfaces, Conservation of Angular Momentum, Centripetal and Coriolis forces (basic concepts); Foucault pendulum.

UNIT II   *Text Book - 2*   **(15)**

Damped and forced oscillations : Harmonic oscillators, Damped harmonic oscillator, Equation of damped harmonic oscillator, Different damping oscillations - Over or heavy, critical and light or under damping, energy and power dissipations in a damped harmonic oscillator, quality factor, forced oscillations, resonance with some examples.

UNIT III   *Text Book - 3*   **(15)**

Planar rigid body Mechanics : Definition of rigid body, translational and rotational motion of a rigidbody, angular momentum of a body rotating about a fixed axis, moment of inertia, theorems of moment of inertia, Euler's laws of motion. Brief introduction to three- dimensional rigid body motion, rate of change of a vector rotating with angular velocity, Moment of inertia tensor.

UNIT IV   *Text Book - 3*   **(15)**

Mechanics of solids : Friction, limiting friction, law of limiting friction, Concept of stress and strain at a point; Concepts of elasticity, plasticity, stress-strain curve; Hooke's law, three moduli of elasticity, Poisson's ratio, Torsion pendulum, determination of rigidity modulus of the material of a wire, bending of beams, uniform and non-uniform bending.

LEARNING RESOURCES:

TEXT BOOK(s):

1. M.N. Avadhanulu, P.G. Kshirasagar - Engineering Physics, S. Chand & Company Ltd.
2. S.L Gupta &Sanjeev Gupta - Unified physics : Waves & Oscillations
3. S.L Gupta & Sanjeev Gupta - Unified physics : Mechanics & Properties of Matter

REFERENCE BOOK(s):

1. Engineering Mechanics, 2nd ed. - MKHarbola.

2. Introduction to Mechanics - MKVerma
3. An Introduction to Mechanics - D Kleppner& RKolenkow
4. Principles of Mechanics - JL Synge & BA Griths
5. Mechanics - JP DenHartog
6. R.K. Gaur & S.L.Gupta - Engineering Physics, Dhanpat Rai Publications Ltd

WEB RESOURCES:

Online course:

CE/CH/EE/ME 113	ENGLISH FOR COMMUNICATION SKILLS	L T P C Int Ext
		2 - - 2 40 60

Semester I [First Year]

COURSE OUTCOMES:

1. Use vocabulary contextually.
2. Compose effectively the various forms of professional communication.
3. Apply grammar rules efficiently in spoken and written forms.
4. Improve clarity to locate and learn the required information.

UNIT I   [CO:1] **(8)**

Vocabulary Building

1.1 - Root words from foreign languages and their use in English.

1.2 - Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

1.3 - Synonyms, antonyms, and standard abbreviations.

1.4 - One word substitutes.

UNIT II   [CO:1,2,3] **(8)**

Writing Skills

2.1 - Proposal writing

2.2 - Letter-writing

2.3 - Techniques for writing precisely (precis writing)

2.4 - E-mail writing

UNIT III   [CO:3] **(8)**

Identifying Common Errors in Writing

3.1 - Subject-verb agreement

3.2 - Noun-pronoun agreement

3.3 - Articles

3.4 - Prepositions

3.5 - Tenses

3.6 - Redundancies

UNIT IV   [CO:1,2,3,4] **(8)**

Nature and Style of Sensible Writing

4.1 - Description & Narration (Paragraph Writing). [CO:1,2,3]

4.2 - Essay Writing (Expository Essay). [CO:1,2,3]

4.3 - Note-Making and Note-Taking. [CO:1,2,4]

4.4 - Methods of preparing notes. [CO:1,2,4]

LEARNING RESOURCES:

TEXT BOOK:

Communication Skills. Sanjay Kumar and Pushpa Lata.Oxford University Press.

REFERENCE BOOK(s):

1. Remedial English Grammar. F.T. Wood. macmillan.2007
2. On Writing Well. William Zinsser. Harper ResourceBook. 2001
3. Study Writing. Liz Hamp-Lyons and Ben Heasly.Cambridge University Press.2006.
4. Practical English Usage.Michael Swan. OUP. 1995Press

CE 151	PHYSICS LAB	L T P C Int Ext
		- - 3 1.5 40 60

COURSE OUTCOMES:

1. Use CRO, Function generator, Spectrometer for making measurements
2. Test the optical instruments using principles of interference and diffraction
3. Understand the concepts learned in the Physics theory.
4. Detail precise measurements and handle sensitive equipment.
5. Infer conclusions from data and develop skills in experimental design.

List of Experiments:

1. Measurements using Vernier Calipers, Screw Gauge and Spherometer.

2. Newton's rings - Measurement of radius of curvature of plano-convex lens.

3. Determination of Energy band gap of a Semiconductor.

4. Optical fibers - Determination of Numerical Aperture.

5. Diffraction grating - Measurement of wavelengthsusing Spectrometer.

6. Magnetic field in Helmholtz coil.

7. PhotoVoltaic Cell - Determination of fill factor.

8. Series LCR resonance circuit - Determination of Q - factor.

9. Four probe method apparatus for measurements of resistivity and conductivityr.

10. Determination of wavelengths using diffraction grating.

11. Variation of magnetic field along the axis of a circular current carrying coil.

12. Carey Foster's bridge - Determination of Specific Resistance.

REFERENCE BOOK : Physics Lab Manual , R.V.R. & J.C. CE, Guntur

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

CE/CH/EE/ME152   ENGLISH LANGUAGE COMMUNICATION SKILLS LAB   L T P C Int Ext
- - 2 1 40 60

Semester I [First Year]

COURSE OUTCOMES:

1. Comprehend relationships between ideas and make inferences and predictions about spoken discourse.
2. Express English with a reasonable degree of accuracy in pronunciation.
3. Develop appropriate speech dynamics in professional situations.
4. Use effective strategies and social graces to enhance the value of communication.
5. Develop effective communication and presentation skills and using language effectively to face interviews with success.

List of Exercises / Activities:

Oral Communication

(This unit involves interactive practice sessions in Language Lab).

1. Listening Comprehension.
2. Pronunciation, Intonation, Stress and Rhythm.
3. Common Everyday Situations: Conversations and Dialogues.
4. Interviews.
5. Formal Presentations.
6. Reading Comprehension.

REFERENCE BOOK(S) :

1. Communication Skills. Sanjay Kumar and Pushpa Lata. Oxford University Press.
2. Practical English Usage. Michael Swan. OUP. 1995 Press
3. Exercises in Spoken English. Parts.I- III. CIEFL, Hyderabad. Oxford University
4. Technical English .M. Sambaiah, Wiley Publications, New Delhi

CE/EE/ME 153   **WORKSHOP PRACTICE LAB**   L T P C Int Ext
                                                            1 - 4 3 40 60

COURSE OUTCOMES:

1. Develop manufacturing processes which are commonly employed in the industry to fabricate components using different materials.

Lectures and Videos: [10 hours]

1. Manufacturing Methods: Introduction to various types of manufacturing methods - casting - forming - various machining operations such as turning, milling, shaping, drilling, slotting etc.,, - various joining methods such as welding, brazing, soldering etc.,- Advanced manufacturing methods (3 Lectures).

2. CNC machining and Additive manufacturing (1 Lecture).

3. Fitting operations and power tools (power hack saw, table mounted circular saw, wood turning lathe, bench grinder, concrete mixer, concrete vibrator etc.,) (1 Lecture).

4. Basic principles involved in electrical circuits and electronic PCB circuits(1 Lecture).

5. Carpentry (1 Lecture).

6. Welding(arc welding & gas welding) (1 Lecture).

7. Metal casting(1 Lecture).

8. Plastic moulding, glass cutting (1 Lecture).

Text book:

1. Hajra Choudhury S, K., Hajra Choudhury A.K and Nirjhar Roy S.K. - Elements of Workshop Technology, VolumeI and Volume II,2010, Media promoters and publishers private limited, Mumbai.

Reference books:.

1. Kalpakjian S and Steven S.Schmid. - Manufacturing Engineering and Technology, 4th edition, Pearson Education, India, 2002.

2. Rao P.N. - Manufacturing Technology, Volume I &II, Tata McGrawHill House, 2017.

Work shop Practice: (60 hours)

Objectives:

Students acquiring practical knowledge on various manufacturing techniques and will be able to fabricate components with their own hands.

Outcomes:

Up on completion of laboratory, students will be able to gain the manufacturing skills and get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

List of Exercises - Trade wise Experiments:

1. Welding shop(both arc &gas welding)
    - Square butt joint
    - Lap joint
    - Single v butt joint
    - Gas welding & Cutting
2. Fitting Shop& Casting
    - Inclined fit
    - Half round fit
    - V fit
    - Moulding and casting of Hand wheel
3. Practice on electrical wiring and Electronic circuit boards
    - One bulb controlled by one switch &one bulb controlled by two switches
    - Two bulbs controlled by one switch (Stair case connection)
    - Tube light connection
    - Measurement of resistance, voltage and current with the help of a multi-meter & soldering on an electronic PCB circuit.
4. Machine Shop
    - Practice of machining operations on Lathe, Milling, Shaping, Drilling and Slotting Machines.
5. Carpentry
    - Lap joint
    - Cross lap joint
    - Dovetail joint
    - Turning on wood turning Lathe
6. Tin Smithy
    - Rectangular tray
    - Funnel
    - Pipe joint
    - Rectangular Scoop

Plastic moulding and glass cutting

Note: A minimum of 2 (Two) from each trade - Total 12 (Twelve) experiments - have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

CE/EC/ME 121	MATHEMATICS-II	L	T	P	C	Int	Ext
	(Calculus, Ordinary Differential Equations and Complex Variable)	3	1	-	4	40	60

Semester II [First Year]

COURSE OUTCOMES:

1. Solve differential equations which model physical processes..
2. Evaluate multiple integrals and their usage.
3. Integrate vector functions.
4. Understand differentiation and integration of functions of a complex variable and appy them in various engineeing problems.

UNIT I [CO:1] **(15)**

Differentials equations of first order-Linear equations, Bernoulli's equation, exact equations, equations reducible to exact equations.

Differentials equations of higher order - Second order linear differential equations with constant coefficients - Method of variation of parameters, Cauchy's homogeneous linear equation and Legendre's linear equation.

UNIT II [CO:2] **(15)**

Multiple Integrals - Double integrals (Cartesian and polar), Change of order of integration, Change of variables Cartesian to polar coordinates.

Area by double integrals, Triple integrals (Cartesian), Volume by triple integrals.

UNIT III [CO:3] **(15)**

Integration of vectors - Line integrals, surface integrals, Green's theorem in the plane (without proof), Stoke's theorem (without proof), Volume integrals, Gauss divergence theorem (without proof).

Complex variables - Differentiation, Cauchy Riemann equations (Cartesian and polar-without proof), analytic functions.

UNIT IV [CO:4] **(15)**

Harmonic functions, finding harmonic conjugate - Milne Thomson method.

Complex integration - Cauchy Integral Theorem (without proof), Cauchy Integral Formula (without proof).

LEARNING RESOURCES:

TEXT BOOK:

B.S.Grewal - Higher Engineering Mathematics, Khanna publishers, 42nd edition, 2017.

REFERENCE BOOK(s):

1. Erwin Kreyszig - Advanced Engineering Mathematics, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal - A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2010.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

CE/CS/IT 122	ENGINEERING CHEMISTRY	L T P C Int Ext
		3 1 - 4 40 60

COURSE OUTCOMES:

1. Identify stable complexes and suitable electrochemical energy systems for end usage.
2. Apply his knowledge for effective water treatment and corrosion prevention.
3. Identify chemical reactions that are used in the synthesis of molecules and polymers
4. Distinguish the ranges of the electromagnetic spectrum and characterize a given compound using analytical techniques..

UNIT I   [CO:1] **(15)**

Molecular structure, Intermolecular forces and Energy systems:

Crystal field theory-salient features, energy level diagrams-tetrahedral and octahedral complexes, crystal field stabilization energies and magnetic properties.

Ionic, dipolar, Vander Waal's interaction and Hydrogen bonding, critical phenomena-Andrew's isotherms of CO_2, derivation of critical constants from Vander Waal's equation.

Electrode potential, electrochemical series, Nernst equation and its applications. Batteries-Primary (Dry cell) and secondary (Lead acid), Lithium battery (Li-MnO$_2$)- advantages, Fuel cell (H$_2$ - O$_2$ cell).

UNIT II   [CO:2] **(15)**

Water Chemistry and Corrosion :

Water Chemistry - WHO standards, Municipal water treatment-Removal of suspended impurities - Sedimentation, Co-agulation and Filtration-Disinfection of water by chlorine, Break point chlorination, Dechlorination, Purification by ion-exchange method and reverse osmosis.

Corrosion-Introduction, Electrochemical theory of corrosion, galvanic corrosion, differential aeration corrosion, Factors-temperature, pH, overvoltage. Cathodic protection by sacrificial anodic method and impressed current method. Electroplating (Cu), Electrolessplating (Ni).

UNIT III   [CO:3] **(15)**

Organic reactions and Polymers :

Types of organic reactions-Substitution(SN^{1}and SN^2), Elimination (E^{1}and E^2), Addition-Markownikoff's rule and anti-Markownikoff's rule, Cyclisation (Diel's Alder reaction), Synthesis of aspirin.

Polymers - Functionality, Degree of Polymerization, Tacticity-Addition and condensation polymerization, Relationship between Structure and Properties of polymers (Strength, Crystallinity, Elasticity, Plastic Deformation, Glass transition temperature (T_g)), Factors affecting T_g.

Conducting polymers: Introduction, Examples, General applications, Mechanism of conduction in polyacetylene.

UNIT IV   [CO:4] **(15)**

Spectroscopic techniques and its applications :

Beer-Lambert's law, limitations, colorimetric determination of Fe(III) UV-VIS spectroscopy - electronic transitions, shifts-blue and red, Block diagram - brief introduction of components, Applications - purity and differentiation of conjugated and non-conjugated dienes.

IR Spectroscopy - condition to be IR active, vibrational modes of - AB_2, Block diagram-brief introduction of components, IR spectrum of CO_2 and H_2O molecules, General applications. Fluorescence and its applications in medicine.

LEARNING RESOURCES:

TEXT BOOK(s):

1. P.C.Jain and Monica Jain- Engineering chemistry, 16th edition, Dhanpat Rai Publishing Company.
2. Wiley Engineering chemistry, 2nd edition, Wiley India Private Limited.

REFERENCE BOOK(s):

1. Bruce H. Mahan, University Chemistry, 3rd edition, Narosa Publishing House..
2. Shashi Chawla - A text book of Engineering chemistry, 3rd edition, Dhanpat Rai Publishing Company..

WEB RESOURCES:

1. Engineering Chemistry (NPTEL Web Book by B.L. Tembe, Kamaluddin & M.S. Krishnan).
2. http://www.powerstream.com/BatteryFAQ.html#lec
3. http://freevideolectures.com/Course/3029/Modern-Instrumental-Methods-ofAnalysis.

CE/CH/CS/EE/ EC/IT/ME 123	**PROGRAMING FOR PROBLEM SOLVING**	L T P C Int Ext
		3 - - 3 40 60

Semester II [First Year]

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COURSE OUTCOMES:
1. Develop algorithms and flow charts for simple problems.
2. Use suitable control structures for developing code in C.
3. Design modular programs using the concepts of functions and recursion.
4. Develop code for complex applications using structures, pointers and file handling features.

UNIT I   [CO:1] **(12)**

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm : Steps to solve logical and numerical problems, Representation of Algorithm: Flowchart / Pseudocode with examples,from algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code, Arithmetic expressions and precedence.

UNIT II   [CO:2] **(11)**

Conditional Branching and Loops : Writing and evaluation of conditionals and consequent branching, Iteration and loops.

Arrays : Arrays (1-D, 2-D), Character arrays and Strings Basic Algorithms:Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations.

UNIT III   [CO:3] **(11)**

Function : Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions : idea of call by reference

Recursion : Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series.

UNIT IV   [CO:4] **(11)**

Structures: Structures, Defining structures and Array of Structures.

Pointers : Idea of pointers, Defining pointers, Use of Pointers in self referential structures.

File handling : Defining and opening a file, closing a file, input/output operations on files using file handling functions, random access to files.

LEARNING RESOURCES:

TEXT BOOK:

Byron Gottfried - Programming with C (Schaum's Outlines), Third Edition, Tata McGraw-Hill.

REFERENCE BOOK(s):

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. Programming in C by Stephen G. Kochan, Fourth Edition, Pearson
3. C Complete Reference, Herbert Sheildt, TMH., 2000.
4. Programming with C by K R Venugopal & Sudeep R Prasad, TMH., 1997.

WEB RESOURCES:

1. http://cprogramminglanguage.net/
2. http://lectures-c.blogspot.com/
3. http://www.coronadoenterprises.com/tutorials/c/c_intro.htm
4. http://vfu.bg/en/e-Learning/Computer-Basics--computer_basics2.pdf

CE 124   **BASIC MECHANICAL ENGINEERING**   L T P C Int Ext

                                                                       2 - - 3 40 60

COURSE OUTCOMES:

1. Describe how the power is transmitted through belt and gear drives, estimate the tensions, power transmitted, length of the belt required etc.
2. Discuss the basic concepts of thermodynamics, efficiencies and performance of 2-stroke and 4 stroke IC Engines.
3. Understand working principles of Babcock and Wilcox boilers, different mountings and accessories used in the boilers. They able to know basic working of refrigerator and air conditioning.
4. Differentiate refrigeration and air-conditioning, Renewable and Non-Renewable resources.

UNIT I   [CO:1] **(15)**

Transmission of Power by Belt Drive : Function of Belt drive, velocity ratios, slip in belts, ratio of tensions in a belt, length of belt- Open, Crossed, maximum power transmitted by belt drive (Basic simple Problems).

Transmission of Power by Gear Drive : Advantages of Gear drive over Belt drive, Types of Gears, Spur, Helical, Bevel, Worm and Worm gear, nomenclature of Spur gears, Simple and Compound Gear trains (Basic simple Problems).

UNIT II   [CO:2] **(15)**

Thermodynamics : Basic Concepts, equilibrium, Zeroth Law and First Law Of thermodynamics definitions and steady flow processes and applications, 2nd Law statements, Carnot's cycle , concept of entropy (Qualitative treatment only).

Internal Combustion Engines : Classification of I.C. Engines-Working principles of Two Stroke and Four stroke SI and CI Engines-Differences (Qualitative treatment only).

UNIT III   [CO:3] **(15)**

Boiler and Steam Turbine : Working of Babcock-Wilcox water tube boiler and Cochran Fire tube boiler, Differences between Fire tube and Water tube boiler, Differences between Impulse and Reaction Steam Turbines. (Qualitative treatment only).

Heat Transfer : Basic modes of heat transfer and their Governing laws, Applications, heat exchangers, types, LMTD (Qualitative treatment only).

UNIT IV   [CO:4] **(15)**

Refrigeration Systems : Need for refrigeration, types, C.O.P, vapour compression refrigeration. Air conditioning Systems: Need for control of environment, summer and winter air conditioning systems - Components in air conditioning system, Variable refrigerant flow (VRF) (Qualitative treatment only).

Non-Conventional Energy : Solar energy; Wind energy;   Ocean Thermal Energy; GEO-Thermal

Energy, Solar Power plant, Thermal Power Plant (Qualitative treatment only).

LEARNING RESOURCES:

TEXT BOOK(s):

1. Elements of Mechanical Engineering, Mathur, and Mehta, Jain Brothers, Delhi (2005).
2. Treatise on Heat Engineering - V. P.Vasandhani & Kumar, Metropolitan Publishers

REFERENCE BOOK:

Basic Mechanical Engineering, T.J.Prabhu & Others, 1stEdition, Scitech Publishers(2010)

WEB RESOURCES:

http://nptel.ac.in/courses/

CE 125   **ENGINEERING MECHANICS**   L T P C Int Ext
                                                                                          3 - - 3 40 60

COURSE OUTCOMES:

1. Apply principles of statics and solve problems involving concurrent forces in a plane
2. Solve problems involving parallel forces and general case of forces in a plane
3. Solve problems with forces oriented in three-dimensions and apply principle virtual work to system of rigid bodies
4. Calculate moments of areas and moments of inertia

UNIT I   [CO:1] **(15)**

Concurrent Forces in a Plane : Principles of statics, Rectangular components of a force, Resultant and equilibrium of concurrent forces in a plane, Method of projections. (8 hours).

Parallel Forces in a Plane : Moment of a force about a point, Couple, Resultant and equilibrium of parallel forces in a plane, Centre of parallel forces and centre of gravity, Centroids of composite plane figures and curves. (7 hours)

UNIT II   [CO:2] **(13)**

General Case of Forces in a Plane : Resultant and equilibrium of general case of parallel forces in a plane, Statically determinate plane trusses-Method of joints and Method of sections. (8 hours).

Friction : Types of friction, Dry friction - Mechanism of friction , Types of friction problems.(5 hours)

UNIT III   [CO:3] **(12)**

Force Systems in Space (using vector notation):   Position vector, Unit vector, Force vector, Component of a force about an axis, Moment of a force about a point, Moment of a force about an axis, Couple, Resultant and equilibrium of concurrent forces in space, Resultant and equilibrium of parallel forces in space, Centre of parallel forces and centre of gravity.(8 hours)

Principle of virtual work : Equilibrium of ideal systems, Stable and Unstable equilibrium.(4 hours)

UNIT IV   [CO:4] **(13)**

Moments of Inertia of Plane Figures : Moment of inertia of a plane figure with respect to an axis in its plane ; Moment of Inertia with respect to an axis perpendicular to the plane of the figure; Parallel axis theorem.(8 hours).

Moments of Inertia of Material Bodies : Moment of inertia of a rigid body; Moment of inertia of a lamina; Moments of inertia of three- dimensional bodies.(5 hours)

LEARNING RESOURCES:

TEXT BOOK:

Engineering mechanics by S.Timoshenko, D.H.Young, J.V.Rao, Sukumar Pati, 5th Edition, McGraw Hill Education(India), 2017.

REFERENCE BOOK(s):

1. Engineering Mechanics by V.Jaya Kumar and M.Kumar,1st Edition, PHI Learning, 2012.
2. Engineering Mechanics by B.Bhattacharyya, 2nd Edition, Oxford University Press, 2014.
3. Engineering mechanics: Statics by J. L. Meriam and L. Kraige , 7th Edition, John Wiley & Sons,2013.
4. Engineering Mechanics by R.C.Hibbeler,14th Edition, Pearson Education (India),2017.
5. Vector Mechanics for Engineers by Beer and Johnston, 11th Edition, McGraw Hill Education(India), 2017.

WEB RESOURCES:

http://nptel.ac.in

CE/CS/IT 161   **CHEMISTRY LAB**   L T P C Int Ext
                                                                              - - 3 1.5 40 60

COURSE OUTCOMES:

1. Estimate the Fe(II) content of a given solution and chloride/hardness content of water.
2. Measure molecular properties such as surface tension, viscosity.
3. Measure conductance of solutions, redox potentials of a cell.
4. Devise a small drug molecule and polymer.

List of Experiments:

1.   Estimation of Mohr's salt using $KMnO_4$.
2.   Estimation of Mohr's salt using $K_2Cr_2O_7$.
3.   Determination of chloride ion content of water.
4.   Determination of Hardness of water using EDTA method.
5.   Determination of Fe(II) strength using $K_2Cr_2O_7$ potentiometrically.
6.   Determination on strength of NaOH using HCl conductometrically.
7.   Determination of surface tension.
8.   Determination of Viscosity.
9.   Determination of Saponification / acid value of oil.
10. Preparation of p-bromo acetanilide.
11. Preparation of Phenol Formaldehyde resin.
12. Determination of partition co-efficient of I2 in water.
13. Determination of Rf value using TLC.
14. Verification of Freundlich isotherm using adsorption of acetic acid on activated charcoal.

Note: A minimum of 10(Ten) experiments have to be performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

CE/CH/CS/EE/	PROGRAMING FOR PROBLEM SOLVING LAB	L	T	P	C	Int	Ext
EC/IT/ME 162		-	-	4	2	40	60

Semester II [First Year]

COURSE OUTCOMES:

1. Develop algorithms and flow charts for simple problems.
2. Use suitable control structures for developing code in C.
3. Design modular programs using the concepts of functions and recursion.
4. Develop code for complex applications using structures, pointers and file handling features.

List of Exercises / Activities:

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Tutorial 1 : Problem solving using computers:

Lab1: Familiarization with programming environment.

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions.

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures.

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series.

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation.

Tutorial 6: 2D arrays and Strings:

Lab 6: Matrix problems, String operations.

Tutorial 7: Functions, call by value:

Lab 7: Simple functions.

Tutorial 8 & 9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems.

Tutorial 10: Recursion, structure of recursive calls:

Lab 10: Recursive functions.

Tutorial 11: Pointers, structures and dynamic memory allocation:

Lab 11: Pointers and structures.

Tutorial 12: File handling:

Lab 12: File operations.

Note: A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

CE/EE/ME 163 **ENGINEERING GRAPHICS & DESIGN LAB** L T P C Int Ext

1 - 4 3 40 60

Semester II [First Year]

COURSE OUTCOMES:

1. Prepare engineering drawings as per BIS conventions mentioned in the relevant codes.
2. Produce computer generated drawings using CAD software..
3. Use the knowledge of orthographic projections to represent engineering information / concepts and present the same in the form of drawings.
4. Develop isometric drawings of simple objects reading the orthographic projections of those objects.
5. Convert pictorial and isometric views of simple objects to orthographic views.

(Units I to IV shall be taught in conventional drawing method and Unit V shall be taught with the aid of computer)

UNIT I

General : Principles of Engineering Graphics and their significance, usage of drawing instruments, lettering.

Conic sections : Construction of Ellipse, Parabola, Hyperbola and Rectangular Hyperbola. (General method only)

Curves : Cycloid, Epicycloid, Hypocycloid and Involute and Scales

UNIT II

Method of Projections : Principles of projection - First angle and third angle projection of points, Projection of straight lines inclined to both planes. Traces of lines.

Projections of planes : Projections of planes inclined to both the planes, projections on auxiliary planes.

UNIT III

Projections of Regular Solids : Projections of solids (Prism, Pyramid, Cylinder and Cone) with varying positions.

Sections of Solids : Sections of Prisms, Pyramids, cylinders and Cones. True shapes of sections. (Limited to the cutting plane perpendicular to one of the principal plane).

Development of surfaces : Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT IV

Isometric Projections: Principles of Isometric projection-Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids

Orthographic Projections : Conversion of pictorial views into Orthographic views and Vice-versa. (Treatment is limited to simple castings).

Perspective Projections : Introduction to Perspective Projection

UNIT V

Over view of Computer Aided drafting (AutoCAD) : Introduction, starting and customizing AutoCAD screen, usage of different menus, toolbars(drawing, editing, dimension, text, object properties..etc), tabs (Object, snap, grid, polar, ortho, otrack..etc) and command prompt. Setting units, limits, layers and viewports (Isometric, Top, Front, back..etc). 2D drawings of various mechanical and structural components, electrical and electronic circuits. Orthographic and Isometric views of mechanical castings and simple structures.

LEARNING RESOURCES:

TEXT BOOK:

Bhatt N.D., Panchal V.M. & Ingle P.R. - Engineering Drawing, Charotar Publishing House, 2014.

REFERENCE BOOK(s):

1. Shah, M.B. & Rana B.C. - Engineering Drawing and Computer Graphics, Pearson Education, 2008.
2. Agrawal B. & Agrawal C. M. - Engineering Graphics, TMH Publication, 2012.
3. Narayana, K.L. & P Kannaiah - Text book on Engineering Drawing, Scitech Publishers, 2008.
4. (Corresponding set of) CAD Software Theory and User Manuals

CE 211	**SURVEYING**	L T P C Int Ext
		3 1 - 4 40 60

COURSE OUTCOMES:

1. Determine the relative positions of a point on the existing ground by conducting the survey.
2. Compute the levels of existing ground and to determine the reduced levels
3. Calculate the reduced level of different locations using tacheometer.
4. Design and layout curves for roads and railways

UNIT I   *Text Book - 1* [CO:1] **(20)**

Surveying & Measurements: Definitions; Classification; Principles of Surveying; Basic measurements in surveying; Instruments used for different measurements. Types of errors and sources of errors; Methods of distance measurement; Procedures for distance measurement - Ranging, Chaining/taping a line, tapes corrections.Chain Surveying: Principle of Chain surveying; Basic definitions; Well-Conditioned & ill-Conditioned triangles; Selection of stations and survey lines; Offsets.Compass Surveying: Angles and Bearings; Instruments used to measure angles and bearings; Designation of Bearings; Traverse Survey; Types of traverse; Fore and Back Bearings; Calculation of Included Angles from Bearings and Bearings from Included Angles; Prismatic & Surveyor's Compass; Magnetic Dip & Declination; Local Attraction and Corrections.

UNIT II   *Text Book - 1* [CO:2] **(15)**

Simple Leveling: Basic definitions; Curvature and Refraction; Different methods of leveling; Types of Levels - Auto level; Leveling staff; Level field book; Booking and reducing levels; Classification of direct differential leveling methods - Fly leveling, check leveling, Profile leveling and Cross sectioning, Reciprocal leveling and Precise leveling; Contouring; contour interval; Characteristics of contours; Uses of contour maps.Computation of Areas: Introduction; Simpson's rule; Boundaries with offsets at irregular intervals; Coordinate method; Area of cross sections -level section and twolevel section.Computation of volumes: Trapezoidal rule; Prismoidal formula; Volume from spot levels; Capacity of a reservoir

UNIT III   *Text Book - 1* [CO:3] **(15)**

Theodolite Surveying: Types of Theodolites; Vernier Theodolite - Essential Parts; Basic definitions; Fundamental lines and desired relations; Temporary adjustments; Field operations -Measurement of horizontal angles (Repetition & Reiteration), vertical angles, direct angles, deflection angles, bearings.Tacheometric Surveying: Advantages of tachometric surveying; Basic systems of tachometricmeasurements; Principle of stadia measurements, Determination of constants K and C; Inclined sight with staff vertical; Inclined sight with staff normal to the line of sight; uses of Tacheometry.

UNIT IV   *Text Book - 1* [CO:4] **(15)**

Curves Ranging: Circular curves - Basic definitions; Designation of a curve; Relationship between radius and degree of curve; Elements of a simple circular curve; Location of the tangent points; selection of peg interval; Methods of setting out - Rankine's method.Modern Systems in Surveying: Electronic Distance Measurements - Basic definitions, distance from measurement of transit time; Infrared EDM instruments; Microwave EDM instruments; Digital theodolite; Total Station; Global Positioning System.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Surveying Volume I & II by Dr. K. R. Arora,11th Edition, Standard Book House,2012.
2. Surveying Volume I & II by S K Duggal, 4th Edition, McGraw Hill Education (India) PrivateLimited,2013.

REFERENCE BOOK(s):

1. Surveying Volume I & II by B.C. Punmia, Laxmi Publications,2005.
2. Surveying and Levelling by N.N Basak, McGraw Hill Education (India) Private Limited,2014.
3. Plane Surveying by AM Chandra, 2nd Edition, New Age International (P) Ltd.,2006.

WEB RESOURCES:

1. http://nptel.ac.in/courses/105104100/
2. http://nptel.ac.in/courses/105104101/
3. http://nptel.ac.in/courses/105107121/
4. http://nptel.ac.in/courses/105107122/

CE 212   **SOLID MECHANICS-I**   L T P C Int Ext
                                                                             3 1 - 4 40 60

COURSE OUTCOMES:

1. Determine stress and strain in bodies subjected axial,biaxial and triaxial stress distributions
2. Draw shear force and bending moment diagram for beams
3. Determine normal stresses/strains in beams
4. Determine shear stresses/strains in beams and circular shafts subjected to torsion

UNIT I   *Text Book - 1* [CO:1,2] **(15)**

Stress: Introduction; Method of sections; Definition of stress; Normal stresses in axially loaded bars; Shear stresses ; Analysis for normal and shear stresses; Stresses on inclined sections in axially loaded bars; Allowable stress and factor of safety. Strain:Introduction; Normal strain; Stress-strain diagrams; Hooke's law; Deformation of axially loaded bars; Thermal strain and deformation; statically indeterminate axially loaded bars; Shear strain; Hooke's law for shear stress and shear strain.Generalized Hooke's law and Pressure vessels Poisson's ratio; Generalized Hooke's law for isotropic materials; Relationship between Modulus of elasticity and Modulus of rigidity; Dilatation and Bulk modulus; Thin-walled pressure vessels- Cylindrical and spherical vessels

UNIT II   *Text Book - 1* [CO:3] **(15)**

Internal forces in beams:Introduction; Diagrammatic conventions for supports and loads; Calculation of beam reactions; Application of method of sections; Shear force in beams; Bending moment in beams; Shear force and bending moment diagrams; Differential equations of equilibrium for a beam element.

UNIT III   *Text Book - 1* [CO:4] **(15)**

Normal stresses in beams:Introduction; Basic assumptions; The elastic flexure formula ; application of flexure formula; Unsymmetric bending- Bending about both principal axes of a beam with symmetric cross section.

UNIT IV   *Text Book - 1* [CO:4,5] **(15)**

Shear stresses in beams: Introduction; Shear flow; The shear stress formula for beams; Shear stress in beam flanges; Shear centre.Torsion:Introduction; Application of the method of sections; Torsion of circular elastic bars- Basic assumptions, the torsion formula ; Power transmission by circular shafts

LEARNING RESOURCES:

TEXT BOOK:

Mechanics of Materials by Pytel and Kiusalaas , Cengage Learning, SI Edition, 2017.

REFERENCE BOOK(s):

1. Mechanics of materials by E.P. Popov , Pearson Education(India) ,2015
2. Engineering mechanics of solids by E.P. Popov, Pearson Education(India) ,2015.
3. Elements of strength of materials by S.P.Timoshenko and D.H.Young, Affiliated East-West Press Pvt.Ltd.,2005.
4. Mechanics of materials by R.C.Hibbeler, SI Edition, Pearson Education(India) ,2018
5. Mechanics of materials by P.Beer and E.R.Johnston, 7th Edition, McGraw-hill Education (India) Pvt.Ltd., 2017

CE 213	FLUID MECHANICS	L T P C Int Ext
		3 1 - 4 40 60

COURSE OUTCOMES:
1. Apply the properties of fluid while analysing it and determine the hydrostatic forces on surfaces and submerged objects.
2. Analyse the fluid motion by using laws of conservation of mass, energy and momentum.
3. Measure the discharge through pipes, channels and tanks using venturimeter, orificemeter, notches, weirs, orifices and mouthpieces.
4. Analyse flows in pipe systems for laminar & turbulent flows.

UNIT I   *Text Book - 1,2* [CO:1] **(15)**

Introduction Dimensions and units; Physical properties of fluids: specific gravity, viscosity, surface tension, vapour pressure and their influences on fluid motionFluid StaticsVariation of static pressure; Absolute and gauge pressure; Pressure measurement by manometers; Pressure on plane surfaces and curved surfaces.BuoyancyBuoyancy; Stability of submerged bodies and floating bodies; Metacentre and metacentric height.

UNIT II   *Text Book - 1,2* [CO:2] **(15)**

Fluid Kinematics:Methods of describing fluid motion; Classification of flows; Steady, unsteady, uniform and non-uniform flows; Laminar and turbulent flows; One, two and three dimensional flows; Irrotational and rotational flows; Streamline; Path line; Streak line; Equation for acceleration; Convective acceleration; Local acceleration; Continuity equation; Velocity potential and stream function; Flow net; Fluid Dynamics:Euler's equation of motion; Bernoulli's equation; Energy correction factor; Momentum principle; Applications of momentum equation- Force exerted on a pipe bend.

UNIT III   *Text Book - 1,2* [CO:3] **(15)**

Flow Measurement in Pipes:Discharge through venturi meter, orifice meter and flow nozzle; Measurement of velocity by pitot tube.Flow through Orifices and Mouthpieces:Flow through orifices; Determination of coefficients for an orifice; Flow through large rectangular orifice; Flow through submerged orifice; Classification of mouthpieces; Flow through external and internal cylindrical mouthpiece. Flow Over Notches and Weirs:Flow through rectangular, triangular and trapezoidal notches and weirs; End contractions; Velocity of approach; Broad crested weir.

UNIT IV   *Text Book - 1,2* [CO:4] **(15)**

Analysis of Pipe Flow:Laws of Fluid friction- Darcy's equation, Minor losses -pipes in series -pipes in parallel- branched pipes; Total energy line and hydraulic gradient line, Hydraulic power transmission through a pipe; Siphon; Water hammer.Laminar Flow:Reynold's experiment; Characteristics of laminar flow; Steady laminar flow through a circular pipe (Hagen Poiseuille equation).Turbulent Flow in Pipes:Characteristics of turbulent flow, Hydro dynamically smooth and rough boundaries, Velocity distribution, Friction factor for pipe flow, Variation of friction factor with Reynolds number- Moody's chart.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Hydraulics and Fluid Mechanics including Hydraulic Machines by P. N. Modi and S. M. Seth; Standard book house; New Delhi, 2009
2. Fluid Mechanics and Hydraulic Machines by R. K. Bansal; 9th Edition, Laxmi Publications, 2011

REFERENCE BOOK(s):

1. Fluid Mechanics by A. K Jain, Khanna Publishers, 2008
2. Fluid Mechanics by Streeter and Wyile, 9th Edition,Tata McGraw-Hill, 2010

WEB RESOURCES:

www.nptel.iitm.ac.in

CE 214   **ENGINEERING GEOLOGY**   L T P C Int Ext
                                                                   3 - - 3 40 60

COURSE OUTCOMES:
1. Discuss the geological processes and recognize the impact on civil engineering projects.
2. Acquire the knowledge on building materials and site rocks
3. Explain the role of geological structures in the site selection.
4. Classify the geological hazards
5. Determine the site selection techniques for dams and tunnels

UNIT I   *Text Book - 1* [CO:1] **(12)**

INTRODUCTION: 1. Branches of geology, Importance of geology in Civil engineering.PHYSICAL GEOLOGY: 2.Geological processes; Weathering, Erosion ,Importance of the process of Weathering and Erosion.MINERALOGY: 3.Definition of mineral; Significance of different physical properties in mineral identification; Study of physical properties, structure and chemical composition of following common rock forming and economic minerals: Feldspar, Quartz, Olivine, Augite, Hornblende, Muscovite, Biotite, Asbestos, Apatite , Kyanite, Garnet, Beryl, Talc, Calcite, Dolomite, Pyrite, Hematite, Magnetite, Galena, Graphite, Magnesite , Bauxite and Clay minerals

UNIT II   *Text Book - 1* [CO:2] **(11)**

PETROLOGY: 4. Introduction; Civil engineering importance of petrology; Rock cycle, Geological Classification of rocksIGNEOUS ROCKS: 5.Forms, Structures and textures of igneous rocks. Megascopic description and civil   engineering uses of Granite, Basalt, Dolerite, Pegmatite and CharnockiteSEDIMENTARY ROCKS: 6. Formation; Structures and textures of sedimentary rocks. Megascopic description and civil engineering uses of Laterite, Conglomerate, Sand stone, Lime stone and ShaleMETAMORPHIC ROCKS: 7.Types of metamorphism; Structures and textures of metamorphic rocks. Megascopic description and civil engineering uses of Gneiss, Schist, Quartzite, Marble and slate

UNIT III   *Text Book - 1* [CO:3] **(12)**

STRUCTURAL GEOLOGY: 8. Introduction; Causes for development of structures; Out crop, Strike and dip; Folds; Faults; Joints; Unconformities.IMPORTANCE OF GEOLOGICAL STRUCTURES: 9.Effects of folds, faults, joints, unconformities and their civil engineering importance.EARTHQUAKES: 10.Classification and causes; Intensity and magnitude and their measuring scales; Effects of earthquakes; Seismic belts; Civil Engineering considerations in seismic areas; Seismic zones of India.Land Slides11.Classification; Causes and effects; Preventive measures.

UNIT IV   *Text Book - 1* [CO:4] **(11)**

GEOPHYSICAL INVESTIGATIONS: 12. Geophysical methods of investigation –Civil engineering importance of geophysical methods; Electrical resistivity method and Seismic refraction method.DAMS: 13. Geological considerations for the selection of dam sites; Stages of investigation; Case histories of some dam failures; Geology of some Indian dam sites.TUNNELS: 14. Effects of tunneling; Geological considerations for tunneling; Over break; Geology of some tunnel sites;IMPROVEMENT IN

PROPERTIES OF ROCK MASS15.Materials and Methods of Grouting, Principles and mechanism of Rock bolting

LEARNING RESOURCES:

TEXT BOOK:

A text Book of Engineering Geology by N. Chennakesavulu; Macmillan India Ltd., Delhi.

REFERENCE BOOK(s):

1. Engineering Geology For Civil Engineers by D. Venkata Reddy; Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
2. Introduction to Geographical Information Systems, Kang-tsung ChangMcGraw Hill Education (India)Pvt Ltd.
3. Remote Sensing and its Applications LR A Narayan , Universities Press (India) Pvt. Ltd.
4. Engineering and General Geology by Parbin Singh; S. K. Kataria & Sons, New Delhi.
5. Rock Mechanics for Engineers by Dr.B.P.Varma, Khana Publishers, Delhi-6.
6. Engineering Geology an environmental approach by P Harahn, PHI

WEB RESOURCES:

1. NPTEL COURSE- Developed by Prof. Debasis Roy, IIT, Kharagpur - 721302
2. http://www.eos.ubc.ca/academic/undergraduate/appsci.html
3. http://web.mst.edu/~rogersda/umrcourses/ge341/
4. http://web.env.auckland.ac.nz/course_pages/geology771/

CE 215   **BUILDING MATERIALS AND CONSTRUCTION**   L T P C Int Ext
                                                                     4 - - 3 40 60

COURSE OUTCOMES:

1. Discuss various building materials
2. Explain plastics, paints, distempers and water proofing materials.
3. Understand brick masonry, specifications in plastering, stairs, lifts and knowledge regarding acoustics of building.
4. Describe building components, scaffolding, shoring, underpinning and formwork.

UNIT I   *Text Book - 1,2* [CO:1] **(20)**

Clay bricks: Brick clay, Preparation of bricks, Types of bricks, Dimensions of bricks, Weight of bricks, Storing of bricks, Brick substitutes, Classification of bricks, Tests for bricks.Timber: Classification of trees, Structure of wood, seasoning and con-version of timber, Market forms of timber, Defects of timber, Treatment of timber, Classification of timber.Glass: Manufacture and Classification, Uses of glass, testing for quality

UNIT II   *Text Book - 1,2* [CO:2] **(15)**

Plastics: Classification of plastics, Properties of plastics, Fabrication of plastic articles, some plastics in common use, Reinforced plastics.Paints: Types of paints, Composition of paints, Considerations in choosing paints, Paints commonly used in buildings. Damp Proofing and water proofing materials and uses, white washing and distempering.

UNIT III   *Text Book - 1,2,3, R-3* [CO:3] **(20)**

Brick Masonry: Terms used in brickwork, Mortars to be used, bonding of bricks, Method of laying bricks.Plastering: Plastering method, Specifications for plastering with cement mortar.Stairs and lifts: Terminology used in stairs, Types of stairs, Recommendations for RCC stair case, liftsAcoustics: Basic theory, Reverberation and echoes, Sound isolation, Acoustical materials, Recommendations for different types of buildings.

UNIT IV   *Text Book - 3, R-3* [CO:4] **(15)**

Building Components Lintels, arches, vaults, Different types of floors – Concrete, Mosaic, Terrazzo floors, Pitched, flat roofs. Lean to roof, Coupled Roofs. Trussed roofs – King and Queen post Trusses. R.C.C Roofs, Madras Terrace and Prefabricated roofs. Shoring, Underpinning, Scaffolding and Formwork: Shoring, Types of shores; Underpinning - Pit method, Pile method; Scaffolding -Types of scaffolding; Formwork-requirements of formwork, formwork for columns, beams, slabs

LEARNING RESOURCES:

TEXT BOOK(s):

1. Engineering Materials by Rangwala, Charotar Publications, Fortieth Edition: 2013
2. Building Materials by P.C. Verghese, 1st Edition, PHI, 2009.
3. Building construction by Rangwala, Charotar Publications ,33rd Edition:2017

REFERENCE BOOK(s):

1. Building construction by P.C. Verghese, 1st Edition, PHI, 2009.
2. Building material by S K Duggal – New Age International Publishers; Second Edition
3. Building construction by BC Punmia et al., 10th Edition, Laxmi Publications, 2008.

WEB RESOURCES:

www.nptel.iitm.ac.in

MC 001	CONSTITUTION OF INDIA	L T P C Int Ext
	[MANDATORY NON-CREDIT COURSE]	2 - - - 100 -
	Semester III [Second Year]	

COURSE OUTCOMES:

1. understand the significance of many provisions of the Constitution as well as to gain insight into their back ground. They will also understand number of fundamental rights subject to limitations in the light of leading cases.
2. Study guidelines for the State as well as for the Citizens to be followed by the State in the matter of administration as well as in making the laws.   It also includes fundamental duties of the Indian Citizens in Part IV A (Article 51A).
3. Understand administration of a State, the doctrine of Separation of Powers.
4. Detail how the State is administered at the State level and also the powers and functions of High Court.
5. Understand special provisions relating to Women empowerment and also children. For the stability and security of the Nation, Emergency Provision are Justified.
6. Understand election commission as an independent body with enormous powers and functions to be followed both at the Union and State level. Amendments are necessary, only major few amendments have been included.

UNIT I   [CO:1] **(10)**

Preamble to the Constitution of India Domicile and Citizenship. Fundamental rights under Part III, Leading Cases.   Relevance of Directive Principles of State Policy under Part-IV, IV-A Fundamental duties.

UNIT II   [CO:2,3] **(10)**

Union Executive - President, Vice-President, Prime Minister, Union Legislature - Parliament and Union Judiciary - Supreme Court of India. State Executive - Governors, Chief Minister, State Legislature and High Court.

UNIT III   [CO:3,5] **(10)**

Special Constitutional Provisions for Scheduled Casters and Tribes, Women and Children and Backward Classes, Emergency Provisions.

UNIT IV   [CO:6] **(10)**

Electoral process, Centre State Relations (Amendment Procedure, 42nd, 44th, 74th, 76th, 86th and 91st Constitutional amendments).

LEARNING RESOURCES:

TEXT BOOK:

Durga Das Basu: "Introduction to the Constitution of India" (student edition) Prentice - Hall EEE, 19th/20th Edition, 2001.

REFERENCE BOOK(s):

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

2. Brij Kishore Sharma, "Introduction to the Constitution of India", PHI, Learning Pvt.Ltd., New Delhi, 2011.

CE 251   **STRENGTH OF MATERIALS LABORATORY**   **L T P C Int Ext**
                                                                  - - 2 1 40 60

COURSE OUTCOMES:
1 Assess the behavior of materials like steel, wood, concrete etc under direct tension, compression, shear, torsion and bending
2 Measure young's modulus, modulus of rigidity, hardness, impact resistance
3 Determine strength properties of concrete
4 Determine percentage of water absorption of bricks

EXPERIMENTS:
1. Study of stress-strain characteristics of mild steel bars by UTM
2. Study of stress-strain characteristics of HYSD bars by UTM
3. Determination of modulus of elasticity of the material of the beam by conducting bending test on simply supported beam
4. Determination of modulus of elasticity of the material of the beam by conducting bending test on cantilever beam
5. Determination of modulus of rigidity by conducting torsion test on solid circular shaft
6. Determination of hardness of the given material by Brinnel's hardness test
7. Determination of hardness of the given material by Rockwell hardness test
8. Determination of hardness of the given material by Vickers hardness test.
9. Determination of impact strength of the given material by conducting Charpy/Izod test
10. Determination of ultimate shear strength of steel by conducting double shear test
11. Determination of modulus of rigidity of the material of closely coiled helical spring.
12. Determination of compressive strength of wood with grain parallel / perpendicular to loading.
13. Determination of compressive strength of CLAY/ FAL-G bricks
14. Determination of water absorption of bricks

Note:**
A minimum of 10 experiments shall be done and recorded

CE 252	**ENGINEERING GEOLOGY LABORATORY**	L	T	P	C	Int	Ext
		-	-	2	1	40	60

COURSE OUTCOMES:

1. Observe the importance of geology in civil engineering.

2. Identify the geological process of the region related to the civil engineering works.

3. Categorize the formation and properties of the minerals, rocks and soil.

4. Develop the ability to prepare the geological section and maps and interpret the site conditions.

EXPERIMENTS:

1. Study of Survey of India Topographical Maps
2. Study of Satellite Imageries through appraisal cards
3. Study of Physical Properties and identification Minerals (2 experiments)
   (i) Silicate minerals
   (ii) Non silicate minerals
4. Megascopic description and identification of Rocks (3 experiments) (i) Igneous rocks (ii) Sedimentary rocks (iii) Metamorphic rocks
5. Simple Structural geology Problems
6. Study of Geological Maps and their Cross-section
7. Electrical Resistivity Method (demo)
8. Seismic Hammer Sounding Method (demo)
9. Study of Structural Models

Note****:**

[A minimum of 10 experiments to be completed and recorded by the students to attain eligibility for semester end practical examination]

LEARNING RESOURCES:

TEXT BOOK(s):

1. F.G. Bell, Fundamental of Engineering Geology, BS Publications PVT Ltd, Hyderabad.
2. Parbin Singh, "Engineering and General Geology ", Katson Publication House, 1987.

WEB RESOURCES:

NPTEL COURSE- Developed by Prof. Debasis Roy, IIT, Kharagpur - 721302
http://web.mst.edu/~rogersda/umrcourses/ge341/
http://web.env.auckland.ac.nz/course_pages/geology771/

CE 253   **COMPUTER AIDED CIVIL ENGINEERING DRAWING LABOR**   **L T P C Int Ext**
ATORY   **- - 2 1 40 60**
Semester III [Second Year]

COURSE OUTCOMES:

1. Utilize basic Auto CAD commands.

2. Draw conventional signs for building materials, symbols for electrical installations and sanitary fittings.

3. Draw plan, section and elevation of buildings components and buildings.

4. Draw 3D building model and render the model.

EXPERIMENTS:

1. Learning basic commands of CAD software & drawing various geometrical Shapes using
   a) Draw commands
   b) Editing commands
   c) Creating text
   d) Dimensioning
2. Draw Conventional signs for building materials and symbols for sanitary installations and fittings.
3. Draw symbols for Doors & Windows and Electrical Installations.
4. Draw Elevation and Sections of Door & Window.
5. Draw Cross section of load bearing wall over spread footing.
6. Draw plan & sectional elevation of Dog-Legged staircase.
7. Draw Pitched roof (King post truss).
8. Draw plan of a single storied residential building showing furniture & cub-boards using layers and blocks in CAD software.
9. Draw plan of a single storied residential building showing Electrical and Sanitary features using layers and blocks in CAD software.
10. Draw Plan, Section & Elevation of single storied residential building.
11. Learning basic commands in 3-D, creating pre-defined solid primitives and applying Boolean operations.
12. Create a two roomed ground floor building in 3-D and render the model.

Note:

CE 254	COMMUNICATIVE ENGLISH LAB	L	T	P	C	Int	Ext
		-	-	2	1	40	60

COURSE OUTCOMES:

1. Recognise the need of good comunication skills for professional courses.
2. Understand the basic tenets of communication.
3. Articulate syllables clearly, speaking fluently with correct pronunciation.
4. Develop their self awareness.
5. Understand the importance of group dynamics.

UNIT I   (7)

Basics of Presentations

Ice breaking session

Student Presentation-I

Learning about Presentations

> - Presentation structure

> - Managing nerves in a presentation

> - Mini Presentations

> - Feedback on presentations

UNIT II   (7)

Professional and Personal Grooming

Functional English

Non Verbal Communication

Stage Manners

Undersatnding and preparing a Presentation

Team presentations

UNIT III   (7)

Speech Nuances

Pronunciation

MTI-Mother Tongue Influence

Stress in English

Tempo of Speech

Indianisms and Often Made Mistakes

Idioms & Phrasal verbs

UNIT IV (7)

Free Talk

Dilemma Questions

Paraphrasing an article or a video in student's own words(Team task)

Impromptu speeches

Introducing TED TALKS

Movie based Learning-Karate Kid Movie-Understanding Life Skills

LEARNING RESOURCES:

REFERENCE BOOK(s):

1. Making Successful Presentations :A Self-Teaching Guide-Terry C. Smith,19846
2. Professional Presentations -Malcom Goodale
3. Giving Presentations -Jo Billingham
4. APA ART Speak Well I
5. HANDOUTS

CE 221	**MATHEMATICS-III**	**L T P C Int Ext**
	(Transform Calculus and Numerical Methods)	**3 - - 3 40 60**
	Semester IV [Second Year]	

COURSE OUTCOMES:

1. Determine Laplace and inverse transforms of a function.
2. Apply integral transforms in engineering.
3. Solve system of equations numerically.
4. Apply numerical methods to solve the mathematical models.

UNIT I   [CO:1] **(15)**

Laplace transforms - Introduction, properties of Laplace transforms, Evaluation of integrals by Laplace transforms, Laplace transform of periodic function.Inverse Laplace transforms - Method of partial fractions, other method of finding inverse transforms $f(t) = -\frac{1}{t} L^{-1}[\frac{d}{ds} F(s)]$, Convolution theorem.

UNIT II   [CO:2] **(15)**

Applications to differential equations - Solving second order ordinary differential equations with constant coefficients using Laplace transforms.Fourier transforms - Fourier transforms, Fourier sine and cosine transforms and inverse transforms.

UNIT III   [CO:3] **(15)**

Numerical solution of equations - Newton Raphson method, Gauss-Seidal method, Finite differences - Forward and backward differences, differences of a polynomial, Interpolation - Newton's forward and backward interpolation formulae (without proof)Lagrange's interpolation formula (without proof), inverse interpolation, Numerical differentiation - Finding first and second order derivatives using Newton's forward and backward differences formulae.

UNIT IV   [CO:4] **(15)**

Numerical Integration - Trapezoidal rule and Simpson's one third rule. Numerical solution of first order ordinary differential equations - Taylor's series method, Euler's method, Runge-Kutta method of fourth order.Numerical solution of partial equations - Classification of second order equations, solutions of Laplace and Poisson's equations.

LEARNING RESOURCES:

TEXT BOOK:

B.S. Grewal - Higher Engineering Mathematics, Khanna publishers, 42nd edition.

REFERENCE BOOK(s):

1. Erwin Kreyszig - Advanced Engineering Mathematics, 8th edition, New Age International (P) Ltd., 2007.

2. N.P. Bali and Manish Goyal - A text book of Engineering Mathematics, Lakshmi Publications.

WEB RESOURCES:

http://nptel.iitm.ac.in/courses/

CE 222   **LIFE SCIENCE FOR ENGINEERS**   L T P C Int Ext
                                                                                          2 - - 2 40 60

COURSE OUTCOMES:

1. Understand and appreciate the cellular organization and its diversity
2. Recognize and understand the molecular basis of different forms of life and their applications
3. Identify the complementarity in the structure and functions of biomolecules
4. Differentiate the genetic phenomena and demonstrate the genetic engineering of organisms

UNIT I   *Text Book - 1,2* [CO:1] **(6)**

Living Organisms:

Comparison of biological organisms with manmade systems, Classification of living organisms, Cellular basis of life.

Differences between prokaryotes and eukaryotes, classification on the basis of carbon and energy sources, molecular taxonomy.

UNIT II   *Text Book - 1,2* [CO:2] **(6)**

Proteins and Enzymes

Water, Biomolecules- carbohydrates, proteins and lipids, structure and functions of proteins and nucleic acids, hemoglobin, antibodies.

Enzymes: Basic Structure and Classification of Enzymes; Enzymes in Fermentation and industrial applications

UNIT III   *Text Book - 2,4* [CO:3] **(6)**

Cell Physiology

Bioenergetics, Respiration: Glycolysis and TCA cycle, Electron transport chain and oxidative phosphorylation.

Mechanism of photosynthesis; Neurons, synaptic and neuromuscular junctions

UNIT IV   *Text Book - 2,3* [CO:4] **(10)**

Genes and genetic material (DNA and RNA)

Mendel's laws, gene mapping, Mitosis and Meiosis, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation

Recombinant DNA Technology: recombinant vaccines, transgenic microbes, animalcloning, biosensors, biochips.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Wiley Editorial - "Biology for Engineers", Wiley India, First Edition 2018, ISBN: 9788126576340
2. U. Satyanarayana and U. Chakrapani - "Biochemistry", 3rd Edition, Uppala - publisher interlinks, 2007
3. AVSS Sambamurty - Genetics, 2nd Edition, Narosa publishing House, 2006
4. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018.

REFERENCE BOOK(s):

1. Alberts et al. The molecular biology of the cell, 6th edition, Garland Science, 2014.
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009.
3. John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3rd edition, 2012.

CE 223   **BASIC ELECTRICAL ENGINEERING**   L T P C Int Ext
                                                                   2 - - 2 40 60

COURSE OUTCOMES:

1. Understand the basic electrical circuits and batteries.
2. Explain the concept of AC circuits.
3. Describe the principle and operation of single phase transformer.
4. Understand the operation of electrical machines, measurement of various electrical quantities

UNIT I   *Text Book - T1,R1,R2* [CO:1] **(15)**

Batteries :Lead-acid, Nickel-iron, Nickel-Cadmium batteries (Operation only). Elementary calculations for energy consumption.DC Circuits :Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation

UNIT II   *Text Book - T1, T2, T4, R1, R3,* [CO:2] **(15)**

AC Circuits :Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. single-phase ac circuits consisting of RLC combinations (series and parallel), Three phase balanced circuits, voltage and current relations in star and deltaconnections.

UNIT III   *Text Book - T1,R2,R3* [CO:3] **(15)**

Transformers:Transformer Construction, Working principle of single phase transformer, EMF Equation, voltage ratio, current ratio, KVA rating,   ideal and practical transformer (Exclude phasor diagram), equivalent circuit form O.C and S.C tests. Losses in transformers, efficiency. Auto-transformer - Working principle, comparison with two winding transformer

UNIT IV   *Text Book - T1,R2,R3* [CO:4] **(15)**

Electrical Machines: Construction, working principle of DC generator and motor (Elementary treatment only). Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Construction and working of synchronous generators.Measuring Instruments: Classification of Instruments, Essentials of an Instrument, Construction and Working of PMMC,Construction and Working of MI Instruments.

LEARNING RESOURCES:

TEXT BOOK(s):

1. T.K.Nagasarkar and M.S.Sukhija - Principles of Basic Electrical Engineering, Oxford University Press, 2018.
2. D. P. Kothari and I. J. Nagrath - Basic Electrical Engineering, Tata McGraw Hill, 2010.

REFERENCE BOOK(s):

1. D. C. Kulshreshtha - Basic Electrical Engineering, McGraw Hill, 2009.

2. L. S. Bobrow - Fundamentals of Electrical Engineering, Oxford University Press, 2011.
3. E. Hughes - Electrical and Electronics Technology, Pearson, 2010.
4. V. D. Toro - Electrical Engineering Fundamentals, Prentice Hall India, 1989.
5. J.B Gupta - Basic Electrical Engineering, S.K.Kataria& Sons, 6th Edition 2015.

WEB RESOURCES:

1. http://www.egate.ws/
2. http://cosmolearning.org/courses/circuit-theory/
3. http://www.nptelvideos.in/2012/11/circuit-theory.html
4. http://elearning.vtu.ac.in/P9/notes/06ES34/Unit1-KCV.pdf

CE 224   **SOLID MECHANICS-II**   L T P C Int Ext
                                                                           3 - - 3 40 60

COURSE OUTCOMES:
1. Determine stress and strain in bodies subjected compound actions
2. Transform plane-stress condition and apply strain energy method
3. Apply failure theories and determine critical loads of columns
4. Determine deflection of statically determinate beams

UNIT I   *Text Book - T1,R1* [CO:1] **(13)**

Compound stresses:Introduction; Superposition and its limitation; Superposition of normal stresses;Stresses in a dam-middle-third rule; Eccentrically loaded short columns; Core or kernel of a section;Superposition of shear stresses; Stresses in closely coiled helical springs; Deflection of closely coiledhelical springs

UNIT II   *Text Book - T1,R1,R2* [CO:2,3] **(12)**

Analysis of Plane-Stress: Introduction; The basic problem; Equations for transformation of plane-stress;Principal planes and Principal stresses ; Maximum shear stresses ; Mohr's circle of stress ; Construction of Mohr's circleWork and Strain Energy:Introduction; Elastic strain energy for uni-axial stress; elasticstrain energy in pure bending; Strain energy of beams in shear; Strain energy of circular shafts intorsion; Work and strain energy method; Determination of displacements by work and strain energymethod

UNIT III   *Text Book - T1,R2,R3* [CO:3,4,5] **(12)**

Failure Theories:Introduction; maximum normal stress theory; maximum shearing stress theory;maximum strain energy theory; maximum distortion energy theory; comparison of theories.Buckling ofcolumns:Introduction; Examples of instability; Criteria for stable equilibrium; Euler load for column withpinned ends; Euler loads for columns with different end restraints; Limitations of the Euler's formulae;Generalized Euler buckling load formulae; Eccentric loads and the secant formula

UNIT IV   *Text Book - T1,R3,R4* [CO:6] **(13)**

Deflection of statically determinate beams:Introduction; strain-curvature and Moment-Curvature relation;Governing differential equation for deflection of elastic beams; Solution of beam deflection problem byDirect integration; Introduction to moment area method; Derivation of Moment area theorems;conjugate-beam method; slope and deflection of beams using moment area method.

LEARNING RESOURCES:

TEXT BOOK:

Mechanics of Materials by Pytel and Kiusalaas , Cengage Learning, SI Edition, 2017

REFERENCE BOOK(s):

1. Mechanics of materials by E.P. Popov , Pearson Education(India) ,2015.
2. Engineering mechanics of solids by E.P. Popov, Pearson Education(India) ,2015.
3. Elements of strength of materials by S.P.Timoshenko and D.H.Young, Affiliated East-West Press Pvt.Ltd.,2005
4. Mechanics of materials by R.C.Hibbeler, SI Edition, Pearson Education(India) ,2018
5. Mechanics of materials by P.Beer and E.R.Johnston, 7th Edition, McGraw-hill Education (India) Pvt.Ltd., 2017

CE 225   **CONCRETE TECHNOLOGY**   L T P C Int Ext

                                                                 3 - - 3 40 60

COURSE OUTCOMES:

1.Describe properties of cement and its testing

2.Describe properties of aggregates and their testing

3.Detail properties of fresh concrete and admixtures

4.Detail properties of hardened concrete

5. Discuss special concretes and mix design

UNIT I   *Text Book - T1,T2,R1,R2* [CO:1] **(13)**

Cement : General, Manufacture of Portland cement by dry process, Approximate oxide composition limits of OPC, Bogue's compounds, heat liberation from a setting cement, structure of hydrated cement, water requirements for hydration, Types Of Cements: Ordinary Portland cement, Portland pozzolana cement, Rapid hardening cement, Sulphate resisting cement, Slag cement, Quick setting cement, Super sulphated cement, Air entraining cement, Coloured cement, Expansive cement, High alumina cement.--Testing Of Cement:Fineness of cement using sieve test and air-permeability method, Normal consistency and setting times using Vicat apparatus, Soundness test using Le-chatlier apparatus, Compressive strength of cement.--Aggregates:Classification, source, size and shape texture and influence of texture on strength, specific gravity of aggregates, moisture in aggregates, bulking of fine aggregate, grading of aggregates, sieve analysis of fine and coarse aggregates.--Water:Permissible limit for solids as per IS456-2000, use of sea water for mixing concrete.

UNIT II   *Text Book - T1,T2,R1,R2* [CO:2,3] **(12)**

Fresh Concrete: Workability, factors affecting workability, slump test, Kelly ball test, V-B test, compaction factor test, segregation, bleeding, volume batching and weigh batching, hand mixing, machine mixing, mixing time, compaction of concrete, hand compaction, compaction by vibration, internal vibrator, form work vibrator, table vibrator, platform vibrator, surface vibrator.--Admixtures And Construction Chemicals: Chemical Admixtures: Plasticizers and super plasticizers, Retarders, Accelerators, Air-entraining admixtures. Effect of mineral admixtures on fresh and hardened concrete. Mineral admixtures: Fly ash, silica fume, Slag, Effect of mineral admixtures on strength and durability of concrete

UNIT III   *Text Book - T1,T2,R1,R2* [CO:2] **(13)**

Hardened Concrete: General; Effect of water-cement ratio on strength, Gain of strength with age, Compressive strength, Effect of height/diameter ratio on compressive strength; Flexural strength of concrete; Tensile strength of concrete; Non-destructive testing methods.   Elastic properties of aggregate, Factor's affecting modulus of elasticity, Poisson's ratio.--Durability Of Concrete: Factors contributing to cracks in concrete, Sulphate attack and methods of controlling sulphate attack, Chloride

attack, Corrosion of steel and its control.

UNIT IV   *Text Book - T1,T2,R1,R2* [CO:4] **(12)**

Special Concretes: Fibre reinforced concrete, Ferrocement, High strength concrete, Light-weight concrete, High performance concrete.--Proportioning Of Concrete Mixes: Concept of mix design, Variables in proportioning, Different methods of   mix design, Nominal mix and design mix, Indian standard method of mix design as per IS-10262:2009.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Concrete technology by A.R.Santha kumar, Ist Edition, Oxford UniversityPress,2006.
2. Concrete technology by M.S.Shetty, S.Chand & Company Pvt. Ltd., NewDelhi,2005

REFERENCE BOOK(s):

1. Properties of concrete by A.M.Neville, Pearson Education, 2007
2. Concrete technology by M.L.Gambhir, Tata McGraw-Hill, 2009.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/video.php?subjectId=105102088
2. http://www.engineeringcivil.com/theory/concrete-engineering/

CE 227   **HYDRAULICS AND HYDRAULIC MACHINES**   L T P C Int Ext
                                                                 3 - - 3 40 60

COURSE OUTCOMES:
1. Design most efficient rectangular, trapezoidal and circular open channel sections when the flow is uniform
2. Analyze varied flows in open channel
3. Construct hydraulic models by applying dimensional analysis and principles of similitude.
4. Predict the behaviour of Pelton, Francis turbines & centrifugal pump by varying pressure heads and speeds.

UNIT I   *Text Book - 1,2* [CO:1] **(15)**

Open Channel Flow - Uniform Flow:Introduction, Classification of flows, Types of channels; Chezy, Manning's, Kutter's Equations; Hydraulically efficient channel sections - Rectangular, Trapezoidal and Circular channels; Velocity distribution; Energy and momentum correction factors; Pressure distribution.Open Channel Flow - Non - Uniform Flow:Concept of specific energy; Specific energy curves; Critical flow; Critical flow in a rectangular channel; Critical slope; Different slope conditions; Channel transitions- Reduction in width of channels, hump;

UNIT II   *Text Book - 1,2* [CO:2] **(15)**

Open Channel Flow - Gradually Varied Flow:Dynamic equation; surface profiles; Computation of length of surface profiles by single step method; Back water curves and Draw down curves; Examples of various types of water surface profiles.Open Channel Flow - Rapidly Varied Flow: Hydraulic jump; Momentum principle applied to open channel flow; Specific force. Relation between sequent depths; Types of hydraulic jump; Energy loss in a hydraulic jump.

UNIT III   *Text Book - 1,2* [CO:3] **(15)**

Dimensional Analysis and Similitude:Dimensional homogeneity; Rayleigh's method; Buckingham π -method ; Geometric, Kinematic and Dynamic similarities; Reynold's, Froude, Euler, Mach and Weber numbers; Reynold's   and Froude Model laws; Scale effect; Distorted models.Momentum Principles:Action of jets on stationary and moving flat plates and curved vanes; Angular momentum principle; Torque in roto dynamic machines.

UNIT IV   *Text Book - 1,2* [CO:4] **(15)**

Hydraulic Turbines:Classification; Impulse; Reaction; Radial, Axial, mixed and tangential flow turbines; Pelton, Francis turbines; Runner profiles; Velocity triangles; Head and efficiency; Draft tube theory; Concept of specific speed and unit quantities; Selection of Turbines; Operational characteristics.Centrifugal Pumps:Manometric head; Losses and efficiencies; Work done; Working Principle; Priming; Velocity triangles; specific speed; characteristic curves; Cavitation effects;

LEARNING RESOURCES:

TEXT BOOK(s):

1. Hydraulics and Fluid Mechanics including Hydraulic Machines by P. N. Modi and S. M. Seth;

Standard Book house, New Delhi,2009

2. Fluid Mechanics and Hydraulic Machines by R. K. Bansal,9th Edition, Laxmi Publications, 2011.

REFERENCE BOOK(s):

1. Fluid Mechanics by A. K. Jain; Khanna Publishers, Delhi, 2008
2. Flow in Open channels by K. Subramanya, 3rd Edition, Tata McGraw-Hill,2008

WEB RESOURCES:

www.nptel.iitm.ac.in

CE 261   **BASIC ELECTRICAL ENGINEERING LAB**   L T P C Int Ext

                                                                                 - - 2 1 40 60

COURSE OUTCOMES:

1. Describe the common electrical components and their ratings
2. Arrange electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of resonance.
5. Verify the network theorems.

EXPERIMENTS:

1. Familiarisation of Electrical Installations and Electrical Testing Equipment: Miniature circuit breakers (MCBs), Moulded Case Circuit Breakers (MCCBs), Earth-leakage circuit breakers (ELCBs), Fuses, Types of Wires, Wire Gauges, continuity test, megger, Cables andEarthing.
2. Basic safety precautions. Introduction and use of measuring instruments voltmeter,ammeter, wattmeter, multi-meter, oscilloscope, measurement of basicparameters
3. Verification of KVL&KCL.
4. Transformers: Observation of the no-load current waveform on an oscilloscope (non sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).
5. OC & SC tests on single phasetransformer.
6. Loading of a transformer: measurement of primary and secondary voltages and currents, and power
7. Determination of choke coil parameters
8. Verification of relation in between voltage and current in three phase balanced star and delta connected loads.
9. Determination of resistance temperature coefficient
10. Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits
11. Demonstration of measurement of electrical quantities in DC and AC systems
12. To measure the single phase power by using three voltmeter method
13. To measure single phase power by using three ammeter method
14. To study the V-I characteristics of an incandescent lamp.

Note:**

A minimum of 10(Ten) experiments have to be Performed and recorded by the candidate to attain eligibility for Semester End Practical Examination.

CE 262	**CONCRETE TECHNOLOGY LAB**	L T P C Int Ext
		- - 2 1 40 60

COURSE OUTCOMES:

1. Assess the properties of concrete making materials like cement, fine aggregate and coarse aggregate for design mix of concrete

2. Determine the properties and behavior of concrete in fresh and hardened states.
3. Evaluate the quality of hardened concrete using non destructive testing methods.
4. Determine the flow properties of self compacting concrete.

EXPERIMENTS:

1. Determination of (a) Normal consistency of cement (b) Fineness of cement using 90 microns IS sieve.
2. Determination of Initial setting and final setting time of cement
3. Determination of (a) Specific gravity of cement (b) soundness of cement.
4. Determination of Fineness modulus of (a) Fine aggregate (b) Coarse aggregate
5. Determination of workability of concrete by conducting Slump cone test
6. Determination of workability of concrete by conducting Compaction factor / Vee-Bee consistometer test
7. Determination of (a) Cube compressive strength (b) Cylinder compressive strength
8. Determination of (a) Split tensile strength of concrete (b) Flexural strength of concrete
9. Determination of modulus of elasticity of concrete by conducting compression test on concrete cylinder
10. Determination of Bulk density and Specific gravity of (a) fine aggregate (b) coarse aggregates
11. Determination of Bulking of fine aggregate
12. Study of the effect of Super plasticizer on workability of concrete
13. Study on flow properties of self compacting concrete
14. Non-destructive test on concrete using Rebound Hammer
    15. Non-destructive test on concrete using Ultrasonic Pulse Velocity Tester
    16. Location of reinforcement bar in concrete using profile meter.
    17. Tests on Fibre reinforced Concrete (Cube crushing, Split tensile and Modulus of rupture tests)

    18. Demonstration of concrete design mix as per IS 10262:2009.

Note**:

CE 263	**FLUID MECHANICS LABORATORY**	**L T P C Int Ext**
		- - 2 1 40 60

COURSE OUTCOMES:
    1. Determine the discharge using various flow measuring devices.
    2. Calculate the minor and major losses in pipes.
    3. Develop performance curves of turbines and pumps.

EXPERIMENTS:
1. Verification of Bernoulli's theorem.
2. Venturi meter : Determination of Coefficient of discharge.
3. Orifice meter: Determination of Coefficient of discharge.
4. Orifices : Determination of Coefficient of discharge by steady and unsteady flow methods.
5. Mouth pieces: Determination of Coefficient of discharge by steady and unsteady flow methods.
6. Characterization of laminar and turbulent flows by Reynold's apparatus.
7. Determination of friction factor of Pipes.
8. Determination of loss of head in pipes due to bend /sudden contraction/ sudden expansion.
9. Determination of Coefficient of discharge for rectangular notch / V – notch.
10. Determination of Manning's and Chezy's coefficients in open channel.
11. Study of characteristics of hydraulic jump.
12. Measurement of force due to impact of jets on vanes of different types.
13. Performance studies on pelton turbine
14. Performance studies on Francis/Kaplan turbine

Note**:

CE264	**SURVEYING FIELDWORK**	L T P C Int Ext
		- - 2 1 40 60

COURSE OUTCOMES:

1. Conduct basic field surveys.

2. Enhance the knowledge in using Auto level, Theodolite instruments.

3. Enhance the knowledge in using the Total Station Instrument by avoiding manual errors.

4. Operate the Total Station instrument which is vital for any construction firm.

5. Conduct experiments inside the institution and also they are trained for the on-site works outside the institution.

EXPERIMENTS:
1. Measurement of area by chain and Cross staff
2. Traversing by compass and graphical adjustment.
3. Measurement of elevation difference between two points using any leveling Instrument (Fly Leveling)
4. Elevation difference between two points by Reciprocal leveling method.
5. Measurement of horizontal and vertical angles.
6. Setting of simple circular curve using tape or/and theodolite.
7. Setting of simple circular curve using two theodolite method.
8. Setting out for Building Foundation.
9. Study of Instrument - Determination of Distances, Directions and Elevations.
10. Determination of Boundaries of a Field and computation of area and volume.
11. Determination of Heights of objects.
12. Stake out and point to line.
13. Setting of a simple circular curve using Total Station.
14. Setting out for Building Using Total Statio

Note:**
A minimum of twelve (12 Nos) shall be done

CE 311   **STRUCTURAL ANALYSIS**   L T P C Int Ext
                                                                        2 1 - 3 40 60

COURSE OUTCOMES:
1. Analyse arches and cables and determine displacements of statically determinate structures by energy methods
2. Draw influence line diagrams for simple beams, trusses and three-hinged arches
3. Apply compatibility methods to statically indeterminate structures
4. Analyse statically indeterminate structures using approximate methods

UNIT I   [CO:1]   ()

ArchesTheoretical and actual arch, Eddy's theorem Types of arches, Three-hinged arches.CablesEquation of the cable subjected to uniformly distributed load, Horizontal tension in the cable, Tension in the cable supported at different levels, Length of the cable, Effect of change in temperature.

UNIT II   [CO:2]   ()

Displacements of statically determinate structures by Energy MethodsVirtual Work, Betti's and Maxwell's laws of reciprocal deflections, Applications of virtual work, Deflection of trusses and frames, Castigliano's theorems.Rolling loads and Influence Lines Maximum shear force and bending moment in simply supported beams due to single concentrated load, uniformly distributed load longer than span, uniformly distributed load shorter than span, two concentrated loads, series of concentrated loads; Concept of influence line, Influence Lines for reaction, shear force and bending moment in simply supported beams, Influence lines for simple trusses and three-hinged arches.

UNIT III   [CO:3]   ()

Statically Indeterminate Structures –Compatibility methodsDegree of indeterminacy and stability of structures, Fixed beams, Theorem of three moments, Two-hinged arches, Influence lines for continuous members-Muller-Breslau's principle.

UNIT IV   [CO:4]   **()**

Statically Indeterminate Structures –ApproximateMethods Indeterminate trusses, Portal frames , Continuous beams,   Building frames subjected to gravity loads, Building frames subjected to lateral loads - Portal method, Cantilever method.

LEARNING RESOURCES:

TEXT BOOK:

Basic structural analysis by CS Reddy, 3rd Edition, Tata McGraw-Hill, 2010.

REFERENCE BOOK(s):

1. Basic structural analysis by KU Muthu et.al. , IK International,2011.
2. Intermediate structural analysis by CK Wang, Tata McGraw-Hill, 2010.
3. Structural Analysis by Devdas Menon, Narosa Publishinh House, 2008.
4. Structural analysis by RC Hibbeler, 6th Edition, Pearson Education

WEB RESOURCES:

1. •   http://www.cdeep.iitb.ac.in/nptel/Civil%20Engineering/Structural%20Mechanic%20II/Course%20Objective.html.
2. •   http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Structural%20Analysis/New_index1.html

CE 312   **SOIL MECHANICS**   **L T P C Int Ext**

                                                       3 - - 3 40 60

COURSE OUTCOMES:

1. Understand index properties of soils
2. Classify the soil, calculate the effective stress, permeability
3. Calculate the seepage flow through soil using flow nets. Able to determine the vertical stress increase due to applied loads and compaction characteristics of soil.
4. Assess engineering properties of soils like compaction, consolidation, shear strength and their importance

UNIT I   *Text Book - T1,R1,R2* [CO:1] **(13)**

Introduction: Soil Formation and soil types; Regional soil deposits of India, Basic Structural unit of clay and soil fabricsBasic Definitions and Relations: Phase diagrams; Simple definitions; some important relationships.Index Properties: Grain size distribution; Atterberg Limits; Relative density; Significance of other Soil Aggregate properties

UNIT II   *Text Book - T1,R1,R2* [CO:2] **(12)**

Soil Classification: Introduction; Particle size classification as per IS-code; Unified soil classification system; Indian standard soil classification system, Applications of Soil Classification.Principles of Effective Stress: Introduction, Principle of effective stress; physical meaning of effective stress; capillarity in soilPermeability of Soils: Darcy's law and its Validity; Determination of coefficient of permeability : constant and variable head methods, Factors affecting permeability; Permeability of stratified soil deposits.

UNIT III   *Text Book - T1,R2,R3* [CO:3] **(13)**

Seepage through Soils: Head, Gradient and Potential; Seepage pressure, Quick sand condition; Two dimensional flow- Laplace's equation; flow nets-properties and uses; seepage calculation; graphical method for obtaining flow nets; unconfined flow; seepage in anisotropic condition; protective filters.Vertical Stresses Below Applied Loads: Introduction; Boussinesq's equation; vertical stress distribution diagrams; vertical stress beneath loaded areas- point load, line load, strip load, Circular, rectangular load; Newmark's influence chart; Approximate stress distribution methods for loaded areas; Westergaard's equation.Compaction of Soils: Introduction; Laboratory tests; Factors affecting compaction; Structure and engineering behaviour of compacted cohesive soils; Compaction in the field; Compaction specifications and field control.

UNIT IV   *Text Book - T1,R2,R3* [CO:4] **(12)**

Compressibility of Soil and Consolidation: Introduction; Compressibility; Time-rate of consolidation- Mechanics of consolidation and Terzaghi's one dimensional consolidation; Consolidation test; Computation of settlement; Secondary consolidation settlement.Shear Strength of Soils: Introduction; Stress at a point- Mohr Circle of stress; Mohr-coulomb Failure Criterion; Modified failure envelope;

Measurement of Shear Strength-Direct shear test, Triaxial test, Unconfined compression test and Vane shear tests; Shear strength of Clayey soils; Shear Strength of Sands; Drainage conditions and Strength parameters; liquefaction.

LEARNING RESOURCES:

TEXT BOOK:

Basic and Applied Soil Mechanics - Gopal Ranjan and A.S.R.Rao, New Age International Publishers, 2011.

REFERENCE BOOK(s):

1. Foundation Analysis & Design by Bowles, J.E., McGraw- Hill , 1995
2. A Textbook of Soil Mechanics and Foundations by B.C. Punmia, Laxmi Publications, 2005
3. A Textbook of Soil Mechanics and Foundation Engineering by K.R.Arora, Standard Publishers & Distributors, 2011
4. A Text book of Soil Mechanics and Foundation Engineering - P.Purushotthama Raj, Pearson Education

WEB RESOURCES:

www.iitm.ac.in

CE 313	HYDROLOGY & IRRIGATION ENGINEERING	L	T	P	C	Int	Ext
		2	1	-	3	40	60

COURSE OUTCOMES:

1. Construct hydrograph of a catchment
2. Measure the stream flows and calculate yield of wells under steady state.
3. Estimate irrigation requirements of crops and canal carrying capacity.
4. Plan selection of site & capacity of a reservoir and identify the functions of components of hydro power plants

.

UNIT I   *Text Book - 1,2* [CO:1] **(15)**

Hydrology:Hydrologic cycle; Precipitation types; Rain gauges; Computation of average rain fall over a basin; Abstraction from rainfall; evaporation, factors affecting evaporation, measurement of evaporation; Infiltration, factors affecting infiltration, measurement of infiltration, infiltration indices; Runoff; Factors affecting runoff; Computation of runoff; Design flood, Estimation of maximum rate of runoff. Hydrographs:Hydrograph analysis; Unit hydrograph; Construction of UH for an isolated storm, Application of UH to the construction of a flood hydrograph resulting from rainfall of unit duration; Construction of unit hydrograph of different unit duration from a unit hydrograph of some given unit duration by superposition method and S-curve method.

UNIT II   *Text Book - 1,2* [CO:2] **(15)**

Stream Gauging:Necessity; Selection of gauging sites; Discharge measurement- Area-Velocity method; Slope-Area method; Tracer method, Electromagnetic induction method, ultrasonic method; Measurement of depth – Sounding rod, Echo-sounder; Measurement of velocity; Floats – Surface float, Sub–surface float, Velocity rod; Current meter; Measurement of stage – Staff gauge, wire gauge, water stage recorder, bubble gauge recorder; stage-discharge curve.Ground Water Hydrology:Introduction; Aquifer; Aquiclude; Aquifuge; Specific yield; Specific retention; Divisions of sub–surface water; Water table; Types of aquifers; Well hydraulics- Steady radial flow to a well– Dupuit's theory for confined and unconfined aquifers; Tube wells - Open wells; Yield of an open well–Constant level pumping test and Recuperation test.

UNIT III   *Text Book - 1,2* [CO:3] **(15)**

Introduction to Irrigation:Definition; Necessity; Scope of irrigation science; Benefits of irrigation; Ill-effects of irrigation; Types of irrigation.Methods of Irrigation:Methods of applying water to crops; Uncontrolled or wild flooding; Free flooding; Contour laterals; Border strip method; Check flooding; Basin flooding; Zigzag method; Furrow method; Contour Farming; Sub-surface irrigation; Sprinkler irrigation; Drip irrigation.Water Requirement of Crops:Functions of irrigation water; Classes and availability of soil water; Saturation capacity; Field capacity; Wilting point; Available moisture and readily available moisture; Moisture equivalent; Soil – moisture deficiency; Limiting soil moisture conditions; Depth and frequency of irrigation; Duty and Delta; Base period; Relation between Duty and Delta; Factors affecting duty; Methods of improving duty; Gross command area; Culturable command area; Culturable cultivated and uncultivated area; Kor depth and Kor period; Consumptive use of water ; Irrigation efficiencies – Water conveyance efficiency, Water application efficiency, Water distribution efficiency and

Consumptive use efficiency; Determination of irrigation requirements of crops; crop rotation, Assessment of Irrigation water.

UNIT IV   *Text Book - 1,2* [CO:4] **(15)**

Reservoir Planning:Introduction; Investigations for reservoir planning; Selection of site for a reservoir; Zones of storage in a reservoir; Storage capacity and yield; Mass inflow curve and demand curve; Calculation of reservoir capacity for a specified yield from the mass inflow curve; Determination of safe yield from a reservoir of a given capacity; Sediment flow in streams; Reservoir sedimentation; Life of reservoir; Reservoir sediment control; Multipurpose reservoir; Flood routing; Methods of flood routing – Inflow - Storage Discharge Curves method and Trial and error method (Description only). Water Power Engineering:Introduction; Hydropower - Advantages and   disadvantages; Estimation of hydropower; Flow duration curve; Power duration curve; Load curve; Load factor; Capacity factor; Utilization factor; Diversity factor; Load duration curve; Firm Power; Secondary power; Types of hydel schemes; Forebay; Intake structures; Penstocks; Surge tank; Tail race; Turbines; Selection of suitable type of turbine.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Irrigation and water power Engineering by B.C. Punmia and Pande B.B. Lal; 16th Edition,Laxmi Publications Pvt. Ltd., New Delhi.
2. Irrigation Engineering and Hydraulic structures by S. K. Garg; Khanna Publishers, Delhi,2011.

REFERENCE BOOK(s):

1. Irrigation, Water Resources and Water Power Engineering by P.N. Modi, 7th Edition, Standard Book House, 2008.
2. Irrigation, water power and water resources Engineering by K R Arora, Standard Publishers, 2010.
3. Engineering Hydrology by K. Subramanya, 3rd Edition, Tata McGraw-Hills
4. Engineering Hydrology by P. Jayarami Reddy, Laxmi Publications
5. Applied Hydrology by Ven Te Chow, Maidenment and Mays, Mc Graw Hill Publications.

WEB RESOURCES:

www.nptel.iitm.ac.in

CE 314   **ENVIRONMENTAL ENGINEERING**   L T P C Int Ext

                                                                                    3 - - 3 40 60

COURSE OUTCOMES:

1. Determine the quantity of water required for a community based on predicted future population and percapita requirement of water.

2. Design water supply main diameter from selected source.

3. Determine the quality of water to check compliance with drinking water quality standards.

4. Design water treatment units based on quality and quantity of water.

5. Analyse complex water distribution system using Hardy Cross method.

UNIT I   *Text Book - T1,R1,R2* [CO:1,2] **(12)**

Introduction to Water Supply Engineering and Quantity of WaterObjectives of water supply systems; Role of Environmental Engineer, Types of Demands, Estimating requirements; Design period; Per capita consumption; Factors affecting per capita consumption; Fluctuations in demand; Prediction of populationSources of water supply & IntakesClassification of sources of water supply; Choice of source; Comparison of sources, Intake structures: Location of intake; River, reservoir and canal intakesTransportation and Pumping of WaterTypes of conduits; Capacity and design; Materials for pipes, Laying and Jointing of pipes; Leakages and testing of pipeline; Classification of pumps; Choice of pumps

UNIT II   *Text Book - T1,R1,R2* [CO:3] **(13)**

Quality of WaterImpurities in water; Water borne diseases, Routine water analysis - physical, chemical and bacteriological tests; BIS Standards for drinking water, Plain Sedimentation and CoagulationTheory of sedimentation; Stoke's law; Sedimentation tanks; Design aspects; Principle of coagulation; Chemicals used for coagulation; Optimum Dose of Coagulant.

UNIT III   *Text Book - T1,R1,R5* [CO:4] **(12)**

Filtration of WaterTheory of filtration; Filter materials; Slow sand and rapid sand filters; Construction operation and design; Slow sand filters verses rapid sand filters; Troubles in rapid sand filters; Pressure filters.Disinfection of WaterDifferent methods of disinfection; Chlorination: Disinfection action; Forms of chlorine; Types of chlorination; Testing of chlorine residuals

UNIT IV   *Text Book - T1,R1,R4* [CO:5] **(12)**

Miscellaneous Treatment MethodsWater softening: Methods of removing temporary and permanent hardness; Aeration, Defluoridation, Desalination: Importance, methods.Distribution SystemGeneral requirements; Classification; Methods of supply; Available pressure in the distribution system; Layouts of distribution networks; Distribution reservoirs; Functions; Types; Capacity of balancing tank; Analysis of distribution system by Hardy-cross method, Service connection, Sluice valves; Check valve; Air valve; Drain valve; Water Meters.

LEARNING RESOURCES:

TEXT BOOK:

Elements of Environmental engineering by K. N. Duggal, S. Chand & Company Ltd., 2010.

REFERENCE BOOK(s):

1. Environmental Engineering Vol. I - Water supply engineering by S. K. Garg; Khanna Publishers, Delhi, 2010.
2. Environmental Engineering by Peavy and Rowe, Mc Graw Hill 7th Edition, 1987.
3. Water Supply and Sewerage by E.W. Steel and Terence J. Mc Ghee, Mc Graw Hill Publishers, New York
4. Water & Wastewater Technology by Mark J. Hammer; John Wiley & Sons.
5. Manual on Water Supply & Treatment; CPH and EEO, Ministry of Urban Development; Govt. of India, New Delhi.

WEB RESOURCES:

www.nptel.iitm.ac.in

CE 315	DESIGN OF STEEL STRUCTURAL ELEMENTS	L T P C Int Ext
		2 1 - 3 40 60

COURSE OUTCOMES:

1. Understand the basic elements of steel structures and the fundamentals of structural steel fasteners
2. Design steel tension members and compression members
3. Design steel beams
4. Design beam-columns, column splices and bases

UNIT I   *Text Book - T1,R1,R2,R3* [CO:1] **(13)**

Introduction: What are steel structures ? ;   What a steel structure consists of ? ;   Structural steel; Products of structural steel ; Standards , Codes and Specifications; Fatigue ;Brittle fracture ; Corrosion protection of steel structures ;   Design philosophies ; Methods of structural analysis ;   Plate(Local) buckling ; Classification of sections;   Structural steel fasteners: Introduction; Welding - Shield metal arc-welding, Automatic submerged arc- welding, Types of welds, Quality of welds, Weld symbols and notation, Specifications for welding ; Bolting-Types of failure, Design specifications, High- strength bolts

UNIT II   *Text Book - T1, R1, R2, R3* [CO:2] **(12)**

Tension members: Introduction ;   Net area ;   Shear-lag ;   Design of tension members Compression membersIntroduction ;   Euler's buckling theory ;   Behaviour of real columns ;   Types of sections ; Design of columns ; Validity of design strength calculations ; Design of compression members ; Design Procedure ;   Built-up compression members.

UNIT III   *Text Book - T1, R1, R2, R3* [CO:3] **(13)**

Beams:Introduction ; Flexural behaviour of beams which does not undergo lateral buckling;   Flexural behaviour of beams which undergo lateral buckling ;   Shear behaviour ;   Web buckling and Crippling ; Design strength in bending ; Design strength in shear ;   Limit state serviceability – Deflection

UNIT IV   *Text Book - T1, R1, R2, R3* [CO:4] **(12)**

Beam-columns:Introduction; Analysis of beam-columns; Modes of failure; Design specifications Column Splices and Bases: Introduction ; Column splices ; Column bases

LEARNING RESOURCES:

TEXT BOOK:

Design of steel structures by K.S.Sai Ram, Pearson Education, 2015

REFERENCE BOOK(s):

1. Design of steel structures by N.Subramanian, Oxford University Press, 2016.
2. Limit state design of steel structures by M.R.Shiyekar , PHI Learning,2017.
3. Limit state design of steel structures by S.K.Duggal, McGraw-Hill,2017.

WEB RESOURCES:

http://nptel.iitm.ac.in

CE 316   **DESIGN OF RC STRUCTURAL ELEMENTS**   L T P C Int Ext
                                                                     3 - - 3 40 60

COURSE OUTCOMES:
1. Design beams for flexure using working stress method.
2. Design beams for flexure, shear and torsion using limit state method.
3. Design beams for Bond, Development length and verify the serviceability checks.
4. Design various RC elements like simply supported beam, cantilever beams and stair case.

UNIT I   *Text Book - T1,T2,R1* [CO:1,3] **(15)**

Introduction: Role of structural engineer; Reinforced concrete; Structural elements; Loads on structures ; Strength and serviceability; Methods of design ; Codes of practice IS456-2000.Design of beams for Flexure (Working Stress Method)Assumptions; Permissible stresses in concrete and steel; Transformed section; Analysis and design of beams for flexure of singly reinforced, doubly reinforced and flanged sections.Deflection and CrackingSpan/Effective depth ratio; Calculation of Short-term and Long-term deflections; Cracking; Bar spacing controls.

UNIT II   *Text Book - T1,T2,R1* [CO:2] **(15)**

Design of beams for Flexure (Limit State Method)Assumptions; Limit states; Partial safety factors; Modes of failure; Maximum depth of neutral axis; Analysis and design for flexure of singly reinforced, doubly reinforced and flanged sections.

UNIT III   *Text Book - T1,T2,R1* [CO:2,3] **(10)**

Design of beams for Shear and Torsion (Limit State Method)Shear in a homogeneous beam; Shear in R.C. beams; Diagonal tension and diagonal compression; Design for shear by working stress method and limit state method; Torsion - Introduction, Effect of torsion, IS Code provisions; Design for torsion; Design of beam for Bond and Development lengthAnchorage bond; flexural bond; Design for bond; Check for development length by working stress method and limit state method.

UNIT IV   *Text Book - T1,T2,R1,R2* [CO:4] **(10)**

Design and Detailing of the following:a.Simply supported and Cantilever beams (Working stress method)b.Simply supported and Cantilever beams (Limit state method)c.Dog-legged stair case (Limit state method)

LEARNING RESOURCES:

TEXT BOOK(s):

1. Reinforced Concrete , Vol.1 by H. J. Shah, Charotar publishing house Pvt.Ltd.,

2. Reinforced Concrete (limit state design) by Ashok K. Jain, Nem Chand & Bros., Roorkee

REFERENCE BOOK(s):

1. Reinforced concrete design by Pillai and Menon, 2nd Edition,Tata McGraw-Hill
2. Reinforced-concrete-structures-R-Park-T-Paulay

WEB RESOURCES:

http://nptel.ac.in/courses/105105105/

MC 003	**ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**	**L T P C Int Ext**
	(Common for all Branches)	**2 - - - 100 -**
	Semester V [Third Year]	

COURSE OUTCOMES:

1. Understand the concept of traditional knowledge and its importance.
2. Apply significance of traditional knowledge protection.
3. Analyze the various enactments related to the protection of traditional knowledge.
4. Evaluate the concepts of intellectual property to protect the traditional knowledge and the traditional knowledge in different sectors .

UNIT I   [CO:1] **(8)**

Introduction to traditional Knowledge: Definition of traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge,characteristics, the historical impact of social change on traditional knowledge syatems, traditional knowledge VS western knowledge, traditional knowledge vis-a-vis formal knowledge.

UNIT II   [CO:2] **(8)**

Protection of traditional knowledge: the need for protecting traditional knnowledge, Significance of TK Protection, Value of TK in global economy, Role of Government to harness TK.

UNIT III   [CO:3] **(8)**

A:Legal framework and TH: The Scheduled Tribes and Other Traditional Forest Dwellers(recognition of Forest Rights) ACt 2006; Plant Varities Protection and Farmer's Rights Act,2001 (PVPFR ACT)

B: The Biological Diversity Act 2002 and Rules 2004 and the protection of traditional knowledge bill, 2016

UNIT IV   [CO:4] **(8)**

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and Traditional knowledge, Strategies to increase protection of traditional knowledge, Traditional knowledge in different sectors; Engineering, Medicine syatem, biotechnology and agriculture, Managment of biodiversity, Food security of the country and protection of TK.

LEARNING RESOURCES:

TEXT BOOK:

Traditional Knowledge System in India, by Amit Jha, ATLANTIC Publishers, 2009.

REFERENCE BOOK(s):

1. Traditional Knowledge System and Technology in India by Basanta Kumar, Mohanta and Vipin Kumar Singh ,PratibhaPrakashanPublishers,2012.
2. Knowledge Traditions and Practices of India by Kapil Kapoor and Michel Danino.

WEB RESOURCES:

1. http://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

CE 351   **SOIL MECHANICS LAB**   L T P C Int Ext
                                                                       - - 2 1 40 60

COURSE OUTCOMES:

    1. Classify the soil.

    2. Study of suitability of soil for various civil engineering projects.

    3. Determine engineering properties of soils which are required to design of retaining walls,

foundations, checking settlements and stability of slopes.

EXPERIMENTS:

1. Determination of water content by oven drying method and rapid moisture tester.
2. Determination of specific gravity soil by using density bottle and pycnometer
3. Gradation analysis
   (a) Mechanical Sieve analysis
   (b) Hydrometer analysis
4. Determination of Atterberg limits
5. Determination of free swell index and swelling pressure of expansive soils
6. Determination of field unit weight by
   (a) Core cutter method
   (b) Sand replacement method
7. Determination of permeability by
   (a) Constant head permeameter
   (b) Variable head permeameter
8. Direct shear test.
9. Vane shear test.
10. Unconfined compression test
11. IS - Light compaction test
12. IS - Heavy compaction test
13. Triaxial shear test
14. Determination of coefficient of consolidation by Taylor's and Casagrande's methods.

Note**:
Note: A minimum of ten (10 No's) shall be done and recorded

CE 352	ENVIRONMENTAL ENGINEERING LAB	L T P C Int Ext
		- - 2 1 40 60

COURSE OUTCOMES:

1. Determine physical, chemical, biological quality of water/sewage.

2. Demonstrate the usage of instruments with appropriate precautions to obtain maximum precision in the readings.

3. Determine the optimum dosage of alum needed at treatment plant based on the turbidity of the given sample.

4. Assess the suitability of given water for drinking purpose as per BIS standards (IS 10500 – 2012).

EXPERIMENTS:

1. Determination of total, suspended and dissolved solids in water / sewage sample
2. Determination of fixed and volatile solids in water / sewage sample
3. Determination of Settleable Solids
4. Determination of turbidity of water / sewage sample
5. Determination of pH value of water / sewage sample
6. Determination of optimum dose of coagulant
7. Determination of residual chlorine
8. Determination of temporary and permanent hardness of water sample
9. Determination of chloride concentration of water / sewage sample
10. Determination of acidity of water sample
11. Determination of alkalinity of water sample
12. Determination of fluorides in water sample
13. Determination of Dissolved Oxygen of water / sewage sample
14. Determination of Biochemical Oxygen Demand (BOD) of waste water

Note:

LEARNING RESOURCES:

TEXT BOOK:

Standard methods for examination of water and wastewater by APHA.

REFERENCE BOOK(s):

1. Environmental Engineering Vol. I - Water supply engineering by S. K. Garg; Khanna Publishers, Delhi, 2010.
2. Water & Wastewater Technology by Mark J. Hammer; John Wiley & Sons.

CE 321   **HIGHWAY ENGINEERING**   L T P C Int Ext
                                                              3 - - 3 40 60

COURSE OUTCOMES:

1. Plan road network by linking of various surveys and to evaluate and develop master plans for a better road network
2. Select appropriate materials for use in different road layers for different types of pavements.
3. Perform road pavement design and analysis by various IRC and other methods
4. Interpret geometric design fundamentals, in relation to safety and driver comfort, focusing on horizontal and vertical alignment
5. Develop traffic signals and help to properly regulate the traffic and better use of road network.

UNIT I   *Text Book - T1,R1* [CO:1] **(10)**

Highway Development and Planning: Brief Introduction; necessity of highway planning surveys preparation of master plan highway planning in India.Highway alignment: Factors controlling alignment; Engineering surveys, Drawing & report.

UNIT II   *Text Book - T1,R1* [CO:2] **(12)**

Highway Geometric Design: Highway cross section elements; Sight distance; Design of horizontal alignment; Design of vertical alignment.   Highway materials Sub grade soils-CBR tests; Stone aggregates; Bitumen materials; Paving mixes.

UNIT III   *Text Book - T1,R2* [CO:3] **(13)**

Design of Highway Pavements: Design factors; Design of flexible pavements - IRC method, IRC recommendations; Design of Rigid pavements -Westergard's stress equation for wheel loads and temperatures stress; IRC recommendations. Highway construction and maintenance: Construction of water bound macadam roads; bituminous pavements and cement concrete pavements; Construction of joints in cement concrete pavements; Maintenance of highways- Water bound macadam roads, Bituminous pavements, Cement concrete pavements

UNIT IV   *Text Book - T1,R2* [CO:4,5] **(12)**

Highway Drainage: Importance of highway drainage; Requirements; Surface drainage; Sub-surface drainage; Road construction in water logged areas and black cotton soils. Traffic engineering : Introduction; Traffic characteristics- Road user, vehicular & travel pattern; Traffic operation- signal design; Types of inter-sections; Design of rotary intersection;

LEARNING RESOURCES:

TEXT BOOK:

Highway Engineering by S. K. Khanna & C. E. G. Justo; Nemchand & Brothers, Roorkee, 2011

REFERENCE BOOK(s):

1. Principles of Transportation Engineering by Partha Chakroborty & Animesh Das, PHI Learning, 2009
2. Principles of Transportation Engineering and highway engineering by G. Venkatappa Rao, Tata McGraw-Hill, 1995

WEB RESOURCES:

1. http://nptel.iitm.ac.in/syllabus/syllabus.php?subjectId=105101087
2. www.irc.org.in (for various journals and manuals and code provisions)
3. www.springerlink.com (for various e journals)

CE 322	FOUNDATION ENGINEERING	L T P C Int Ext
		3 - - 3 40 60

COURSE OUTCOMES:

1. U n d e r s t a n d exploration of soil
2. Calculate earth pressures to design retaining walls
3. Verify stability of various slopes
4. Determine bearing capacities of shallow foundations
5. Determine bearing capacities of pile foundation and selection of pile

UNIT I   *Text Book - T1,R1,R2,R3* [CO:1, CO:2] **(14)**

Soil Exploration: Introduction; Methods of exploration; Methods of Boring; Soil Samples; Soil samples and Sampling; Number and disposition of trial pits and borings; Depth of exploration; Plate load test; Penetration tests- SPT, SCPT and DCPT; Geophysical methods- Electrical resistivity and seismic refraction methods; Bore logs; Site investigation report.Earth Pressures & Retaining Walls: Introduction; Effect of wall movement on Earth Pressure; Earth Pressure at rest; Rankine's theory of Earth pressure; Coulomb's theory of earth pressure; Culmann's graphical method for active earth pressure; Friction circle method; Types of retaining walls, selection of backfill and placement condition, drainage in retaining walls, Design considerations for retaining walls.

UNIT II   *Text Book - T1,R4,R5* [CO:3, CO:4] **(10)**

Stability of Slopes: Introduction; Infinite slopes and translational slides; Definitions of factor of safety; Finite slopes- Types of slip surface; Total stress and Effective stress methods of analysis; $\emptyset_u = 0$ Analysis (Total Stress Analysis) ; c-Ø Analysis- Method of slices; Location of most Critical Circle; Stability of Earth Dam Slopes; Friction Circle Method; Taylor's Stability Number; Bishop's method of stability analysis.Shallow Foundations: Concept of Foundations; Types of foundations and their applicability; General requirements of foundations; Location and Depth of foundation

UNIT III   *Text Book - T1,R4,R5* [CO:4] **(12)**

Bearing Capacity of Shallow Foundation: Terminology relating to bearing capacity; Bearing Capacity of Shallow Foundations - Terzaghi's Bearing Capacity theory, Meyerhof's Bearing Capacity Theory, Skempton's Bearing Capacity theory for Clay soils; IS-Code Recommendations for Bearing Capacity; Influence of water table on bearing capacity.Settlement Analysis: Settlement of Shallow foundation - Types; Settlements of foundations on granular soils, Allowable settlements, Methods to reduce differential settlements, Allowable Bearing Pressure based on SPT Number- Teng's correlation and IS recommendation.

UNIT IV   *Text Book - T1,R3,R4* [CO:5] **(12)**

Pile Foundations: Introduction; Uses of Piles; Types of Piles; Pile load carrying capacity in compression - Static Pile Load formula, Dynamic Pile formulae; static pile load test; Correlations with Penetration test data; Group action of Piles - load carrying capacity and settlement; Negative skin friction.Well

Foundations: Types of wells; Components of well foundation; Shapes of wells; Depth of a well foundation, Forces acting on well foundation; Construction and Sinking of wells.

LEARNING RESOURCES:

TEXT BOOK:

Basic and Applied Soil Mechanics - Gopal Ranjan and A.S.R.Rao, New Age International Publishers, 2011.

REFERENCE BOOK(s):

1. Foundation Analysis & Design by Bowles, J.E., McGraw- Hill, 1995.
2. Geotechnical Engineering by SK Gulati & Manoj Datta, Tata McGraw- Hill,2010.
3. Principles of Foundation Engineering by B.M. Das., PWS Publishing Company, 4th edition, 1999.
4. Foundation Engineering by Varghese, P.C., Printice Hall of India, New Delhi
5. Soil Mechanics and Foundation Engineering by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications Pvt., Ltd., New Delhi

WEB RESOURCES:

www.iitm.ac.in

CE 323   **IRRIGATION STRUCTURES**   L T P C Int Ext
                                                               3 - - 3 40 60

COURSE OUTCOMES:
1. Design gravity and earth dams
2. Select suitable type of spillway and energy dissipation work
3. Design irrigation canals and suggest suitable remedial measures of water logging.
4. Design impervious floor of diversion head works using seepage theories and identify suitable types of canal regulation works.

UNIT I   *Text Book - 1,2* [CO:1] **(15)**

Dams In General:Introduction; Classification; Gravity dams, Arch dams, Buttress dams, Steel dams, Timber dams, Earth dams and rock fill dams; Physical factors governing selection of type of dam and selection of site for a dam.Gravity Dams:Introduction; Forces acting on a gravity dam; Combination of loading for design; Modes of failure and criteria for stability requirements; Stability analysis; Elementary profile of a gravity dam; Practical profile of a gravity dam; Limiting height of a gravity dam; High and low gravity dams; Design of gravity dams–single step method; Galleries; Joints; Keys and Water seals; Stability analysis of non–overflow section of gravity dam.

UNIT II   *Text Book - 1,2* [CO:2] **(15)**

Earth Dams:Introduction; Types of earth dams; Causes of failure of earth dams; Criteria for safe design of earth dams; Section of an earth dam; Seepage control measures.Spillways:Introduction; Types of spillways; Energy dissipation below spillways for relative positions of jump height curve and tail water curve; Stilling basins; Indian standards on criteria for design of hydraulic jump type stilling basins with horizontal and sloping aprons.

UNIT III   *Text Book - 1,2* [CO:3] **(15)**

Irrigation Channels – Silt Theories and Design Procedure:Classification; Canal alignment; Inundation canals; Cross–section of an irrigation channel; Balancing depth; Borrow pit; Spoil bank; Land width; Silt theories–Kennedy's theory, Kennedy's method of channel design; Drawbacks in Kennedy's theory; Lacey's regime theory; Lacey's theory applied to channel design; Defects in Lacey's theory; Comparison of Kennedy's and Lacey's theory.Water Logging and Canal Lining:Water logging; Effects of water logging; Causes of water logging; Remedial measures; Saline and alkaline soils and their reclamation; Losses in canal; Lining of irrigation channels – necessity, advantages and disadvantages; Types of lining; Design of lined canal.

UNIT IV   *Text Book - 1,2* [CO:4] **(15)**

Diversion Head Works:Component parts of a Diversion Head work; Weirs and barrages- Types of weirs; Causes of failure of weirs and their remedies; Design of weirs on permeable foundations – Bligh's creep theory, Silt control at head works.Canal regulation works:Types of outlets; Non–modular outlets; Semi-module outlets; Rigid modules; Canal falls; Necessity and location of falls; Development of falls; Types of falls; Canal regulators; Off-take alignment; Head regulators and cross-regulators; Canal escape (Designs not included). Cross Drainage Works:Introduction; Types of cross - drainage works;

Selection of suitable type of cross - drainage work; Classification of Aqueducts and Syphon Aqueducts.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Irrigation and Water Power Engineering by B.C. Punmia and Pande B.B. Lal; 16th Edition, Laxmi Publications,New Delhi.
2. Irrigation Engineering and Hydraulic Structure by S. K. Garg; Khanna Publishers, Delhi, 2011.

REFERENCE BOOK(s):

1. Irrigation, Water Resources and Waterpower Engineering by P.N. Modi, 7th Edition, Standard Book House, 2008.
2. Irrigation, Waterpower and Water Resources Engineering by K R Arora, Standard Publishers, 2010.
3. Water Power Engineering by M.M. Dandekar and K. K. Sharma; Vikas Publishing House Pvt. Ltd., 1979.

WEB RESOURCES:

www.nptel.iitm.ac.in

CE 324   **WASTE WATER ENGINEERING**   L T P C Int Ext
                                                                3 - - 3 40 60

COURSE OUTCOMES:

1. Estimate the quantity of drainage and sewage produced from a community and design of sewers with all its appurtenances
2. Ascertain the quality and characteristics of wastewater
3. Design septic tanks, primary and secondary treatment units of wastewater.
4. Understand the process of anaerobic digestion Select suitable method for disposal of sewage treated or untreated and sludge
5. Plan plumbing system for various types of residential buildings

UNIT I   *Text Book - T1,R1* [CO:1] **(13)**

Introduction, Quantity of Sewage and Storm waterSanitation; Sewerage systems; Relative merits and Suitability, Sanitary Sewage: Factors affecting sanitary sewage; Determination of quantity of sanitary sewage; Storm Water Sewage: Factors affecting storm water sewage; Determination of quantity of storm water sewage.Sewers design, Sewer Appurtenances and Sewage PumpingTypes of sewers; Design; Laying and Testing; Maintenance of sewers. Sewer appurtenances – Man holes, Drop man holes, Inverted siphons; Street inlets; Catch basins; Storm water regulators; Sewage pumping; Types of pumps.

UNIT II   *Text Book - T1,R1,R6* [CO:2,3] **(12)**

Quality and Characteristics of SewageCharacteristics of sewage; Decomposition of sewage; Carbon, and nitrogen cycles of decomposition; Physical and chemical analysis of sewage; BOD, BOD equation; CODSeptic TankSeptic tank design; Septic tank effluent disposal, soak pits, leaching cess pools; Primary Treatment of SewageScreens; Grit chamber; Grease traps; Skimming tanks; Sedimentation tanks.

UNIT III   *Text Book - T1,R2,R6* [CO:3] **(12)**

Secondary Treatment of SewageTrickling filters: Principles of action; Filter types; Design parameters, Operational problems and remedies; Activated sludge process: Principle of action; Organic loading parameters; Methods of aeration: Diffused air system; Mechanical aeration; Combined system; Activated sludge process vs Trickling filter process; Sludge bulking; Sludge volume index, Secondary Settling Tanks, Oxidation Ponds

UNIT IV   *Text Book - T1,R4,R5* [CO:4,5] **(13)**

Sewage DisposalObjects; Methods; Disposal by dilution; Disposal by irrigation; Sewage sickness. Sludge Treatment and DisposalCharacteristics of sewage sludge; Anaerobic sludge digestion process; Stages of sludge digestion; Factors affecting sludge digestion; Sludge digestion tank; Methods of de-watering the sludge; Methods of sludge disposal.House PlumbingHouse drainage - Sanitary fittings, Traps; Plumbing system of drainage – Single stack, One pipe and Two pipe systems; Principles

governing design of building drainage.

LEARNING RESOURCES:

TEXT BOOK:

1.   Elements of Environmental Engineering by K. N. Duggal, S. Chand & Company Ltd., 2010.

REFERENCE BOOK(s):

1. Environmental Engineering vol. II – Sewage disposal and air pollution engineering by S. K. Garg; Khanna Publishers, Delhi. 2010.
2. Wastewater Engineering: Treatment, Disposal & Reuse by Met Calf, McGraw-Hill.
3. Environmental Engineering by Peavy and Rowe, McGraw-Hill (India), 2013.
4. Water & Wastewater Technology by Hammer and Hammer, PHI, 2010.
5. Water Supply and Sewerage by E.W. Steel and Terence J. Mc Ghee, McGraw-Hill, 1991.
6. Manual on Sewerage & Sewage treatment; CPH and EEO, Ministry of Works and Housing; Govt. of India; New Delhi.

WEB RESOURCES:

www.nptel.iitm.ac.in

CE 325   **DESIGN OF STEEL STRUCTURES**   L T P C Int Ext
                                                             3 - - 3 40 60

COURSE OUTCOMES:
1. Design gantry girder and welded plate girder
2. Design connections
3. Design structural steel components of roof truss
4. Design light gauge steel sections and composite construction

UNIT I   *Text Book - T1,R1,R2,R3* [CO:1] **(13)**

Gantry girder:Introduction; Loads on gantry girder; Web buckling and Crippling; Deflection, Check ; Design of gantry girder.Welded Plate girder:Introduction ;   Behaviour of transversely stiffened plate girder panels in shear ; Design methods for transversely stiffened web panels ; Design of end panels ; Other design specifications ; Design of stiffeners ; Design of welded plate girder

UNIT II   *Text Book - T1,R1,R2, R3* [CO:2] **(12)**

Connections: Introduction; Bracket connections using welding/bolting;   Simple beam end connections-Web connections using welding/bolting, Seat-angle connection using welding/bolting, Stiffened seat angle connection using welding/bolting; End plate connection, Fin-plate connection; Moment resistant beam end connection- Extended end plate connection; Splicing of beams /girders using bolts

UNIT III   *Text Book - T1,R1,R2,R3* [CO:3] **(12)**

Roof Trusses:Components of a trussed roof; Types of trusses; Dead, Live and wind loads on trussed roof; Design of tubular purlins ; Design of members of a roof truss using tubes; Design of connections using welding

UNIT IV   *Text Book - T1, R1, R2, R3* [CO:4] **(13)**

Light-gauge steel sections: Introduction; Types of sections; Design of light gauge sections; Design of axially loaded columns; Design of beams which do not buckle laterally.   Composite Construction: Introduction; Composite beam ; Method of construction ; Limit states of collapse; Limit states of serviceability – Deflection

LEARNING RESOURCES:

TEXT BOOK:

Design of steel structures by K.S.Sai Ram, Pearson Education, 2015

REFERENCE BOOK(s):

1. Design of steel structures by N.Subramanian, Oxford University Press, 2016.
2. Limit state design of steel structures by M.R.Shiyekar , PHI Learning,2017.
3. Limit state design of steel structures by S.K.Duggal, McGraw-Hill,2017.

WEB RESOURCES:

http://nptel.iitm.ac.in

CE 361	HIGHWAY ENGINEERING LAB	L	T	P	C	Int	Ext
		-	-	2	1	40	60

COURSE OUTCOMES:

1. Select aggregate for different construction components
2. Evaluate and conduct the required tests on the given aggregate and propose the suitable inference
3. Evaluate the grade of bitumen by conducting the required tests and propose it for suitable region and place of pavement construction

EXPERIMENTS:

1. Aggregate Crushing value test.
2. Aggregate impact value test.
3. Los Angeles abrasion test.
4. Deval's attrition value test.
5. Shape test a) Flakiness index test b) Elongation index test c) Angularity number test.
6. Specific gravity Test.
7. Penetration test.
8. Softening point test.
9. Flash and fire point test.
10. Ductility test.
11. Viscosity test.
12. Specific gravity of Bitumen
13. Bitumen Extractions Test.
14. Marshall stability test.

Note:**
A minimum of twelve (12No) shall be done and recorded

LEARNING RESOURCES:

TEXT BOOK:

Highway Engineering by S. K. Khanna & C. E. G. Justo; Nemchand & Brothers, Roorkee,2011.

CE 362	**COMPUTER PROGRAMMING IN CIVIL ENGINEERING**	L	T	P	C	Int	Ext
		-	-	2	1	40	60

COURSE OUTCOMES:

1. Develop programmes for design of various structural elements like beams, steel structural connections, slab base, open channel etc using C or C++ programming languages
2. Develop programmes for determining various properties of soils using C or C++ programming languages
3. Develop programmes for solving different problems in surveying

EXPERIMENTS:

1. Design of Reinforced Beam for flexure by limit state method.
2. Design of T- Beam for flexure by limit state method.
3. Design of Reinforced beam for Shear by limit state method.
4. Design of steel tension member
5. Design of steel compression member
6. Design of slab base for a steel column
7. Design of laterally supported steel beam
8. Classification of soil by Indian standard classification system.
9. Stresses due to applied loads both Boussinesq and Westerguard analysis
   a) Concentrated load   b) circular loaded area   c) Rectangular loaded area
10. Determination of permeability coefficient by constant head and fall-ing permeability tests.
11. Determination of index properties of soil.
12. Design of an open channel
13. Analysis of water distribution networks (Hardy cross method).
14. Determination of the height of the building when base is accessible.

Note:**

A minimum of ten (10 Nos) shall be done and recorded Students are required to write and execute programmes to solve the following problems. Programmes shall be in C or C++ language or MATLAB/JAVA. or MS-Office Softwares

CE 363   **COMPUTER AIDED DESIGN AND DETAILING LAB**   L T P C Int Ext
                                                                         - - 2 1 40 60

COURSE OUTCOMES:

1. Analyse and design of various elements/ structures as per relevant IS code provisions.
2. Draw various reinforcement and other details of various structural elements using computer software packages

EXPERIMENTS:

1. Students are required to analyse and design the following structures using software packages like STAAD Pro/Etabs/STRUDS/STRAP/MSEXCEL etc.

   1. Analysis of a two span continuous beam with one side fixed and other side overhang. Analysis of a single bay single storeyed plane frame with vertical legs subjected to gravity and lateral loads.
   2. Analysis of a reinforced concrete framed building (3D) subjected to 1.2(DL+LL+/-EQX).
   3. Analysis and design of a steel roof truss of an industrial shed subjected to (DL+/-WL).)
   4. Design of beam for flexure and shear.
   5. Design of reinforced concrete solid slab.
   6. Design of isolated RC footing.
   7. Design of reinforced concrete columns.
   8. Design of steel welded plate girder.
   9. Design of members of a roof truss.

2. PART-B (CO2)
   (At least four of the followingshall be done and recorded)

   Students are required to draw the following structural elements using software packages like Auto CAD,RIVET etc.

   1. Detailing of continuous beam with one end overhang.
   2. Detailing of isolated footing.
   3. Detailing of pile cap.
   4. Detailing of two way and one way slab.
   5. Typical detailing of reinforced footing with steel column.
   6. Detailing of beam to column moment resistant connection (using bolts).
   7. Detailing of welded plate girder.
   8. Typical detailing of Industrial steel roof truss.

Note:**

CE 411	CONSTRUCTION MANAGEMENT	L T P C Int Ext
		3 - - 3 40 60

COURSE OUTCOMES:

1. Plan and schedule a project.
2. Optimize and manage resources.
3. Understand about various equipment used in construction projects.
4. Describe quality management, safety measures and project economics

UNIT I   *Text Book - T1,T2,R1* [CO:1] **(12)**

Introduction:Significance of Construction Management, Objectives and functions of construction management.--Planning and Scheduling:Planning techniques, Bar charts, Limitations of Bar Charts, Mile stone charts.

UNIT II   *Text Book - T1,T2,R2* [CO:2] **(13)**

Project Management through Networks:Objectives of network techniques; Events; Activities; Time estimates; Float and Slack; Critical path, near critical path; CPM and PERT and their use in Construction Planning; Difference between CPM and PERT; Probability of completion time for a project.--Cost Control: Direct cost; indirect cost; Total project cost; Optimization of cost through networks.

UNIT III   *Text Book - T1,T2,R1* [CO:3] **(12)**

Resource Management (Manpower): Introduction; Resource smoothing; Resource leveling.--Construction Equipment: Different types of construction equipment and their use in Constriction Industry; Factors affecting selection of Equip- ments; Owning and operating the equipment; Equipment maintenance.

UNIT IV   *Text Book - T1,T2,R2* [CO:4] **(13)**

Quality Control: Importance of quality; Elements of quality; Quality assurance techniques; Documentation; Total quality management.--Safety Management:Importance of safety; Approaches to improve safety in construction industry; Safety benefits to employers, employees and customers.--Project Economics: Time value of money; discounted cash flow analysis; Payback period; Return on investment; Benefit cost analysis, re-placement analysis, Inflation.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Fundamentals of PERT/CPM and Project Management by S. K. Bhattacharjee; Khanna Publishers,2004.
2. PERT & CPM Principles and applications by L. S. Srinath, 3rd Edition, Affiliated East West Press.

REFERENCE BOOK(s):

1. Construction Engineering and Management by Dr. S. Seetharaman,4th Edition, Umesh Publications, 2008.
2. Construction Planning, Equipment & Methods by Peurifoy R. L.; Tata McGraw-Hill, 2008.

CE 412	**ESTIMATION AND COSTING**	L T P C Int Ext
		3 - - 3 40 60

COURSE OUTCOMES:

1. Estimate the quantities and cost of different items of work required for residential buildings and R.C.C structures.

2. Estimate the quantity and cost of earth work in roads and irrigation canals.

3. Determine the unit rate of different items of work.

4. Determine the Valuation and rent fixation for buildings.

UNIT I   *Text Book - T1,R2* [CO:1] **(13)**

Procedure of Estimating: Methods of estimating; Main items of work; Deduction for openings; Degree of accuracy; Units of measurement.Methods of building estimates: Individual wall method; Centre line method; Arch masonry calculation; Estimate of steps.Estimate of Buildings: Estimate of residential building; Estimate of a building from line plan.

UNIT II   *Text Book - T1,R2* [CO:1] **(13)**

Estimate of RCC works: Standard hooks and cranks; Estimate of RCC slab; RCC beam; and RCC column with foundation.Road Estimating: Estimate of earthwork; Estimate of pitching of slopes; Estimate of earthwork of road from longitudinal sections; Estimate of earthwork in hill roads.Canal estimate: Earthwork in canals–different cases; Estimate of earthwork in irrigation channels.

UNIT III   *Text Book - T1,R2* [CO:2] **(12)**

Specifications: Purpose and method of writing specifications; General specifications. Detailed Specifications for Brick work; R.C.C; Plastering; Mosaic Flooring; R.R.Stone Masonary.Analysis of Rates: Task or out – turn work; Labour and materials required for different works; Rates of materials and labour; Preparing analysis of rates for the following items of work: i) Concrete ii) RCC Works iii) Brick work in foundation and super structure iv) Plastering v) CC flooring vi) White washing.

UNIT IV   *Text Book - T1,T2,R1,R2* [CO:3,4] **(12)**

PWD Accounts and Procedure of Works: Organization of Engineering department; Work charged establishment; Contract; Tender; Tender notice; Tender Schedule; Earnest money; Security money; Measurement book; Administrative approval; Technical sanction; Plinth area; Floor Area; Carpet area; Approximate Estimate; Plinth area estimate; Revised Estimate; Supplementary estimate.Valuation: Cost; Price & value; Methods of valuation; Out goings; Depreciation; Methods for Estimating cost depreciation; Valuation of building.Miscellaneous Topics: Gross income; Net income; Scrap value; Salvage value; Obsolescence; Annuity; Capitalized value; Years purchase; Life of structures; Sinking fund; Standard rent; Process of fixing standard rent; Mortgage.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Estimating & Costing in Civil Engineering by B.N. Dutta; UBS Publishers & Distributors, 2010.
2. 2.Valuation of Real properties by S. C. Rangwala, 8th Edition, Charotar Publishing House, 2011.

REFERENCE BOOK(s):

1. Practical information for Quantity Surveyors, Contract Managers, Architects Engineers & Builders by P.T. Joglekhar.
2. Estimating, Costing and specification in Civil Engineering by M.Chakraborti.

CEEL2A   **ADVANCED STRUCTURAL ANALYSIS**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Analyse continuous beams and simple frames using slope deflection method
2. Analyse continuous beams and simple frames using moment distribution method
3. Analyse structures using Flexibility and Stiffness methods
4. Apply plastic analysis to beams and simple frames

UNIT I   [CO:1]   ()

Slope Deflection Method:Slope - deflection equations; Principles of the method; Applications of the method to the analysis of continuous beams and portal frames (Single bay, single story with vertical legs only) without and with sidesway.

UNIT II   [CO:2]   ()

Moment Distribution Method:Principles of the method; Application of the method to analysis of continuous beams and portal frames (Single bay, single story with vertical legs only) without and with side sway.

UNIT III   [CO:3]   ()

Matrix methods of Structural analysis:Flexibility and stiffness; Flexibility matrix; Stiffness matrix; Relationship between flexibility matrix and stiffness matrix; Analysis of continuous beams and rigid jointed plane frames (Single bay, single storey with vertical legs only) by flexibility and stiffness methods

UNIT IV   [CO:4]   ()

Plastic analysis of structures:Introduction, Stress-strain curve, Plastic moment – Plastic section modulus, Shape factor, Load factor, Failure mechanisms; Methods of analysis - Static method   and Mechanism method; Analysis of continuous beams and single bay rectangular portal frames.

LEARNING RESOURCES:

TEXT BOOK:

Basic structural analysis by CS Reddy, 3rd Edition, Tata McGraw-Hill ,2010.

2.

REFERENCE BOOK(s):

1. Structural Analysis by Devdas Menon, Narosa Publishinh House, 2008.
2. Intermediate structural analysis by CK Wang, Tata McGraw-Hill,2010.
3. Structural Analysis: A matrix approach by G. S. Pandit & S. P. Gupta; Tata Mc Graw – Hill Publishing Co. Ltd., 2008.
4. Fundamentals of limit analysis of structures by Manicka Selvam, Dhanpat Rai &Sons

WEB RESOURCES:

1. http://www.cdeep.iitb.ac.in/nptel/Civil%20Engineering/Structural%20Mechanic%20II/Course%20Objective.html.
2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Structural%20Analysis/New_index1.html

CEEL2B   **SOLID AND HAZARDOUS WASTE MANAGEMENT**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Correlate various functions elements of solid waste management
2. Suggest effective methods for on-site storage, processing, collection and transport of solid waste
3. Plan methods for recovery, reuse and treatment of solid waste
4. Identify suitable site and design sanitary landfill
5. Visualise the impacts of hazardous wastes and plan proper methods for collection, treatment and disposal of bio-medical wastes and radioactive wastes

UNIT I   *Text Book - T1,R1* [CO:1] **(13)**

Introduction, sources and typesSources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics of solid waste, Effects of improper disposal of solid wastes-Public health and environmental effects-need for integrated solid waste managementFunctional elements of solid waste managementFunctional elements and their inter relationship, on-site storage, handling and processing of solid wasteCollection of solid waste Types and methods of waste collection systems, factors affecting collection, analysis of collection systems, optimization of collection routes

UNIT II   *Text Book - T1,R1* [CO:2] **(12)**

Transfer and TransportNeed for transfer operation, compaction of solid waste, transport means and methods, transfer stations types and design requirementsSeparation and Transformation of solid wasteUnit operations used for separation and transformation: Shredding – material separation and recovery, source reduction and waste minimization

UNIT III   *Text Book - T1,R1,R2* [CO:3,4] **(13)**

Processing and treatmentProcessing of solid waste viz., combustion and composting, anaerobic treatment for energy and material recovery, incineration and pyrolysisDisposal of solid wasteSanitary landfillmethods of operation,advantages and disadvantages of sanitary land fill, site selection, reactions accruing in completed landfills, gas and leachate movement and control

UNIT IV   *Text Book - T1,T2,R1* [CO:5] **(12)**

Fundamentals of Hazardous Waste Management Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effectsBiomedical wasteBiomedical wastes and their impacts on health and environment, Collection and transport, treatment and disposalRadioactive wastesRadioactive wastes and their impact on health and environment, sources, classification and disposal

LEARNING RESOURCES:

TEXT BOOK(s):

1. Vesilind, P.A., Worrell, W., Reinhart, D. "Solid Waste Engineering", Cenage learning, New Delhi, 2004
2. Solid and Hazardous Waste Management by M.N. Rao and Razia Sultana, BS Publications, Hyderabad

REFERENCE BOOK(s):

1. George Techobanoglous "Integrated Solid Waste Management", McGraw Hill Publication, 1993
2. Environmental Engineering by Peavy, Rowe and Techobanoglous, Tata McGraw Hill Publication

CEEL2C   **SURFACE HYDROLOGY**   **L T P C Int Ext**

COURSE OUTCOMES:
1. Analyze precipitation data.
2. Estimate abstractions from precipitation.
3. Determine runoff by hydrograph analysis.
4. Analyze the floods entering into a reservoir.

UNIT I   *Text Book - T1,T2,T3,T4,R1* [CO:1] **(12)**

Introduction: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.Precipitation: Types and forms, measurement, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm.

UNIT II   *Text Book - T1,T2,R2* [CO:2] **(13)**

Abstractions from Precipitation: Initial abstractions. Evaporation: factors affecting, measurement, reduction Evapotranspiration: factors affecting, measurement, controlInfiltration: factors affecting, Infiltration capacity curve, measurement, infiltration indices

UNIT III   *Text Book - T1,T2,R3* [CO:3] **(12)**

Runoff :Catchment characteristics, Factors affecting runoff, components, computation- empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.Hydrograph analysis: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph

UNIT IV   *Text Book - T1,T2,T3R2,R1* [CO:4] **(13)**

Floods: Causes and effects, frequency analysis- Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management. Flood Routing: Hydrologic routing, channel and reservoir routing- Muskingum and Puls methods of routing.

LEARNING RESOURCES:

TEXT BOOK(s):

1. 'Engineering Hydrology' by Subramanya, K, Tata Mc Graw-Hill Education Pvt. Ltd, (2013), New Delhi.
2. 'Engineering Hydrology' by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), New Delhi
3. 'Applied hydrology'by Chow V.T., D.R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt. Ltd., (2011), New Delhi.

4. 'Engineering Hydrology'by Ojha C.S.P, R. Berndtsson and P. Bhunya, Oxford University Press, (2010).

REFERENCE BOOK(s):

1. Water Resources Engineering', Mays L.W, Wiley India Pvt. Ltd, (2013).
2. 'Hydrology'by Raghunath. H.M., New Age International Publishers, (2010).
3. 'Engineering Hydrology –Principles and Practice'by Ponce V.M., Prentice Hall International, (1994).
4. 'Hydrology and Water Resources Engineering' by Patra K.C.,Narosa Publications, (2011).

CEEL2D   **FINITE ELEMENT METHOD**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Understand standard discrete system and direct physical approach to problems of elasticity
2. Generalize the finite element concepts
3. Describe different types of finite elements and numerical integration
4. Apply finite element method to problems of   linear elasticity and heat conduction, electric/magnetic potential and fluid flow

UNIT I   *Text Book - T1,R1,R2,R3,R4* [CO:1] **(12)**

Overview of finite element methodBasic concept; Historical background; General applicability of the method; Engineering applications of the finite element method; Engineering applications of the finite element method; General description of the finite element method; Derivation of finite element equations using a direct approachDiscretisation of the domainIntroduction; Basic element shapes; discretisation process; Node numbering schmeInterpolation modelsIntroduction ; Polynomial form of interpolation functions; Selection of the order of interpolation polynomial; Convergence requirements; Linear interpolation polynomials in terms of local coordinates

UNIT II   *Text Book - T1,R1,R2,R3,R4* [CO:2] **(13)**

Derivation of element matrices and vectorsIntroduction; Variational approach- Solution of equilibrium problems using Rayleigh-Ritz metod, Derivation of finite element equations using Rayleigh-Ritz approach; Weighted residual approach-Solution of equilibrium problems using weighted residual method, Galerkin method, Derivation of finite element equations using Galerkin approach

UNIT III   *Text Book - T1,R1,R2,R3,R4* [CO:3] **(12)**

Assembly of element matrices and derivation of system equationsAssemblage of element equations; Incorporation of boundary conditions;Numerical solution of finite element equationsIntroduction; Solution of equilibrium problems- Gaussian elimination method

UNIT IV   *Text Book - T1,R1,R2,R3,R4* [CO:4] **(13)**

Application to heat transfer problemsSteady state one-dimension problems; Steady state two dimensional heat transfer problems using linear triangular elementApplication to fluid flow problems problemsInviscid and incompressible flow problems using linear triangular elementApplication to electromagnetic problemsSolution to one-dimensional electrostatic boundary value problems ; Solution to two-dimensional electrostatic boundary value problems using linear triangular element

LEARNING RESOURCES:

TEXT BOOK:

The finite element method in engineering by S. S.Rao, Butterworth-Heinemann, New Delhi, 2011.

REFERENCE BOOK(s):

1. The finite element method – Basic concepts and applications with MATLAB, MAPLE and COMSOL by D.W.Pepper and J.C.Heinrick, CRC Press, 2017.
2. Introduction to the finite element method in electromagnetic by A.C.Polycarpou, Morgan & Claypool, 2006.
3. The finite element method in electromagnetics by J.Jin, John Wiley & Sons, 2002.
4. Finite elements for electrical engineers by R.L.Ferrari, Cambridge University Press, 1996.

CEEL3A   **RAILWAY, AIRPORT & HARBOR ENGINEERING**   **L T P C Int Ext**

COURSE OUTCOMES:
1. Design a railway track and select proper materials.
2. Detail a railway station.
3. Plan of various amenities of an airport and planning and also serves as a basic for airport pavement design and runway design.
4. Describe various features of a harbor and a port to enable for proper design and maintenance of various amenities.

UNIT I   *Text Book - T1,R1* [CO:1]   **()**

IntroductionRole of railways in transportation; Comparison of railway and highway transportation;Development of railway systems with particular reference to India; Classification of railways.Railway TrackPermanent way: Gauges in Railway track, Railway track cross – sections; Coning of wheels.Rails & Rail JointsFunctions of rails; Requirements of rails; Types of rails sections; Standard rail sections; Length of rails; Rail failures; Wear on rails. Requirements of an ideal joint; Types of rail joints; Welding of rails.SleepersFunctions of sleepers; Requirements of sleepers; Classification of Sleepers – Timber sleepers, Metal sleepers & Concrete sleepers; Comparison of different types of sleepers.Fish PlatesFish plates, section of fish plates, and failure of fish plates.BallastFunctions and requirements of ballast; Types of ballast; Renewal of ballast

UNIT II   *Text Book - T1,R1* [CO:2]   **()**

Geometric Design Of TrackNecessity; Gradients & Gradient Compensation; Elements of horizontal alignment; Super elevation; Cant deficiency and cant excess; Negative Super elevation; Length of Transition Curve, Length of vertical curve. Points And CrossingsFunctions of components of turnout; Crossings.Stations And YardsSite selection for railway station; Requirements of railway station; Classifications; Station yards; Level crossing.SignallingObjects of signaling; Classification of signals; Controlling- absolute block system. Standards of inter locking

UNIT III   *Text Book - T2,,R2* [CO:3]   **()**

AIRPORT PLANNING AND DESIGNIntroductionDevelopment of air transportation system with particular reference to India; Aeroplane components; Air–craft characteristics.Airport planning and layoutSelection of site; Apron; Hanger; Typical airport layouts; Airport marking; Airport lighting; Drainage systems.Airport ObstructionZoning laws; Classification of obstructions; Imaginary surfaces; Approach zone; Turning zone.Runway DesignRunway orientation; Basic runway length; Corrections for elevation; Temperature and gradient;Runway geometric design.Specifications for Structural Design of Airport Pavements, Design factors methods for flexible and rigid pavements; LCN system of pavement design.

UNIT IV   *Text Book - T3* [CO:4]   **()**

DOCKS AND HARBOUR ENGINEERINGIntroductionTypes of water transportation; Economics and advantages of water transportation.Planning and Design Of Port FacilitiesGeneral layout and design considerations; Pier and wharf structures; Fender systems; Transit sheds and Apron; Container ports; Docks; Dredging; Light Houses.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Railway Engineering by S.C.Saxena and S.Arora , Dhanpat Rai & sons.
2. Airport Planning and Design by S. K. Khanna & M. G. Arora, 6th Edition, Nemchand & Bros, 1999.
3. Dock, harbour engineering by rangawala

REFERENCE BOOK(s):

1. Railway Engineering by M.M.Agarwal and Satish Chandra, Oxford University Press, 2007.
2. Airport Engineering by G.V.Rao; Tata Mc Graw Hill, 1991

CEEL3B	BRIDGE ENGINEERING	L T P C Int Ext

COURSE OUTCOMES:

1. Summarize various investigations to be conducted before constructing a bridge.

2 .Classify various RC bridges and IRC loadings.

3. Design slab culvert and T-beam bridge.

4 .Design substructure like piers and abutments.

5 .Classify various types of bearings and design elastomeric pad bearing.

6 .Design well foundation.

UNIT I   *Text Book - T1,R1,R2* [CO:1,2] **(12)**

Introduction & Investigation For Bridges:Components of a Bridge; Classification; Standard Specifications; Need for Investigation; Selection of Bridge Site; Preliminary Data to be Collected; Preliminary Drawings; Determination of Design Discharge; Economical Span; Location of Piers and Abutments; Vertical clearance above HFL; Scour depth; Traffic Projection; Choice of Bridge type; Importance of Proper Investigation. --Concrete Bridges:Various types of bridges; I. R. C. Specifications for road bridges.

UNIT II   *Text Book - T1,R1,R2* [CO:3] **(13)**

Culverts : Design of R. C. slab culvert.--T – Beam Bridge: Pigeaud's method for computation of slab moments; Courbon's method for computation of moments in girders; Design of simply supported T–beam bridge.

UNIT III   *Text Book - T1,R1,R2* [CO:4] **(12)**

Sub Structure for Bridges:Pier and abutment caps; Materials for piers and abutments; Design of pier; Design of abutment; Backfill behind abutment; Approach slab.

UNIT IV   *Text Book - T1,R1,R2* [CO:5,6] **(13)**

Bearings for Bridges: Importance of bearings; Bearings for slab bridges; Bearings for girder bridges; Expansion bearings; Fixed bearings; Design of elastomeric pad bearing.--Foundations for Bridges: Scour at abutments and piers; Grip length; Types of foundations; Design of well foundation.

LEARNING RESOURCES:

TEXT BOOK:

Essentials of Bridge Engineering by Dr. Johnson Victor; 6th Edition, Oxford & IBH Publishing Company Pvt. Ltd., 2007.

REFERENCE BOOK(s):

1. Bridge Engineering by S Ponnuswamy, 2nd edition, Mc Graw Hill Education, 2009

2. Design of bridge structures by Jagadeesh and Jayaram, 2nd Edition, PHI Learning, 2009.

CEEL3C   **ENVIRONMENT IMPACT ASSESSMENT**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Demonstrate the key concepts of environmental impact assessment and the current legislation covering them.

2. Perceive environmental impact on land, water, air, noise and energy, Flora and fauna and Socio Economics.

3. Plan options for mitigation of adverse impact on environment

4. Identify the components and decision making processes involved in Environmental assessment through various case studies.

5. Outline Environmental Audit report.

UNIT I   *Text Book - T1,R1* [CO:1] **(13)**

Basic concepts of EIA : Initial Environmental Examination; Elements of EIA; Factors affecting EIA; Impact evaluation and analysis; Preparation of Environmental Base map; Classification of Environmental parameters.EIA Methodologies : Introduction; criteria for the selection of EIA Methodology; EIA Methods: Ad-hoc methods, Matrix methods, Network method, Environmental media quality index method; Overlay methods; Cost/benefit Analysis.

UNIT II   *Text Book - T1,R2* [CO:2,3] **(12)**

Impact of Developmental Activities and Land Use : Introduction and Methodology for the assessment of soil and ground water; Delineation of study area; Identification of activities; Procurement of relevant soil quality; Impact prediction; Assessment of Impact significance; Identification and Incorporation of mitigation measures.EIA in surface water, Air and Biological Environment: Methodology for the assessment of Impacts on surface water environment; Air pollution sources; Generalized approach for assessment of Air pollution Impact.

UNIT III   *Text Book - T1,T2,R1* [CO:4] **(12)**

Assessment of Impact of Development activities on vegetation and wildlifeEnvironmental Impact of Deforestation; Causes and effects of deforestation.EIA Case Studies : Preparation of Environmental Impact Assessment statement for thermal power plants, mining industry; river valley projects etc.

UNIT IV   *Text Book - T1,R1* [CO:5] **(13)**

Environmental Audit and Environmental legislation : Objectives of Environmental Audit; Types of Environmental Audit; audit protocol; stages of Environmental Audit; On-site activities; Evaluation of Audit data and preparation of Audit report, Post Audit activities, The Environmental Pollution Act, The Water Act; The Air (Prevention and Control of Pollution) Act; Mota Act; Wild life Act.Life Cycle AnalysisIntroduction, types, importance, stages in LCA-goals and scope, inventory analysis, impact assessment and interpretations, case studies

LEARNING RESOURCES:

TEXT BOOK(s):

1. Environmental Impact Assessment Methodologies by Y. Anjaneyulu; B.S. Publication, Sultan Bazar, Hyderabad.
2. Environmental Science and Engineering by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers.

REFERENCE BOOK(s):

1. Environmental Science and Engineering by Suresh K. Dhameja, S.K. Kataria & Sons Publications, New Delhi.
2. Environmental Pollution and Control by Dr. H.S. Bhatia, Galgotia Publications Pvt. Ltd. De

CEEL3D   **GROUND IMPROVEMENT TECHNIQUES**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Understand the concept of ground improvement technique and learn various techniques for in-situ densification of granular soil

2. Describe various techniques for in-situ densification of cohesive soil and dewatering techniques

3. Discuss mechanical and chemical modification by use of cement, lime, emulsions, industrial wastes etc.

4. Design reinforced earth walls

UNIT I   *Text Book - T1,R1* [CO:1]   **(8)**

Introduction to Engineering ground modification: Need for engineered ground improvement, classification of ground modification techniques; suitability, feasibility and desirability of ground improvement technique; objectives of improving soil.In-situ densification of granular soil: Dynamic compaction; Basting; Vibro compaction; Blasting: compaction grouting.

UNIT II   *Text Book - T1,R1* [CO:2]   **(8)**

In-situ densification of cohesive soil: Preloading and Vertical drains- Sand Drains, Wick Drains, Geosynthetic Drains; Radial consolidation, combined radial and vertical consolidation; stone columns and lime columns.Dewatering: Objectives and techniques, Traditional dewatering methods-open sumps and ditches, Single and Multiple stage Well points, Vacuum dewatering wells, Electro osmosis method.

UNIT III   *Text Book - T1,R1* [CO:3] **(10)**

Mechanical and chemical modification: Mechanical modification by rollers for shallow compaction; Rothfutch's method; Cement stabilization; Lime stabilization; Bitumen stabilization; Stabilization using industrial waste-fly ash;Use of Geosynthetic material: Filtration, drainage and seepage control with Geosynthetics-Geotextiles -types, Basic functions and applications of geotextiles.

UNIT IV   *Text Book - T1,R1* [CO:4] **(10)**

Reinforced Earth: Principles, components of reinforced earth; governing design of reinforced earth wall and design principle of reinforced earth wall using metallic strip reinforcement, Geotextile reinforcement and Geogrid reinforcement.

LEARNING RESOURCES:

TEXT BOOK:

Hausmann M.R (1990) Engineering Principles of ground modification, McGraw-Hill Education (India), Pvt., Ltd., New Delhi.

REFERENCE BOOK:

Ground improvement Techniques, P.PurushothamaRaju, Laxmi Publications Pvt., Ltd., New Delhi.

CEEL4A   **PRE-STRESSED CONCRETE**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Understand pre-stressing of concrete and various pre-stressing systems

2. Analyze and design pre-stressed concrete beams

3. Estimate the losses in pre-stressing

4.Analyse and design end block

UNIT I   *Text Book - T1,R1,R2* [CO:1,2] **(12)**

Introduction:Basic concepts of prestressing; Historical development; Need for High strength steel and high strength concrete; Advantages of prestressed concrete.--Materials for Prestressed Concrete: High strength concrete; High tensile steel.--Pretressing Systems: Tensioning devices; Hoyer's long line system of pretensioning; Post tensioning systems;   detailed study of Freyssinet system, Lee-McCall System and Gifford – Udall system.--Analysis of Prestress and Bending Stresses:Basic assumptions; Analysis of prestress; Resultant stresses at a section; Pressure (Thrust) line and   internal resisting couple; Concept of Load balancing; Stresses in tendons; Cracking moment.

UNIT II   *Text Book - T1,R1,R2* [CO:2,3] **(13)**

Losses of Prestress:Nature of losses of prestress; Loss due to elastic deformation of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip; Total losses allowed for in design.--Deflections of Prestressed Concrete MembersImportance of control of deflections; Factors influencing deflections; Short term deflections of uncracked members.

UNIT III   *Text Book - T1,R1,R3* [CO:2,4] **(12)**

Flexural strength of prestressed concrete sections: Types of flexural failure; Flexural strength of prestressed concrete sections as per IS1343: 2012.--Design of sections for flexure as per IS1343: 2012:Introduction; Design loads and strengths; Strength and serviceability limit states;   Minimum section modulus; Prestressing force; Limiting zone for the prestressing force;   Design of rectangular and I sections for the limit state of collapse in flexure.--Shear Resistance Shear and Principal Stresses; Ultimate shear resistance of prestressed concrete members and design of shear reinforcement as per IS1343:2012.

UNIT IV   *Text Book - T1,R3,R4* [CO:5] **(13)**

Transfer of Prestress in Pre–Tensioned Members & Flexural Bond Stresses:Transmission of prestressing force by bond; Transmission length; Bond stresses;   Transverse tensile stresses; End zone reinforcement; Flexural bond stresses in pre tensioned and post tensioned grouted beams.--Anchorage Zone Stresses In Post-Tensioned Members:Stress distribution in end block; Anchorage zone stresses and Anchorage zone Reinforcement   as per IS1343: 2012

LEARNING RESOURCES:

TEXT BOOK:

Prestressed Concrete by N. Krishna Raju; 4th Edition, Tata Mc Graw - Hill Publishing Company Limited, 2012.

REFERENCE BOOK(s):

1. Design of Prestressed Concrete Structures by T.Y. Lin & Ned H. Burns,3rd Edition, John Wiley & Sons, 2010.
2. Prestressed Concrete by Pandit & Gupta , CBS Publishers, 1995.
3. Fundamentals of Pre-stressed concrete by NC Sinha and SK Roy, 3rd Edition, S.Chand Publishers, 1985.
4. Prestressed Concrete by N.Raja Gopalan ,2nd Edition,Narosa Publishing House, 2008.

WEB RESOURCES:

www.iitm.ac.in

CEEL4B   **EARTHQUAKE RESISTANT DESIGN OF STRUCTURES**   **L T P C Int Ext**

COURSE OUTCOMES:
1. Enumerate the fundamental vibration of single degree freedom systems.
2. Describe the earthquake ground motion characteristics.
3. Compute the lateral forces on a building using equivalent static method.
4. Analyse and design a single storey and single bay RC framed building.
5. Describe the behavior of soil beneath a foundation during an earthquake.

UNIT I   *Text Book - T1,R1,R2* [CO:1] **(13)**

Elements of structural dynamics : Sources of vibrations; Types of vibrations; Degrees of freedom; Spring action and damping; Free vibration of undamped system having single degree of freedom; Free vibration of viscous damped system having single degree of freedom; Forced vibration of a viscous damped single degree freedom system subjected to harmonic excitation; Earthquake excitation (Base excitation) of a single degree freedom system.

UNIT II   *Text Book - T1,R1,R2* [CO:2] **(13)**

Elements of Earthquake Ground motion: Earthquake size - Intensity and magnitude; Seismic Zoning-Introduction; Strong Motion Earthquakes - Introduction; Response spectrum (elastic); Local site effect (Effect of type of soil).Seismo-resistant building architecture: Introduction; Lateral load resisting systems- moment resisting frame, Building with shear wall or bearing wall system, building with dual system; Building configuration- Problems and solutions; Building characteristics - Mode shape and fundamental period, building frequency and ground period, damping, ductility, seismic weight, hyperstaticity/redundancy, non-structural elements, foundation soil/ liquefaction. Foundations; Quality of construction and materials - quality of concrete, construction joints, general detailing requirements.

UNIT III   *Text Book - T1,R1,R2* [CO:2,3] **(12)**

Analysis of single storey and single bay RCC Plane Frame (Columns vertical): (As per IS:1893(part-I)-2002) Calculation of lateral force due to earthquake using equivalent static method ; Analysis for different load combinations; Design forces and moments in beam and columns.

UNIT IV   *Text Book - T1,T2,R1,R2* [CO:3,4] **(12)**

Design of single storey and single bay RCC plane frames (Columns vertical) (As per IS:456-2000 and IS13920-1993) Design of column; Design of beam; Design of footing ; Detailing of entire frame.Elements of Geotechnical Earthquake Engineering: Liquefaction - Definition and types, Effect of liquefaction on built environment, Evaluation of liquefaction susceptibility, Liquefaction hazard mitigation ; Seismic slope stability - Introduction, Pseudo-static analysis, Sliding block methods.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Earthquake Resistant Design of Structures by Pankaj Agarwal, and Manish Shrikhande, PHI Learning, 2006 .
2. Geotechnical Engineering by S.K.Gulhati & Manoj Datta, Tata McGraw-Hill, 2010

REFERENCE BOOK(s):

1. Elements of Earthquake Engineering by Jai Krishna, A.R.Chandrasekaran and Brijesh Chandra, Second Edition, South Asian Publishers, 1994.
2. Dynamics of Structures by A.K.Chopra, 3rd Edition, Person Education, 2007

CEEL4C   **ADVANCED ENVIRONMENTAL ENGINEERING**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Predict dilution and dispersion patterns of air pollution based on meteorological conditions.

2. Select suitable methods of control of air and noise pollution.

3. Select suitable methods for solid waste management including reuse and recycling.

4. Determine the degree of treatment required based on critical D.O. deficit in a polluted stream.

5. Select suitable methods for treatment and disposal of industrial wastewater from Dairy industry, Sugar industry and Pulp & paper industry, based on their characteristics.

UNIT I   *Text Book - T3,R3* [CO:1] **(12)**

Sources and Classification of Air Pollution : Natural and Man-made sources, Stationary and mobile sources; Point, line and area sources, Primary and secondary pollutants; Natural contaminants; Aerosols; Gaseous pollutants.Effects of Air Pollution : Global Effects: Global warming; Ozone depletion; Acid rains; Effects of air pollutants on human health; Effects on plants; Economical effects.Meteorology and Air Pollution : Atmospheric stability and temperature inversions; Maximum Mixing Depth; Wind direction and speed; Plume behaviour; Gaussian Dispersion Model; Plume rise; Design of stack height, Wind rose.

UNIT II   *Text Book - T2,T3,R3* [CO:2,3] **(12)**

Control of Air Pollution : Objectives; Types of collection equipment: Settling chamber; Inertialseparators; Cyclones; Filters; Electrostatic Precipitators; Scrubbers.Noise Pollution : Introduction; Levels of noise; Noise rating systems; Measurement of noise; Sources of noise and their noise levels; Acceptable noise levels; Effects of noise; Control of noise.Urban Solid Waste Management: Sources; Quantities and characteristics; Classification; Collection and transportation; Recovery and reuse; Treatment methods – sanitary land filling, compositing, incineration and pyrolysis

UNIT III   *Text Book - T1,R1,R3* [CO:4] **(13)**

Stream Sanitation : Introduction; Self-purification in streams; factors affecting self-purification; Dissolved Oxygen Balance in streams; Streeter-Phelps's Dissolved Oxygen Model; Zones of Self-purification; Impact of pollutants on stream waters and usage of stream water with special reference to flora and fauna.New Concepts in Biological Waste Treatment (theory only) :Introduction; Nitrogen removal by biological nitrification and de-nitrification; Phosphate removal from the activated sludge process;

Rotating Disc Biological Contactor; Anaerobic filters; U-Tube aeration systems.

UNIT IV   *Text Book - T1,R3* [CO:5] **(10)**

Industrial Wastewater Treatment : Introduction to Industrial Wastewater treatment;Sugar Plant: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal.Dairy Industry: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal.Pulp and Paper Industry: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Wastewater Treatment by M.N. Rao and A.K. Datta; Oxford & IBH Publishing Co. Pvt. Ltd.,2008.
2. Environmental Pollution Control Engineering by C.S. Rao, New Age International, 2006.
3. Air Pollution by M.N. Rao and H.V.N. Rao, Tata Mc Graw-Hill,1989.

REFERENCE BOOK(s):

1. Wastewater Engineering : Treatment, Disposal and Reuse by Metcalf & Eddy , 3rd Edition, Mc Graw-Hill, 1991.
2. Sewage Disposal and Air Pollution Engineering by S.K. Garg; Khanna Publications, 2010.
3. Environmental Engineering by Peavy and Rowe, Mc Graw Hill, 7th Edition, 1987.

CEEL4D   **REMOTE SENSING AND GIS**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Demonstrate the concepts of, Electro Magnetic energy and spectrum, Remote sensing process and Photogrammetry.

2. Describe types of Remote sensing, resolutions and observe various image processing techniques.

3. Demonstrate the concepts of GIS and analyze raster and vector data modeling in GIS.

4. Demonstrate the GIS spatial analysis and importance of Remote sensing and GIS applications in Civil engineering.

UNIT I   *Text Book - T1,T2,T3,T4* [CO:1] **(20)**

Photogrammetry: Introduction, Important Definitions, Types of Photogrammetry-Aerial Photograph ,Map vs Aerial photograph, Scale of Vertical Photograph, Displacement of errors due to ground relief, Procedure for aerial survey-Ground control, Flight Planning-Reasons for overlap ,Number of photographs to cover a given area, Interval between exposures.Remote Sensing – I : Introduction to Remote Sensing; Remote Sensing terminology and units; Importance of Remote Sensing; Electromagnetic spectrum, Remote Sensing process- Interactions with atmosphere -Energy interactions with earth's surface materials - Transmission, Reception and Processing; Interpretation and Analysis.

UNIT II   *Text Book - T1,T2,R1* [CO:2] **(10)**

Remote Sensing – II :Ideal Remote Sensing system , Applications of Remote Sensing ,Advantages and Limitations of Remote Sensing , Spectral reflectance curves for water, soil and vegetation .Types of Remote Sensing system. Types of resolutions; Concepts of Nadir and Swath.Image Analysis: Introduction; Elements of Visual Interpretation; Digital Image Processing – Image preprocessing, Image enhancement.

UNIT III   *Text Book - T1,T2,R1* [CO:3] **(10)**

Geographic Information System (GIS): Introduction; GIS definition and terminology; GIS categories; Components of GIS; Fundamental operations of GIS; A theoretical framework for GIS.Types of Data Representations: Data input and output; Data editing; Types of data entry – Keyboard entry, Coordinate geometry procedure, Manual digitizing and Scanning; Types of GIS – Raster GIS and Vector GIS; Advantages and Disadvantages of Raster and Vector GIS.

UNIT IV   *Text Book - T1,T2,R2* [CO:4] **(10)**

GIS Spatial Analysis: Spatial Data – Layer based GIS and Feature based GIS, Data integration- Map overlay, Database and Database management system.Applications of GIS : Application areas and user segments; Guide lines for preparation of GIS; Applications of GIS for land use and housing

management; Assessment of physical transformation in an urban area.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Text Book of Remote Sensing and Geographical Information systems by M.Anji Reddy, 4th Edition, B.S.Publications, 2012.
2. Text Book of Remote Sensing and Geographical Information systems by Basudeb Bhatta, Oxford University Press.
3. Text Book of Remote Sensing and Geographical Information systems by A M Chandra and S K Ghosh, Narosa Publishing House.
4. Advanced Surveying: Total Station, GIS and Remote Sensing Book by N. Madhu, R. Sathikumar, and Satheesh Gopi , Pearson Education India, 2006

REFERENCE BOOK(s):

1. Geographic information Systems by Kang- tsung Chang, McGraw-Hill, 2003
2. Basics of Remote sensing & GIS by S.Kumar, USP, 2005

WEB RESOURCES:

1. https://en.wikipedia.org/wiki/Indian_Institute_of_Remote_Sensing
2. http://nptel.ac.in/downloads/105108077/
3. http://nptel.ac.in/courses/105102015/28

CE 451	QUNANTITY ESTIMATION & PROJECT MANAGEMENT	L	T	P	C	Int	Ext
		-	-	2	1	40	60

COURSE OUTCOMES:

1. Estimate the quantities and cost of different items of work required for residential buildings, R.C.C structures, BT road and irrigation canal etc.

2. Determine the unit rate of different items of work.

3. Plan and schedule for different civil engineering works like single storey residential building, BT road, and irrigation canal etc. using software packages like Primavera/MS Project etc.

4. Optimize and manage resources.

EXPERIMENTS:

1. Quantity Surveying
   (At least SIX of the following using software's like MS Excel/ Qty./Road Estimate/Super Rate analysis etc.)
   1. Quantity estimation of a single storey residential building (different items).
   2. Cost estimation of a single storey residential building.
   3. Quantity estimation of a B.T.Road(different items).
   4. Cost estimation of a B.T.Road.
   5. Quantity estimation of a Canal (different items).
   6. Cost estimation of a Canal.
   7. Find out the labour requirement and preparing the Rate Analysis for different items of work. a) C.C b) R.C.C c) Brick work d) Flooring

2. UNIT-II
   Project Management
   (At least THREE of the following using softwares like MS Project/Primavera etc.)
   8. Preparing the Project management report for a single storey residential building/Road/Canal by using the Bar Chart/Mile stone chart.
   9. Preparing the Project management report for a single storey residential building by using the network technique (PERT/CPM).
   10. Preparing the Project management report for a B.T.Road by using the network technique (PERT/CPM).
   11. Preparing the Project management report for a Canal by using the network technique (PERT/CPM).

3. UNIT-III
   (At least THREE of the following using softwares like MS Excel.)
   12. Quantity estimation of RCC roof slab and preparing schedule of bars
   13. Quantity estimation of RCC beam and preparing schedule of bars
   14. Quantity estimation of RCC Column with foundation footing and preparing schedule of bars
   15. Quantity estimation of RCC retaining wall and preparing schedule of bars

Note**:
A minimum of twelve (12No) shall be done and recorded

CEEL1A   **DESIGN OF REINFORCED CONCRETE STRUCTURES**   L T P C Int Ext

COURSE OUTCOMES:

1. Design continuous beams.
2. Design various slab systems.
3. Design different types of columns.
4. Design isolated, combined footings and retaining walls.

UNIT I   *Text Book - T1,R1,R2* [CO:1] **(10)**

Continuous Beam (Limit State Method)Design of continuous beamOne Way Slabs (Limit State Method)Design of simply supported, cantilever and Continuous slabs.

UNIT II   *Text Book - T1,R1,R2* [CO:2] **(10)**

Two Way Slabs (Limit State Method)Design and detailing of two way slabsFlat Slabs (Limit State Method)Design and detailing of flat slabs by direct design method.

UNIT III   *Text Book - T1,R1,R2* [CO:3] **(15)**

Columns (Limit State Method)Assumptions; Design of axially loaded columns ; Design of rectangular columns (short and Long) subjected to axial load and bending moment using Interaction diagrams (SP-16 Charts)

UNIT IV   *Text Book - T1,R1,R2* [CO:4] **(15)**

Foundations (Limit State Method)Design and detailing of rectangular Isolated footing, Combined footing for two columns.Retaining Walls (Limit State Method)Types of retaining walls, Forces on retaining walls; Stability requirements; Design and detailing of cantilever type retaining wall.

LEARNING RESOURCES:

TEXT BOOK:

Reinforced concrete , Vol.1 & 2 by H. J. Shah, Charotar publishing house Pvt. Ltd.,2011.

REFERENCE BOOK(s):

1. Reinforced Concrete (limit state design) by Ashok K. Jain; 6th Edition, NemChand & Bros., Roorkee
2. Reinforced concrete design by Pillai and Menon, 2nd Edition,Tata Mc Graw- Hill

WEB RESOURCES:

https://www.youtube.com/watchv=pIdaC_I6H_M&list=PL51300B0778FB5784

CEEL1B   **REPAIR AND REHABILITATION OF STRUCTURES**   **L T P C Int Ext**

COURSE OUTCOMES:
1. Enhance the knowledge on various distress and damages to concrete and masonry structures
2 .Acquire the knowledge on maintenance of structures and evaluation of concrete structures
3 .Assess the various types and properties of repair materials.
4 .Assess the damage to structures and various strengthening techniques
5. Apply various retrofitting techniques used for seismic retrofitting of buildings

UNIT I   *Text Book - T1, T2, T4, R1, R2* [CO:1] **(13)**

Introduction:Need for repair and rehabilitation of structures, Road map to repair of structures.Deterioration of concrete structures:Degradation of reinforced concrete structures; Major causes and signs of deterioration; Durability and permeability aspect of concrete; Deterioration of concrete structures; Cracking-Types, causes and characteristics.

UNIT II   *Text Book - T1, T2, T4, R1, R3,* [CO:2] **(12)**

Evaluation of concrete structures:Preliminary investigation-Scope and methodology of preliminary investigation, rapid visual investigation; Output of preliminary investigation-Damage classification based on preliminary investigation, reporting of findings of preliminary investigation; Detailed investigation-Scope and methodology of detailed investigation; In-situ and laboratory testing of concrete structures-Non destructive tests for strength estimation of concrete, Semi-destructive tests for strength evaluation of concrete, Tests to assess the corrosion potential of concrete, Chemical tests of concrete; Concrete repair materials:Repair methodology- Options, performance requirements of repair systems, factors of selecting repair methods, causes of damage, extent of damage, selection of repair material and repair methods, preparation of the old concrete for repair, application of the repair material and curing method.   Materials for repair:Cement based repair methods, Polymer modified repair materials, Resin based products, Micro-concrete, Composites.

UNIT III   *Text Book - T1, T2,T4, R1, R2* [CO:3] **(12)**

Repair techniques:Repairs using mortars, Dry pack and epoxy bonded dry pack, Pre-placed aggregate concrete, Gunite or Shortcrete, replacement of concrete, grouting, polymer impregnation, resin injection, routing and sealing, stitching, surface patching, overlays and surface coatings, autogenous healing, gravity filling, drilling and plugging.Strengthening of structures:Design philosophy of strengthening-General procedure for strengthening of structures; Strengthening techniques-Section enlargement, composite construction, post tensioning, stress reduction, strengthening by reinforcement; Strengthening of beams-Flexural strengthening of beams, shear strengthening of beams; Strengthening of slabs; strengthening of columns; strengthening of footings;

UNIT IV   *Text Book - T3, T4, R3* [CO:4] **(13)**

Seismic Retrofitting of reinforced concrete buildings:Introduction, Considerations in retrofitting of structures, Source of weakness in RC frame buildings- Structure damage due to discontinuous load path, Structural damage due to lack of deformation, Quality of workmanship and materials, Classification of retrofitting techniques, Retrofitting strategies for RC buildings, Structural level (global)

retrofit methods, Member level (local) retrofit methods,

LEARNING RESOURCES:

TEXT BOOK(s):

1. Repair and Rehabilitation of concrete structures by Poonam I.Modi, Chirag N.Patel, PHI, 2016.
2. Maintenance repair & rehabilitation of minor works of buildings by P.C.Varghese, PHI, 2014.
3. Earthquake resistant design of structures by Pankaj agarwal, Manish shrikande, PHI, 2006.
4. Rehabilitation of concrete structures by Dr.B.Vidivelli, Standard Publishers Distributors, 2015.

REFERENCE BOOK(s):

1. Failures and repair of concrete structures by S.Champion, John Wiley and Sons, 1961.
2. Diagnosis and treatment of structures in distress by R.N.Raikar Published by R & D Centre of Structural Designers and Consultants Pvt.Ltd, Mumbai.
3. Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India.
4. Handbook on seismic retrofit of buildings, A. Chakrabarti et.al., Narosa Publishing House, 2010.

CEEL1C   **PAVEMENT MATERIALS**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Understand the need for tests and procedures adopted for construction.
2. Discuss road construction using suitable materials

UNIT I   *Text Book - T1,R1* [CO:1] **(10)**

Soil Characterization of subgrade soil, Properties and test for use as subgrade material. Soil classification systems regarding suitability as subgrade soil. Soil stabilization methods Soil-Lime Stabilization, Soil-Cement- Stabilization, Soil-Bitumen Stabilization, Mechanical stabilization. Road aggregatesProperties of various Road aggregates, tests on road aggregates.

UNIT II   *Text Book - T1,R1* [CO:1] **(12)**

Bitumen Manufacturing, Grading and tests. Emulsions, Cut backs and Modified binders-Properties, types and uses.Bituminous pavement typesPenetration layer systems and Pre mixed aggregate and bituminous mixtures. Mix Design- Marshall method and Superpave procedure. Construction of bituminous pavements- Preparation and construction of Base, Sub base and surface layers.

UNIT III   *Text Book - T1,R2,R3* [CO:2] **(13)**

Material characterization for Cement concrete pavementsProperties and tests for the materials used for CC pavements. Construction of Cement concrete pavements – Preparation of Subgrade and Base, Presetting reinforcements in joints and PCC slab construction stages. Thin white topping and ultra thin white toppings.

UNIT IV   *Text Book - T1,R2,R3* [CO:2] **(12)**

Specialised applications of materials and construction practices Interlocking concrete block pavements – Materials used and the construction procedures. Geo-Textiles- Types and functions as pavement material. Introduction to Microsurfacing, Porous pavements, Warm mix asphalt & Recycling of pavements.

LEARNING RESOURCES:

TEXT BOOK:

Khanna S. K. and C. E. G. Justo, Highway Material Testing, New Chand & Bros., 1999.

REFERENCE BOOK(s):

1. Wright P. H. and K. Dixon, Highway Engineering, John Wiley & Sons, 1996.
2. Mallick R. B. and T. E. Korchi, Pavement Engineering, CRC Press, 2009.
3. Manual for Construction and Supervision of Bituminous Works, MoRTH , 2001.
4. IRC SP: 63-2004, Guidelines for Use of Interlocking Concrete Block Pavement, Indian Roads Congress.
5. G.V. Rao, P. K. Banerjee, J. T. Shahu, G. V. Ramana, Geosynthetics -New Horizons, Asian Books Private Ltd., New Delhi, 2004.

CEEL1D   **EARTH RETAINING STRUCTURES**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Determine lateral earth pressure to design retaining walls and sheet pile walls
2. Design of braced cuts and coffer dams
3. Analyse stability of earth dams
4. Detail protection and construction of earth dams

UNIT I   *Text Book - T1,R1,R2* [CO:1] **(10)**

Lateral Pressure: Basic concepts; Rankine's and Coulomb's earth pressure theories; Graphical methods- Culmanns, Rebhan's, logarithmic spiral methods, friction circle method. Consideration of surcharge, seepage, earthquake, wave effect, stratification, type of backfill, wall friction and adhesion.Retaining walls: Uses, types, stability and design principles of retaining walls, backfill drainage, settlement and tilting.

UNIT II   *Text Book - T1,R2,R4* [CO:2] **(10)**

Lateral Pressure: Basic concepts; Rankine's and Coulomb's earth pressure theories; Graphical methods- Culmanns, Rebhan's, logarithmic spiral methods, friction circle method. Consideration of surcharge, seepage, earthquake, wave effect, stratification, type of backfill, wall friction and adhesion.Retaining walls: Uses, types, stability and design principles of retaining walls, backfill drainage, settlement and tilting.

UNIT III   *Text Book - T2,T3,R3* [CO:3] **(12)**

Earth dam-Stability analysis: Classification, seepage control in embankments and foundations, seepage analysis, stability analysis: upstream and downstream for steady seepage, rapid draw down, end of construction, method of slices and Bishop's method.

UNIT IV   *Text Book - T2,T3,R3* [CO:4] **(8)**

Earth dams-Protection & Construction: Slope protection, filters, embankment construction materials and construction, quality control, grouting techniques. Instrumentation and performance observations in earth dams.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Basic & Applied soil mechanics - Gopal Ranjan & ASR Rao, New Age International Publishers, 2011.

2. Embankment Dams by Sharma Hd, Publisher: India Book House (IBH) Limited, 1991.
3. Engineering for Embankment Dams By B. Singh & R. S. Varshney, A A Balkema Publishers, 1995

REFERENCE BOOK(s):

1. Foundation design by W. C. Teng, Prentice Hall, 1962
2. Analysis and design of foundations by Bowles. J. W McGraw Hill, 4th edition, 1955.
3. Earth and Rock-Fill Dams: General Design and Construction Considerations by United States Army Corps of Engineers, University Press of the Pacific, 2004.
4. Soil mechanics in engineering and practice by Karl Terzaghi, Ralph B. Peck, Gholamreza Mesri, 3rd Edition. Wiley India Pvt., Ltd., 2010.

CEEL2A   **ADVANCED STRUCTURAL ANALYSIS**   **L T P C Int Ext**

COURSE OUTCOMES:
1. Analyse beams and simple frames using slope-deflection method
2. Analyse beams and simple frames using Moment distribution
3. Analyse structures using Flexibility method
4. Analyse structures using Stiffness method
5. Apply plastic analysis to beams and simple frames

UNIT I   [CO:1]   ()

Slope Deflection Method:Slope - deflection equations; Principles of the method; Applications of the method to the analysis of continuous beams and portal frames (Single bay, single story with vertical legs only) without and with sidesway.

UNIT II   [CO:2]   ()

Moment Distribution Method:Principles of the method; Application of the method to analysis of continuous beams and portal frames (Single bay, single story with vertical legs only) without and with side sway.

UNIT III   [CO:3]   ()

Matrix methods of Structural analysis:Flexibility and stiffness; Flexibility matrix; Stiffness matrix; Relationship between flexibility matrix and stiffness matrix; Analysis of continuous beams and rigid jointed plane frames (Single bay, single storey with vertical legs only) by flexibility and stiffness methods

UNIT IV   [CO:4]   ()

Plastic analysis of structures:Introduction, Stress-strain curve, Plastic moment – Plastic section modulus, Shape factor, Load factor, Failure mechanisms; Methods of analysis - Static method   and Mechanism method; Analysis of continuous beams and single bay rectangular portal frames.

LEARNING RESOURCES:

TEXT BOOK:

Basic structural analysis by CS Reddy, 3rd Edition, Tata McGraw-Hill ,2010.

2.

REFERENCE BOOK(s):

1. Structural Analysis by Devdas Menon, Narosa Publishinh House, 2008.
2. Intermediate structural analysis by CK Wang, Tata McGraw-Hill,2010.
3. Structural Analysis: A matrix approach by G. S. Pandit & S. P. Gupta; Tata Mc Graw – Hill Publishing Co. Ltd., 2008.
4. Fundamentals of limit analysis of structures by Manicka Selvam, Dhanpat Rai &Sons

WEB RESOURCES:

1. http://www.cdeep.iitb.ac.in/nptel/Civil%20Engineering/Structural%20Mechanic%20II/Course%20Objective.html.
2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Structural%20Analysis/New_index1.html

CEEL2B   **SOLID AND HAZARDOUS WASTE MANAGEMENT**   **L T P C Int Ext**

COURSE OUTCOMES:
1. Correlate various functions elements of solid waste management
2. Suggest effective methods for on-site storage, processing, collection and transport of solid waste
3. Plan methods for recovery, reuse and treatment of solid waste
4. Identify a suitable site and design sanitary landfill
5. Visualise the impacts of hazardous wastes and plan proper methods for collection, treatment and disposal of bio-medical wastes and radioactive wastes

UNIT I   *Text Book - T1,R1* [CO:1] **(13)**

Introduction, sources and typesSources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics of solid waste, Effects of improper disposal of solid wastes-Public health and environmental effects-need for integrated solid waste managementFunctional elements of solid waste managementFunctional elements and their inter relationship, on-site storage, handling and processing of solid wasteCollection of solid waste Types and methods of waste collection systems, factors affecting collection, analysis of collection systems, optimization of collection routes

UNIT II   *Text Book - T1,R1* [CO:2] **(12)**

Transfer and TransportNeed for transfer operation, compaction of solid waste, transport means and methods, transfer stations types and design requirementsSeparation and Transformation of solid wasteUnit operations used for separation and transformation: Shredding – material separation and recovery, source reduction and waste minimization

UNIT III   *Text Book - T1,R1,R2* [CO:3,4] **(13)**

Processing and treatmentProcessing of solid waste viz., combustion and composting, anaerobic treatment for energy and material recovery, incineration and pyrolysisDisposal of solid wasteSanitary landfillmethods of operation,advantages and disadvantages of sanitary land fill, site selection, reactions accruing in completed landfills, gas and leachate movement and control

UNIT IV   *Text Book - T1,T2,R1* [CO:5] **(12)**

Fundamentals of Hazardous Waste Management Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effectsBiomedical wasteBiomedical wastes and their impacts on health and environment, Collection and transport, treatment and disposalRadioactive wastesRadioactive wastes and their impact on health and environment, sources, classification and disposal

LEARNING RESOURCES:

TEXT BOOK(s):

1. Vesilind, P.A., Worrell, W., Reinhart, D. "Solid Waste Engineering", Cenage learning, New Delhi, 2004
2. Solid and Hazardous Waste Management by M.N. Rao and Razia Sultana, BS Publications, Hyderabad

REFERENCE BOOK(s):

1. George Techobanoglous "Integrated Solid Waste Management", McGraw Hill Publication, 1993
2. Environmental Engineering by Peavy, Rowe and Techobanoglous, Tata McGraw Hill Publication

CEEL2C   **SURFACE HYDROLOGY**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Analyze precipitation data and prepare IDF and DAD curves.
2. Estimate abstractions from precipitation.
3. Compute runoff by hydrograph analysis.
4. Estimate design flood of the project and understand flood routing process.

UNIT I   *Text Book - T1,T2,T3,T4,R1* [CO:1] **(12)**

Introduction: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.Precipitation: Types and forms, measurement, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm.

UNIT II   *Text Book - T1,T2,R2* [CO:2] **(13)**

Abstractions from Precipitation: Initial abstractions. Evaporation: factors affecting, measurement, reduction Evapotranspiration: factors affecting, measurement, controlInfiltration: factors affecting, Infiltration capacity curve, measurement, infiltration indices

UNIT III   *Text Book - T1,T2,R3* [CO:3] **(12)**

Runoff :Catchment characteristics, Factors affecting runoff, components, computation- empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.Hydrograph analysis: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph

UNIT IV   *Text Book - T1,T2,T3R2,R1* [CO:4] **(13)**

Floods: Causes and effects, frequency analysis- Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management. Flood Routing: Hydrologic routing, channel and reservoir routing- Muskingum and Puls methods of routing.

LEARNING RESOURCES:

TEXT BOOK(s):

1. 'Engineering Hydrology' by Subramanya, K, Tata Mc Graw-Hill Education Pvt. Ltd, (2013), New Delhi.
2. 'Engineering Hydrology' by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), New Delhi
3. 'Applied hydrology'by Chow V.T., D.R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt. Ltd., (2011), New Delhi.

4. 'Engineering Hydrology'by Ojha C.S.P, R. Berndtsson and P. Bhunya, Oxford University Press, (2010).

REFERENCE BOOK(s):

1. Water Resources Engineering', Mays L.W, Wiley India Pvt. Ltd, (2013).
2. 'Hydrology'by Raghunath. H.M., New Age International Publishers, (2010).
3. 'Engineering Hydrology –Principles and Practice'by Ponce V.M., Prentice Hall International, (1994).
4. 'Hydrology and Water Resources Engineering' by Patra K.C.,Narosa Publications, (2011).

CEEL2D   **FINITE ELEMENT METHOD**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Describe standard discrete system and direct physical approach to problems of elasticity
2. Generalize the finite element concepts
3. Detail different types of finite elements and numerical integration
4. Apply finite element method to problems of linear elasticity and heat conduction, electric/magnetic potential and fluid flow

UNIT I   *Text Book - T1,R1,R2,R3,R4* [CO:1] **(12)**

Overview of finite element methodBasic concept; Historical background; General applicability of the method; Engineering applications of the finite element method; Engineering applications of the finite element method; General description of the finite element method; Derivation of finite element equations using a direct approachDiscretisation of the domainIntroduction; Basic element shapes; discretisation process; Node numbering schmeInterpolation modelsIntroduction ; Polynomial form of interpolation functions; Selection of the order of interpolation polynomial; Convergence requirements; Linear interpolation polynomials in terms of local coordinates

UNIT II   *Text Book - T1,R1,R2,R3,R4* [CO:2] **(13)**

Derivation of element matrices and vectorsIntroduction; Variational approach- Solution of equilibrium problems using Rayleigh-Ritz metod, Derivation of finite element equations using Rayleigh-Ritz approach; Weighted residual approach-Solution of equilibrium problems using weighted residual method, Galerkin method, Derivation of finite element equations using Galerkin approach

UNIT III   *Text Book - T1,R1,R2,R3,R4* [CO:3] **(12)**

Assembly of element matrices and derivation of system equationsAssemblage of element equations; Incorporation of boundary conditions;Numerical solution of finite element equationsIntroduction; Solution of equilibrium problems- Gaussian elimination method

UNIT IV   *Text Book - T1,R1,R2,R3,R4* [CO:4] **(13)**

Application to heat transfer problemsSteady state one-dimension problems; Steady state two dimensional heat transfer problems using linear triangular elementApplication to fluid flow problems problemsInviscid and incompressible flow problems using linear triangular elementApplication to electromagnetic problemsSolution to one-dimensional electrostatic boundary value problems ; Solution to two-dimensional electrostatic boundary value problems using linear triangular element

LEARNING RESOURCES:

TEXT BOOK:

The finite element method in engineering by S. S.Rao, Butterworth-Heinemann, New Delhi, 2011.

REFERENCE BOOK(s):

1. The finite element method – Basic concepts and applications with MATLAB, MAPLE and COMSOL by D.W.Pepper and J.C.Heinrick, CRC Press, 2017.
2. Introduction to the finite element method in electromagnetic by A.C.Polycarpou, Morgan & Claypool, 2006.
3. The finite element method in electromagnetics by J.Jin, John Wiley & Sons, 2002.
4. Finite elements for electrical engineers by R.L.Ferrari, Cambridge University Press, 1996.

CEEL3A   **RAILWAY, AIRPORT & HARBOR ENGINEERING**   **L T P C Int Ext**

COURSE OUTCOMES:
1. Design a railway track and select proper materials.
2. Detail a railway station.
3. Plan and design various amenities of an airport
4. Describe various features of a harbor and a port

UNIT I   *Text Book - T1,R1* [CO:1]   **()**

IntroductionRole of railways in transportation; Comparison of railway and highway transportation;Development of railway systems with particular reference to India; Classification of railways.Railway TrackPermanent way: Gauges in Railway track, Railway track cross – sections; Coning of wheels.Rails & Rail JointsFunctions of rails; Requirements of rails; Types of rails sections; Standard rail sections; Length of rails; Rail failures; Wear on rails. Requirements of an ideal joint; Types of rail joints; Welding of rails.SleepersFunctions of sleepers; Requirements of sleepers; Classification of Sleepers – Timber sleepers, Metal sleepers & Concrete sleepers; Comparison of different types of sleepers.Fish PlatesFish plates, section of fish plates, and failure of fish plates.BallastFunctions and requirements of ballast; Types of ballast; Renewal of ballast

UNIT II   *Text Book - T1,R1* [CO:2]   **()**

Geometric Design Of TrackNecessity; Gradients & Gradient Compensation; Elements of horizontal alignment; Super elevation; Cant deficiency and cant excess; Negative Super elevation; Length of Transition Curve, Length of vertical curve. Points And CrossingsFunctions of components of turnout; Crossings.Stations And YardsSite selection for railway station; Requirements of railway station; Classifications; Station yards; Level crossing.SignallingObjects of signaling; Classification of signals; Controlling- absolute block system. Standards of inter locking

UNIT III   *Text Book - T2,,R2* [CO:3]   **()**

AIRPORT PLANNING AND DESIGNIntroductionDevelopment of air transportation system with particular reference to India; Aeroplane components; Air–craft characteristics.Airport planning and layoutSelection of site; Apron; Hanger; Typical airport layouts; Airport marking; Airport lighting; Drainage systems.Airport ObstructionZoning laws; Classification of obstructions; Imaginary surfaces; Approach zone; Turning zone.Runway DesignRunway orientation; Basic runway length; Corrections for elevation; Temperature and gradient;Runway geometric design.Specifications for Structural Design of Airport Pavements, Design factors methods for flexible and rigid pavements; LCN system of pavement design.

UNIT IV   *Text Book - T3* [CO:4]   **()**

DOCKS AND HARBOUR ENGINEERINGIntroductionTypes of water transportation; Economics and advantages of water transportation.Planning and Design Of Port FacilitiesGeneral layout and design considerations; Pier and wharf structures; Fender systems; Transit sheds and Apron; Container ports; Docks; Dredging; Light Houses.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Railway Engineering by S.C.Saxena and S.Arora , Dhanpat Rai & sons.
2. Airport Planning and Design by S. K. Khanna & M. G. Arora, 6th Edition, Nemchand & Bros, 1999.
3. Dock, harbour engineering by rangawala

REFERENCE BOOK(s):

1. Railway Engineering by M.M.Agarwal and Satish Chandra, Oxford University Press, 2007.
2. Airport Engineering by G.V.Rao; Tata Mc Graw Hill, 1991

CEEL3B   **BRIDGE ENGINEERING**   **L T P C Int Ext**

COURSE OUTCOMES:
1. Summarize various investigations to be conducted before constructing a bridge.

2 .Classify various RC bridges and IRC loadings.

3. Design slab culvert and T-beam bridge.

4 .Design substructure like piers and abutments.

5 .Classify various types of bearings and design elastomeric pad bearing.

6 .Design well foundation

UNIT I   *Text Book - T1,R1,R2* [CO:1,2] **(12)**

Introduction & Investigation For Bridges:Components of a Bridge; Classification; Standard Specifications; Need for Investigation; Selection of Bridge Site; Preliminary Data to be Collected; Preliminary Drawings; Determination of Design Discharge; Economical Span; Location of Piers and Abutments; Vertical clearance above HFL; Scour depth; Traffic Projection; Choice of Bridge type; Importance of Proper Investigation. --Concrete Bridges:Various types of bridges; I. R. C. Specifications for road bridges.

UNIT II   *Text Book - T1,R1,R2* [CO:3] **(13)**

Culverts : Design of R. C. slab culvert.--T – Beam Bridge: Pigeaud's method for computation of slab moments; Courbon's method for computation of moments in girders; Design of simply supported T–beam bridge.

UNIT III   *Text Book - T1,R1,R2* [CO:4] **(12)**

Sub Structure for Bridges:Pier and abutment caps; Materials for piers and abutments; Design of pier; Design of abutment; Backfill behind abutment; Approach slab.

UNIT IV   *Text Book - T1,R1,R2* [CO:5,6] **(13)**

Bearings for Bridges: Importance of bearings; Bearings for slab bridges; Bearings for girder bridges; Expansion bearings; Fixed bearings; Design of elastomeric pad bearing.--Foundations for Bridges: Scour at abutments and piers; Grip length; Types of foundations; Design of well foundation.

LEARNING RESOURCES:

TEXT BOOK:

Essentials of Bridge Engineering by Dr. Johnson Victor; 6th Edition, Oxford & IBH Publishing Company Pvt. Ltd., 2007.

REFERENCE BOOK(s):

1. Bridge Engineering by S Ponnuswamy, 2nd edition, Mc Graw Hill Education, 2009

2. Design of bridge structures by Jagadeesh and Jayaram, 2nd Edition, PHI Learning, 2009.

CEEL3C   **ENVIRONMENT IMPACT ASSESSMENT**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Demonstrate the key concepts of environmental impact assessment and the current legislation covering them.

2. Perceive environmental impact on land, water, air, noise and energy, Flora and fauna and Socio Economics.

3. Plan options for mitigation of adverse impact on environment

4. Identify the components and decision making processes involved in Environmental assessment through various case studies.

5. Outline Environmental Audit report.

UNIT I   *Text Book - T1,R1* [CO:1] **(13)**

Basic concepts of EIA : Initial Environmental Examination; Elements of EIA; Factors affecting EIA; Impact evaluation and analysis; Preparation of Environmental Base map; Classification of Environmental parameters.EIA Methodologies : Introduction; criteria for the selection of EIA Methodology; EIA Methods: Ad-hoc methods, Matrix methods, Network method, Environmental media quality index method; Overlay methods; Cost/benefit Analysis.

UNIT II   *Text Book - T1,R2* [CO:2,3] **(12)**

Impact of Developmental Activities and Land Use : Introduction and Methodology for the assessment of soil and ground water; Delineation of study area; Identification of activities; Procurement of relevant soil quality; Impact prediction; Assessment of Impact significance; Identification and Incorporation of mitigation measures.EIA in surface water, Air and Biological Environment: Methodology for the assessment of Impacts on surface water environment; Air pollution sources; Generalized approach for assessment of Air pollution Impact.

UNIT III   *Text Book - T1,T2,R1* [CO:4] **(12)**

Assessment of Impact of Development activities on vegetation and wildlifeEnvironmental Impact of Deforestation; Causes and effects of deforestation.EIA Case Studies : Preparation of Environmental Impact Assessment statement for thermal power plants, mining industry; river valley projects etc.

UNIT IV   *Text Book - T1,R1* [CO:5] **(13)**

Environmental Audit and Environmental legislation : Objectives of Environmental Audit; Types of Environmental Audit; audit protocol; stages of Environmental Audit; On-site activities; Evaluation of Audit data and preparation of Audit report, Post Audit activities, The Environmental Pollution Act, The Water Act; The Air (Prevention and Control of Pollution) Act; Mota Act; Wild life Act.Life Cycle AnalysisIntroduction, types, importance, stages in LCA-goals and scope, inventory analysis, impact assessment and interpretations, case studies

LEARNING RESOURCES:

TEXT BOOK(s):

1. Environmental Impact Assessment Methodologies by Y. Anjaneyulu; B.S. Publication, Sultan Bazar, Hyderabad.
2. Environmental Science and Engineering by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers.

REFERENCE BOOK(s):

1. Environmental Science and Engineering by Suresh K. Dhameja, S.K. Kataria & Sons Publications, New Delhi.
2. Environmental Pollution and Control by Dr. H.S. Bhatia, Galgotia Publications Pvt. Ltd. De

CEEL3D   **GROUND IMPROVEMENT TECHNIQUES**   **L T P C Int Ext**

COURSE OUTCOMES:
1 Describe alternative solutions to difficult and earth construction problems and in evaluating their effectiveness before, during and after construction.
2 Study ground modification by Mechanical modification like   Dynamic compaction, deep compaction,hydromechanical compaction etc.
3 Study hydraulic modification like dewatering methods, use of geosynthetics,preloading techniques etc.
4 Discuss physical and chemical modification by use of cement,lime,emulsions,industrial wastes etc.
5 Detail modification by inclusions like metallic strips and geotextiles and In-situ Ground reinforcement by ground anchors, rock bolts and soil nailing.

UNIT I   *Text Book - T1,R1* [CO:1]   **(8)**

Introduction to Engineering ground modification: Need for engineered ground improvement, classification of ground modification techniques; suitability, feasibility and desirability of ground improvement technique; objectives of improving soil.In-situ densification of granular soil: Dynamic compaction; Basting; Vibro compaction; Blasting: compaction grouting.

UNIT II   *Text Book - T1,R1* [CO:2]   **(8)**

In-situ densification of cohesive soil: Preloading and Vertical drains- Sand Drains, Wick Drains, Geosynthetic Drains; Radial consolidation, combined radial and vertical consolidation; stone columns and lime columns.Dewatering: Objectives and techniques, Traditional dewatering methods-open sumps and ditches, Single and Multiple stage Well points, Vacuum dewatering wells, Electro osmosis method.

UNIT III   *Text Book - T1,R1* [CO:3]   **(10)**

Mechanical and chemical modification: Mechanical modification by rollers for shallow compaction; Rothfutch's method; Cement stabilization; Lime stabilization; Bitumen stabilization; Stabilization using industrial waste-fly ash;Use of Geosynthetic material: Filtration, drainage and seepage control with Geosynthetics-Geotextiles -types, Basic functions and applications of geotextiles.

UNIT IV   *Text Book - T1,R1* [CO:4]   **(10)**

Reinforced Earth: Principles, components of reinforced earth; governing design of reinforced earth wall and design principle of reinforced earth wall using metallic strip reinforcement, Geotextile reinforcement and Geogrid reinforcement.

LEARNING RESOURCES:

TEXT BOOK:

Hausmann M.R (1990) Engineering Principles of ground modification, McGraw-Hill Education (India), Pvt., Ltd., New Delhi.

REFERENCE BOOK:

Ground improvement Techniques, P.PurushothamaRaju, Laxmi Publications Pvt., Ltd., New Delhi.

CEEL4A   **PRE-STRESSED CONCRETE**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Understand pre-stressing of concrete and various pre-stressing systems

2. Analyze and design pre-stressed concrete beams

3. Estimate the losses in pre-stressing

4.Analyse and design end block

UNIT I   *Text Book - T1,R1,R2* [CO:1,2] **(12)**

Introduction:Basic concepts of prestressing; Historical development; Need for High strength steel and high strength concrete; Advantages of prestressed concrete.--Materials for Prestressed Concrete: High strength concrete; High tensile steel.--Pretressing Systems: Tensioning devices; Hoyer's long line system of pretensioning; Post tensioning systems;   detailed study of Freyssinet system, Lee-McCall System and Gifford – Udall system.--Analysis of Prestress and Bending Stresses:Basic assumptions; Analysis of prestress; Resultant stresses at a section; Pressure (Thrust) line and   internal resisting couple; Concept of Load balancing; Stresses in tendons; Cracking moment.

UNIT II   *Text Book - T1,R1,R2* [CO:2,3] **(13)**

Losses of Prestress:Nature of losses of prestress; Loss due to elastic deformation of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip; Total losses allowed for in design.--Deflections of Prestressed Concrete MembersImportance of control of deflections; Factors influencing deflections; Short term deflections of uncracked members.

UNIT III   *Text Book - T1,R1,R3* [CO:2,4] **(12)**

Flexural strength of prestressed concrete sections: Types of flexural failure; Flexural strength of prestressed concrete sections as per IS1343: 2012.--Design of sections for flexure as per IS1343: 2012:Introduction; Design loads and strengths; Strength and serviceability limit states;   Minimum section modulus; Prestressing force; Limiting zone for the prestressing force;   Design of rectangular and I sections for the limit state of collapse in flexure.--Shear Resistance Shear and Principal Stresses; Ultimate shear resistance of prestressed concrete members and design of shear reinforcement as per IS1343:2012.

UNIT IV   *Text Book - T1,R3,R4* [CO:5] **(13)**

Transfer of Prestress in Pre–Tensioned Members & Flexural Bond Stresses:Transmission of prestressing force by bond; Transmission length; Bond stresses;   Transverse tensile stresses; End zone reinforcement; Flexural bond stresses in pre tensioned and post tensioned grouted beams.--Anchorage Zone Stresses In Post-Tensioned Members:Stress distribution in end block; Anchorage zone stresses and Anchorage zone Reinforcement   as per IS1343: 2012

LEARNING RESOURCES:

TEXT BOOK:

Prestressed Concrete by N. Krishna Raju; 4th Edition, Tata Mc Graw - Hill Publishing Company Limited, 2012.

REFERENCE BOOK(s):

1. Design of Prestressed Concrete Structures by T.Y. Lin & Ned H. Burns,3rd Edition, John Wiley & Sons, 2010.
2. Prestressed Concrete by Pandit & Gupta , CBS Publishers, 1995.
3. Fundamentals of Pre-stressed concrete by NC Sinha and SK Roy, 3rd Edition, S.Chand Publishers, 1985.
4. Prestressed Concrete by N.Raja Gopalan ,2nd Edition,Narosa Publishing House, 2008.

WEB RESOURCES:

www.iitm.ac.in

CEEL4B   **EARTHQUAKE RESISTANT DESIGN OF STRUCTURES   L T P C Int Ext**

COURSE OUTCOMES:
1. Enumerate the fundamental vibration of single degree freedom systems.
2. Describe the earthquake ground motion characteristics.
3. Compute the lateral forces on a building using equivalent static method.
4. Analyse and design a single storey and single bay RC framed building.
5. Identify the architectural features of buildings to resist earthquakes.
6. Describe the behavior of soil beneath a foundation during an earthquake.

UNIT I   *Text Book - T1,R1,R2* [CO:1] **(13)**

Elements of structural dynamics : Sources of vibrations; Types of vibrations; Degrees of freedom; Spring action and damping; Free vibration of undamped system having single degree of freedom; Free vibration of viscous damped system having single degree of freedom; Forced vibration of a viscous damped single degree freedom system subjected to harmonic excitation; Earthquake excitation (Base excitation) of a single degree freedom system.

UNIT II   *Text Book - T1,R1,R2* [CO:2] **(13)**

Elements of Earthquake Ground motion: Earthquake size - Intensity and magnitude; Seismic Zoning-Introduction; Strong Motion Earthquakes - Introduction; Response spectrum (elastic); Local site effect (Effect of type of soil).Seismo-resistant building architecture: Introduction; Lateral load resisting systems- moment resisting frame, Building with shear wall or bearing wall system, building with dual system; Building configuration- Problems and solutions; Building characteristics - Mode shape and fundamental period, building frequency and ground period, damping, ductility, seismic weight, hyperstaticity/redundancy, non-structural elements, foundation soil/ liquefaction. Foundations; Quality of construction and materials - quality of concrete, construction joints, general detailing requirements.

UNIT III   *Text Book - T1,R1,R2* [CO:2,3] **(12)**

Analysis of single storey and single bay RCC Plane Frame (Columns vertical): (As per IS:1893(part-I)-2002) Calculation of lateral force due to earthquake using equivalent static method ; Analysis for different load combinations; Design forces and moments in beam and columns.

UNIT IV   *Text Book - T1,T2,R1,R2* [CO:3,4] **(12)**

Design of single storey and single bay RCC plane frames (Columns vertical) (As per IS:456-2000 and IS13920-1993) Design of column; Design of beam; Design of footing ; Detailing of entire frame.Elements of Geotechnical Earthquake Engineering: Liquefaction - Definition and types, Effect of liquefaction on built environment, Evaluation of liquefaction susceptibility, Liquefaction hazard mitigation ; Seismic slope stability - Introduction, Pseudo-static analysis, Sliding block methods.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Earthquake Resistant Design of Structures by Pankaj Agarwal, and Manish Shrikhande, PHI Learning, 2006 .
2. Geotechnical Engineering by S.K.Gulhati & Manoj Datta, Tata McGraw-Hill, 2010

REFERENCE BOOK(s):

1. Elements of Earthquake Engineering by Jai Krishna, A.R.Chandrasekaran and Brijesh Chandra, Second Edition, South Asian Publishers, 1994.
2. Dynamics of Structures by A.K.Chopra, 3rd Edition, Person Education, 2007

CEEL4C   **ADVANCED ENVIRONMENTAL ENGINEERING**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Predict dilution and dispersion patterns of air pollution based on meteorological conditions.

2. Select suitable methods of control of air and noise pollution.

3. Select suitable methods for solid waste management including reuse and recycling.

4. Determine the degree of treatment required based on critical D.O. deficit in a polluted stream.

5. Select suitable methods for treatment and disposal of industrial wastewater from Dairy industry, Sugar industry and Pulp & paper industry, based on their characteristics.

UNIT I   *Text Book - T3,R3* [CO:1] **(12)**

Sources and Classification of Air Pollution : Natural and Man-made sources, Stationary and mobile sources; Point, line and area sources, Primary and secondary pollutants; Natural contaminants; Aerosols; Gaseous pollutants.Effects of Air Pollution : Global Effects: Global warming; Ozone depletion; Acid rains; Effects of air pollutants on human health; Effects on plants; Economical effects.Meteorology and Air Pollution : Atmospheric stability and temperature inversions; Maximum Mixing Depth; Wind direction and speed; Plume behaviour; Gaussian Dispersion Model; Plume rise; Design of stack height, Wind rose.

UNIT II   *Text Book - T2,T3,R3* [CO:2,3] **(12)**

Control of Air Pollution : Objectives; Types of collection equipment: Settling chamber; Inertialseparators; Cyclones; Filters; Electrostatic Precipitators; Scrubbers.Noise Pollution : Introduction; Levels of noise; Noise rating systems; Measurement of noise; Sources of noise and their noise levels; Acceptable noise levels; Effects of noise; Control of noise.Urban Solid Waste Management: Sources; Quantities and characteristics; Classification; Collection and transportation; Recovery and reuse; Treatment methods – sanitary land filling, compositing, incineration and pyrolysis

UNIT III   *Text Book - T1,R1,R3* [CO:4] **(13)**

Stream Sanitation : Introduction; Self-purification in streams; factors affecting self-purification; Dissolved Oxygen Balance in streams; Streeter-Phelps's Dissolved Oxygen Model; Zones of Self-purification; Impact of pollutants on stream waters and usage of stream water with special reference to flora and fauna.New Concepts in Biological Waste Treatment (theory only) :Introduction; Nitrogen removal by biological nitrification and de-nitrification; Phosphate removal from the activated sludge process;

Rotating Disc Biological Contactor; Anaerobic filters; U-Tube aeration systems.

UNIT IV   *Text Book - T1,R3* [CO:5] **(10)**

Industrial Wastewater Treatment : Introduction to Industrial Wastewater treatment;Sugar Plant: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal.Dairy Industry: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal.Pulp and Paper Industry: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Wastewater Treatment by M.N. Rao and A.K. Datta; Oxford & IBH Publishing Co. Pvt. Ltd.,2008.
2. Environmental Pollution Control Engineering by C.S. Rao, New Age International, 2006.
3. Air Pollution by M.N. Rao and H.V.N. Rao, Tata Mc Graw-Hill,1989.

REFERENCE BOOK(s):

1. Wastewater Engineering : Treatment, Disposal and Reuse by Metcalf & Eddy , 3rd Edition, Mc Graw-Hill, 1991.
2. Sewage Disposal and Air Pollution Engineering by S.K. Garg; Khanna Publications, 2010.
3. Environmental Engineering by Peavy and Rowe, Mc Graw Hill, 7th Edition, 1987.

CEEL4D   **REMOTE SENSING AND GIS**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Demonstrate the concepts of, Electro Magnetic energy and spectrum, Remote sensing process and Photogrammetry.

2. Describe types of Remote sensing, resolutions and observe various image processing techniques.

3. Demonstrate the concepts of GIS and analyze raster and vector data modeling in GIS.

4. Demonstrate the GIS spatial analysis and importance of Remote sensing and GIS applications in Civil engineering.

UNIT I   *Text Book - T1,T2,T3,T4* [CO:1] **(20)**

Photogrammetry: Introduction, Important Definitions, Types of Photogrammetry-Aerial Photograph ,Map vs Aerial photograph, Scale of Vertical Photograph, Displacement of errors due to ground relief, Procedure for aerial survey-Ground control, Flight Planning-Reasons for overlap ,Number of photographs to cover a given area, Interval between exposures.Remote Sensing – I : Introduction to Remote Sensing; Remote Sensing terminology and units; Importance of Remote Sensing; Electromagnetic spectrum, Remote Sensing process- Interactions with atmosphere -Energy interactions with earth's surface materials - Transmission, Reception and Processing; Interpretation and Analysis.

UNIT II   *Text Book - T1,T2,R1* [CO:2] **(10)**

Remote Sensing – II :Ideal Remote Sensing system , Applications of Remote Sensing ,Advantages and Limitations of Remote Sensing , Spectral reflectance curves for water, soil and vegetation .Types of Remote Sensing system. Types of resolutions; Concepts of Nadir and Swath.Image Analysis: Introduction; Elements of Visual Interpretation; Digital Image Processing – Image preprocessing, Image enhancement.

UNIT III   *Text Book - T1,T2,R1* [CO:3] **(10)**

Geographic Information System (GIS): Introduction; GIS definition and terminology; GIS categories; Components of GIS; Fundamental operations of GIS; A theoretical framework for GIS.Types of Data Representations: Data input and output; Data editing; Types of data entry – Keyboard entry, Coordinate geometry procedure, Manual digitizing and Scanning; Types of GIS – Raster GIS and Vector GIS; Advantages and Disadvantages of Raster and Vector GIS.

UNIT IV   *Text Book - T1,T2,R2* [CO:4] **(10)**

GIS Spatial Analysis: Spatial Data – Layer based GIS and Feature based GIS, Data integration- Map overlay, Database and Database management system.Applications of GIS : Application areas and user segments; Guide lines for preparation of GIS; Applications of GIS for land use and housing

management; Assessment of physical transformation in an urban area.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Text Book of Remote Sensing and Geographical Information systems by M.Anji Reddy, 4th Edition, B.S.Publications, 2012.
2. Text Book of Remote Sensing and Geographical Information systems by Basudeb Bhatta, Oxford University Press.
3. Text Book of Remote Sensing and Geographical Information systems by A M Chandra and S K Ghosh, Narosa Publishing House.
4. Advanced Surveying: Total Station, GIS and Remote Sensing Book by N. Madhu, R. Sathikumar, and Satheesh Gopi , Pearson Education India, 2006

REFERENCE BOOK(s):

1. Geographic information Systems by Kang- tsung Chang, McGraw-Hill, 2003
2. Basics of Remote sensing & GIS by S.Kumar, USP, 2005

WEB RESOURCES:

1. https://en.wikipedia.org/wiki/Indian_Institute_of_Remote_Sensing
2. http://nptel.ac.in/downloads/105108077/
3. http://nptel.ac.in/courses/105102015/28

CEOL01   **BUILDING MATERIALS AND CONSTRUCTION**   **L T P C Int Ext**

COURSE OUTCOMES:
1. Describe various building materials
2. Acquire the knowledge about plastics, paints, distempers and water proofing materials.
3. Understand brick masonry, specifications in plastering, stairs, lifts and acoustics of building.
4. Discuss building components, scaffolding, shoring, underpinning and formwork.

UNIT I   *Text Book - 1,2* [CO:1] **(20)**

Clay bricks: Brick clay, Preparation of bricks, Types of bricks, Dimensions of bricks, Weight of bricks, Storing of bricks, Brick substitutes, Classification of bricks, Tests for bricks.Timber: Classification of trees, Structure of wood, seasoning and con-version of timber, Market forms of timber, Defects of timber, Treatment of timber, Classification of timber.Glass: Manufacture and Classification, Uses of glass, testing for quality.

UNIT II   *Text Book - 1,2* [CO:2] **(15)**

Plastics: Classification of plastics, Properties of plastics, Fabrication of plastic articles, some plastics in common use, Reinforced plastics.Paints: Types of paints, Composition of paints, Considerations in choosing paints, Paints commonly used in buildings. Damp Proofing and water proofing materials and uses, white washing and distempering.

UNIT III   *Text Book - 1,2,3* [CO:3] **(20)**

Brick Masonry: Terms used in brickwork, Mortars to be used, bonding of bricks, Method of laying bricks.Plastering: Plastering method, Specifications for plastering with cement mortar.Stairs and lifts: Terminology used in stairs, Types of stairs, Recommendations for RCC stair case, liftsAcoustics: Basic theory, Reverberation and echoes, Sound isolation, Acoustical materials, Recommendations for different types of buildings.

UNIT IV   *Text Book - 3* [CO:4] **(15)**

Building Components Lintels, arches, vaults, Different types of floors – Concrete, Mosaic, Terrazzo floors, Pitched, flat roofs. Lean to roof, Coupled Roofs. Trussed roofs – King and Queen post Trusses. R.C.C Roofs, Madras Terrace and Prefabricated roofs. Shoring, Underpinning, Scaffolding and Formwork: Shoring, Types of shores; Underpinning - Pit method, Pile method; Scaffolding -Types of scaffolding; Formwork-requirements of formwork, formwork for columns, beams, slabs.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Engineering Materials by Rangwala, Charotar Publications, Fortieth Edition: 2013
2. Building Materials by P.C. Verghese, 1st Edition, PHI, 2009.
3. Building construction by Rangwala, Charotar Publications ,33rd Edition:2017

REFERENCE BOOK(s):

1. Building construction by P.C. Verghese, 1st Edition, PHI, 2009.
2. Building material by S K Duggal – New Age International Publishers; Second Edition
3. Building construction by BC Punmia et al., 10th Edition, Laxmi Publications, 2008.

WEB RESOURCES:

www.nptel.iitm.ac.in

CEOL02   **SOLID WASTE MANAGEMENT**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Identify sources and relationship between various functional elements of solid waste management and methods of storage and collection and transport of solid wastes.
2. Describe the importance of transfer station and suggest suitable methods of solid waste disposal based on the composition of solid waste.
3. Suggest suitable methods for the management of plastic and E-wastes
4. Identify hazardous wastes and suggest suitable management techniques for radio active wastes and Bio-medical wastes.

UNIT I   *Text Book - T1,R1* [CO:1] **(12)**

UNIT IIntroduction, sources and types   Sources and types of municipal solid wastes, characteristics of solid waste, Effects of improper disposal of solid wastes-Public health and environmental effects-need for integrated solid waste managementFunctional elements of solid waste management Functional elements and their inter relationship, waste generation rates-factors affecting generation, on-site storage, handling and processing of solid waste, Types and methods of waste collection systems, factors affecting collection

UNIT II   *Text Book - T1,T2,R1* [CO:2] **(12)**

Transfer and Transport:Need for transfer operation, compaction of solid waste, transport means and methods, transfer stationsDisposal of solid wastes Disposal methods: composting, incineration and pyrolysis, merits and demerits, Sanitary landfill method of operation – advantages and disadvantages of sanitary land fill, Recycle and reuse

UNIT III   *Text Book - T2,R2* [CO:3] **(12)**

Plastic Wastes: Introduction, types of plastics, characterization, environmental and health impacts, Technologies for plastic waste managementE-wastes:Introduction to E-wastes, definition, Average life of Electronic goods, obsolescence rate, classification of E-wastes, Categories of E-wastes, Composition and characteristics of E-wastes: Hazardous substances and impact on environment and Human health, Quantity of E-waste: Indian scenario, Organization and Management of E-wastes, Technologies for E-waste Management

UNIT IV   *Text Book - T2* [CO:4] **(12)**

Hazardous Waste Management Fundamentals: Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effectsRadioactive wastes:Radioactive wastes and their impact on health and environment, sources, classification and disposalBio-medical waste:Bio-medical wastes and their impacts on health and environment, Collection and transport, treatment and disposal

LEARNING RESOURCES:

TEXT BOOK(s):

1. Vesilind, P.A., Worrell, W., Reinhart, D. "Solid Waste Engineering", Cenage learning, New Delhi, 2004
2. Solid and Hazardous Waste Management by M.N. Rao and Razia Sultana, BS Publications, Hyderabad

REFERENCE BOOK(s):

1. George Techobanoglous "Integrated Solid Waste Management", McGraw Hill Publication, 1993
2. Environmental Engineering by Peavy, Rowe and Techobanoglous, Tata McGraw Hill Publication

CEOL03   **REMOTE SENSING AND GIS**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Demonstrate the concepts of, Electro Magnetic energy and spectrum, Remote sensing process .
2. Apply the concepts of remote sensing platforms, resolutions and Compute an image visually and digitally with digital image processing techniques.
3. Demonstrate the concepts of GIS,analyze raster and vector data and modeling in GIS
4. Understand the GIS spatial analysis

UNIT I   *Text Book - T1,T2,T3,T4* [CO:1] **(15)**

Remote Sensing – I : Introduction to Remote Sensing; Remote Sensing terminology and units; Applications of Remote Sensing; Importance of Remote Sensing; Advantages and Limitations of Remote Sensing; Electromagnetic spectrum Remote Sensing process; Ideal Remote Sensing system; Concepts of Nadir and Swath.Remote Sensing – II : Interactions with atmosphere, Interactions with target; Spectral; Transmission, Reception and Processing; Interpretation and Analysis. reflectance curves for water, soil and vegetation, Types of Remote Sensing, Types of resolutions.

UNIT II   *Text Book - T1,T2,R1* [CO:2] **(10)**

Image Analysis: Introduction; Elements of Visual Interpretation; Digital Image Processing – Image preprocessing, Image enhancement.Geographic Information System (GIS): Introduction; GIS definition and terminology; GIS categories; Components of GIS; Fundamental operations of GIS; A theoretical framework for GIS.

UNIT III   *Text Book - T1,T2,R1* [CO:3] **(15)**

Types of Data Representations: Data input and output; Data editing; Types of data entry – Keyboard entry, Coordinate geometry procedure, Manual digitizing and Scanning; Types of GIS – Raster GIS and Vector GIS; Advantages and Disadvantages of Raster and Vector GIS.GIS Spatial Analysis: Spatial Data – Layer based GIS and Feature based GIS;Data integration- Map overlay, Database and Database management system.

UNIT IV   *Text Book - T1,T2,R2,R1* [CO:4] **(10)**

Applications of GIS : Application areas and user segments; Guide lines for preparation of GIS; Applications of GIS for land use and housing management; Assessment of physical transformation in an urban area; Water Resources Applications: Land use/Land cover in water resources; Watershed management for sustainable development; Reservoir sedimentation; Ground Water Targeting and Identification of sites for artificial Recharge structures.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Text Book of Remote Sensing and Geographical Information systems by M.Anji Reddy, 4th Edition, B.S.Publications, 2012.
2. Text Book of Remote Sensing and Geographical Information systems by Basudeb Bhatta, Oxford University Press.

3. Text Book of Remote Sensing and Geographical Information systems by A M Chandra and S K Ghosh, Narosa Publishing House.
4. Advanced Surveying: Total Station, GIS and Remote Sensing Book by N. Madhu, R. Sathikumar, and Satheesh Gopi , Pearson Education India, 2006.

REFERENCE BOOK(s):

1. Geographic information Systems by Kang- tsung Chang, McGraw-Hill, 2003.
2. Basics of Remote sensing & GIS by S.Kumar, USP, 2005.

WEB RESOURCES:

1. https://en.wikipedia.org/wiki/Indian_Institute_of_Remote_Sensing
2. http://nptel.ac.in/downloads/105108077/
3. http://nptel.ac.in/courses/105102015/28

CHOL01   **ENERGY ENGINEERING**   L T P C Int Ext

COURSE OUTCOMES:
1. Understand the importance of environment and conservation of natural resources.
2. Write competitive exams of energy industry.
3. Use the non-conventional energies in place of conventional energies and its manufacture.
4. Use the non- conventional energies in place of conventional energies and its manufacture.
5. Discuss sustainability of environment

UNIT I   *Text Book - 1* [CO:1] **(12)**

Conventional energy resources, the present scenario, scope for future development

Coal: Origin, occurrence and reserves, classification, ranking, analysis and testing, coal carbonization, manufacture of coke, coal gasification, coal liquefaction

UNIT II   *Text Book - 1* [CO:2] **(12)**

Petroleum: Origin, occurrence and reserves, composition, classification, characteristics, exploration and production

Petroleum Refining: Refinery processes, petroleum products, testing and analysis of petroleum products

UNIT III   *Text Book - 2,3* [CO:3] **(12)**

Non conventional energy sources: Solar energy, solar radiation, principles of heating and cooling, photo voltaic cells

Bio gas products, bio-mass, wind energy, hydrogen energy, geothermal and ocean thermal energy, fuel cells.

UNIT IV   *Text Book - 2,3* [CO:4] **(12)**

Energy storage: mechanical energy storage, water storage, solar pond, phase change storage, chemical storage

Energy Conservation: Conservation methods in process industries, Theoretical analysis, practical limitations, equipment for energy saving / recovery

LEARNING RESOURCES:

TEXT BOOK(s):

1. Conventional Energy technology by S.B.Pandy, Tata McGraw Hill (1987)
2. Non-Conventional Energy Sources, G. D. Rai, Khanna Publishers
3. Principles of Energy conversion by Culp, Mc Graw Hill(1991)

REFERENCE BOOK(s):

1. Hand book of Energy Technology by Considine D. M,McGraw Hill(1977)
2. Fuels and energy by Harker and Backhusst, Academic press (1981)
3. Solar Energy Thermal Process by John A Duffie, John Wiley & Sons Inc (1975)

REFERENCE BOOK(s):

1. Hand book of Energy Technology by Considine D. M,McGraw Hill(1977)
2. Fuels and energy by Harker and Backhusst, Academic press (1981)

CHOL02   **BIOFUELS**

COURSE OUTCOMES:

1. Describe the functional principle of biofuel technologies in small and large scale.
2. Describe the main steps and components in bioethanol, biodiesel and biogas production.
3. Interact actively in teamwork and work with case related problem solving.
4. Associate with professional problem solving in an industrial environment.
5. Interact with other fields of engineering.

UNIT I   [CO:1] **(12)**

Introduction: Sources of energy, introduction of biofuels, availability of bio mass, composition of biomass,terrestrial biomass, aquatic biomass. Physical and chemical properties of biomass.

Useful features of biofuels, undesirable features of biofuels, energy crops, modes of utilization of biomass and their environmental impacts

UNIT II   [CO:2] **(12)**

Biogas: The substrate, the digester, the microorganisms, the process of bio gas production, factors affecting bio gas yields, advantages, disadvantages.

Bioethanol: Bioethanol vs. Petrol, production of bio ethanol, ethanol recovery. Bio butanol

UNIT III   [CO:3] **(12)**

Bio diesel: Sources of lipids, production of lipids, methods of production of bio diesel, comparison of bio diesel with conventional diesel. Standards of bio diesel

UNIT IV   [CO:4] **(12)**

Bio hydrogen: Production of bio hydrogen from anaerobic bacteria, photosynthetic algae, photosynthetic–hydrogenase system

Fuel cells: Enzymatic fuel cells, microbial fuel cells

LEARNING RESOURCES:

TEXT BOOK:

Bio Technology – Expanding horizons, B.D.Sing, Kalyani Publishers, Ludhiana

REFERENCE BOOK(s):

1. Fundamentals of Renewable Energy Systems, D.Mukherjee, S.Chakrabarti, New Age International Publishers
2. A Text Book of Biotechnology, R.C.Dubey, S.Chand & Company Ltd., New Delhi
3. Non-Conventional Energy Sources, G.D.Rai, Khanna Publishers

CHOL03   **ENVIRONMENTAL ENGINEERING**

COURSE OUTCOMES:
1. Describe the sources, effects and analysis of Air pollutants.
2. Select methods for control, and prevention of air pollution
3. Analyze the sources , effects and abatement of Water pollution
4. Analyze the sources of solid waste and their control measures

UNIT I   [CO:1] **(12)**

Air Pollution: Definition and scale of concentration, Classification and Properties of Air pollutants, Emission sources, Behaviour and fate of Air pollutants, effects of air pollution, Air pollution laws & standards, Temperature lapse rates and Stability, wind velocity and Turbulence and Plume behavior.

Air pollution Sampling and Measurement: Ambient air sampling, Stack sampling and Analysis of Sulphur Dioxide, Nitrogen Oxides and Particulate matter.

UNIT II   [CO:2] **(12)**

Air Pollution Control Methods and Equipment: Control methods, Source correction methods, Cleaning of gaseous effluents, Particulate emission control, Selection of a particulate collector and Control of Gaseous emissions.

Control of Specific Gaseous Pollutants: Control of Sulphur dioxide emission, Control of Nitrogen Oxides, Control of Carbon Monoxide and Hydrocarbons.

UNIT III   [CO:3] **(12)**

Water Pollution: Water resources, Origin of waste water, Types of Water Pollutants and their effects, Water Pollution Laws and Standards.Waste Water Sampling, Analysis and Treatment: Sampling, Methods of Analysis, Determination of Organic Matter, Inorganic Matter and Physical Characteristics, Primary, Secondary, Advanced Waste Water Treatment and Recovery of Materials from Process Effluents.

UNIT IV   [CO:4] **(12)**

Solid waste Management: Sources and Classification, Public health aspects, Disposal methods and Potential methods of disposal.

Hazardous Waste Management: Definition, Sources, Classification, Hazardous Waste Management Strategy, treatment methods and Disposal methods.

LEARNING RESOURCES:

TEXT BOOK:

Environmental Pollution Control Engineering by C.S.Rao, 2nd edition, New Age International Ltd (2006)

REFERENCE BOOK:

Air pollution by M.N.Rao, H.V.N. Rao, Tata McGraw Hill (2007)

CHOL04   **NANOSCIENCE AND NANOTECHNOLOGY**

COURSE OUTCOMES:

After successful completion of the course, the students are able to

1. Explain about molecular nanotechnology, nanolithography
2. Explain the concept of preparation of nanomaterials, sol-gels
3. Explain the applications of rotaxanes, catenanes Proteins, lipids and DNA
4. Explain about drug delivery systems and impact on environment

UNIT I   [CO:l]

Introduction to nanotechnology and materials, Nano sizes, nano properties comparison with the bulk materials, different shapes, sizes and morphology, Nano tweezers, atom manipulation , nano dots, nano lithography

Nanomaterial's characterization: Microscopies SEM, TEM, Atomic Forced Microscopy, Scanning and Tunneling Microscopy

UNIT II   [C0:2]

Nano powders and Nanomaterial's: Preparation, Plasma arcmg, Chemical vapor deposition, Sol-gels, Electro deposition, Ball milling

Carbon nanotubes: Structure, Types, formation, assemblies, purification, properties anduses

UNIT III   [C0:3]

Catenanes and rotaxanes, various molecular switches, synthesis of rotaxanes and catenanes, molecular computers, Properties of light in nanotechnology and interaction

Nano biometrics: Self-assembled monolayer' s, Proteins, Lipids, Liposomes, DNA, DNA structure, using DNA to build Nano-cubes, switches, hinges, smart glue, wire template

UNIT IV   [C0:4]

Nanobiology: Biological methods of synthesis. Applications in drug delivery, Nano containers and Responsive Release of active agents, Layer by Layer assembly for Nano spheres

Safety and health Issues of Nanomaterial, Environmental Impacts, Case Study for

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R-18

Environmental and Societal Impacts

LEARNING RESOURCES:

TEXTBOOK:

Nanotechnology (Basic Science and Emerging Technologies) by Mick Wilson, K.K.GeoffSmith, Michella Simmons and BurkhardRaguge, Oversea

CSOL01   **PROGRAMMING WITH JAVA**

Course Outcomes:

1. Use the syntax and semantics of java programming language and basic concepts of OOP.

2. Develop reusable programs using the concepts of inheritance, polymorphism, interfaces andpackages.
3. Apply the concepts of Multithreading and Exception handling to develop efficient and errorfree codes.
4. Design event driven GUI and web related applications which mimic the real word scenarios.

UNIT I   12 Periods

Introduction: Introduction to java, java buzzword, data types, dynamic initialization, scope and life time, operators, control statements, arrays, type conversion and casting, finals & blank finals. **Classes and Objects:** Concepts, methods, constructors, usage of static, access control, this key word, garbage collection, overloading, parameterpassing mechanisms, nested classes and inner classes.
Inheritance: Basic concepts, access specifiers, usage of super key word,method overriding, final methods and classes, abstract classes, dynamicmethod dispatch, Object class.

UNIT II   12 Periods

Interfaces: Differences between classes and interfaces, defining aninterface, implementing interface, variables in interface and extendinginterfaces
Packages: Creating a Package, setting CLASSPATH, Access controlprotection, importing packages.
Exception Handling: Concepts of Exception handling, types ofexceptions, usage of try, catch,throw, throws and finally keywords, Built-in exceptions, creating own exception sub classes.

UNIT III   12 Periods

Strings: Exploring the String class, String buffer class, Command-linearguments. Library: Date class, Wrapper classes.
Multithreading: Concepts of Multithreading, differences betweenprocess and thread, thread life cycle, Thread class, Runnable interface,creating multiple threads, Synchronization, thread priorities, inter threadcommunication, daemon threads, deadlocks.
1/0 Streams: Streams, Byte streams, Character streams, File class, Filestreams.

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UNIT IV   12 periods

Applets: Concepts of Applets, life cycle of an applet, creating applets, passing parameters to applets, accessing remote applet, Color class and Graphics

Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling events.

AWT: AWT Components, windows, canvas, panel, File Dialog boxes, Layout Managers, Eventhandling model of AWT, Adapter classes, Menu, Menu bar.

Learning Resources:
Text Book:

1. Java The Complete Reference 9th Edition, Herbert Schildt, Mc Graw Hill Education (India) Private Limited, New Delhi.

Reference Books:
1. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI.
Introduction to Java programming, By Y.Danielliang,Pearson Publication

CSOL02   **RELATIONAL DATABASE MANAGEMENT SYSTEMS**

Course Outcomes:

1. Describe the basic concepts of database systems.
2. Explain various data models and database system architectures.
3. Write queries to access database using SQL.
4. Design a database using normalization theory and explain the concepts of transaction processing.

UNIT I   12 Periods

Databases and Database Users: Introduction - An Example - Characteristics of the Database Approach - Actors on the Scene - Workers behind the Scene - Advantages of Using the DBMS Approach.

Database System Concepts and Architecture: Data Models, Schemas, and Instances - Three-Schema Architecture and Data Independence - Database Languages and Interfaces - The Database System Environment - Centralized and Client/Server Architectures for DBMSs.

UNIT II   12 Periods

Data Modeling Using the Entity-Relationship (ER) Model: Using High- Level Conceptual Data Models for Database Design - An Example Database Application - Entity Types, Entity Sets, Attributes, and Keys - Relationship Types, Relationship Sets, Roles, and Structural Constraints -Weak Entity Types.

The Relational Data Model and Relational Database Constraints: Relational Model Concepts - Relational Model Constraints and Relational Database Schemas - Update Operations, Transactions, and Dealing with Constraint Violations.

UNIT III   12Periods

SQL-99: Schema Definition, Constraints, Queries, and Views: SQL Data Definition and Data Types - Specifying Constraints in SQL - Schema Change Statements in SQL - Basic Queries in SQL - More Complex SQL Queries - INSERT, DELETE, and UPDATE Statements in SQL - Views (Virtual Tables) in SQL.

UNIT IV   12 Periods

Functional Dependencies and Normalization for Relational Databases: Informal Design Guidelines for Relation Schemas - Functional Dependencies - Normal Forms Based on Primary Keys - General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.

Introduction to Transaction Processing Concepts and Theory: Introduction to Transaction Processing - Transaction and System Concepts - Desirable Properties of Transactions

-Characterizing Schedules Based on Recoverability -Characterizing Schedules Based on serializability.

Learning Resources:
Text Book:

1. Fundamentals of Database Systems, RamezElmasri and SHamKanthB.NavatePearsonEducation, 5th edition.

Reference Books:
1. Introduction to Database Systems, CJ.Date Pearson Education.
2. Data Base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill,3rdEdition.

CSOL03   INTRODUCTION TO PYTHON PROGRAMMING

Course Outcomes:
1. Develop simple programs in python.
2. Write modular programs using the concepts of Lists and Strings.
3. Apply Object oriented programming features of python.
4. Manipulate various mutable and immutable data types.
5. Write programs using dictionaries and files

UNITI   15 Periods

Basics of Python Programming: Python Character set,Token, Python Core Data Type , The print() function, Assigning value to a variable, Multiple assignments,, Writing simple programs in Python, the input() Function, Python inbuiltFunctions: the ord and chr functions

Operators and Expressions: Introduction, Operators and Expressionș Arithmetic operators Operator precedence and Associativity, Changing Precedence and Associativity, Bit Wise operator, The compound Assignment operator.

Decision making statements: Introduction, Boolean operators Decision making statements, Conditional Expressions

Loop Control Statements: The while,range,for,Nestedloops,The break statement,The continue statement

UNITII   15 Periods

Functions:Introduction, Syntax and Basics of a Function, Use of a Function, parameters with Arguments in a Function The local and Global scope of a variable,The return Statement ,RecursiveFun ctions.

Strings:Introduction,thestrclass, Basic Inbuilt Python functions for String, the index[] Operator, Traversing a String, Immutable strings, String operators, String operations.

Lists &List Processing: Searching and Sorting;

UNIT III   15 Periods

  Object Oriented Programming: Classes, objects and Inheritance, Introduction, DefiningClasses, Method Overloading, Inheritance.

Tuples and Sets:
Tuples, Creating Tuple() Function, inbuilt function for Tuples, Indexing and Slicing Operations in Tuples, passing Arguments and Variable length Arguments in Tuples Lists and Tuple, Traverse Tuples from a List, The zip() Function In inverse zip Function; More Programs in Tuples.

Sets: Creating Sets, The set in and not in operator, The python set classes, Set Operations

UNIT IV   15 Periods

Dictionaries: Need for Dictionaries, Basics of Dictionaries, Creating a Dictionary, Adding and Replacing Values,Retrieving values Formatting Dictionaries, Deleting Items, Comparing Two Dictionaries, The Methods of Dictionary Class, Traversing Dictionaries, Nested Dictionaries, Simple Programs in Dictionaries, and Polynomials as Dictionaries.

File Handling: Introduction, Need for File handling Text input and output, Theseek() Function, BinaryFiles, Accessing and manipulating Files and Directories in a Disk.

Learning Resources:

Text Book:

1. Programming and Problem Solving with Python - Ashok NamdevKamthane and Amit Ashok Kamthane ,Tata McGraw Hill,2018 Edition

Reference Books:
1.   Beginning Python from novice to professional by Magnus Lie Hedland, 2nd Edition, Apress
2.   Programming in Python 3 - A complete introduction to the Python Language by Mark Summerfield, Pearson.
3.   Learning Python by Mark Lutz, 5th Edition, O'Reilly.
4.   Programming Python by Mark Lutz, 4th Edition, O'Reilly.

CSOL04   **INTERNET OF THINGS**   L T   P   C

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Course Outcomes:

1.   Explain the physical and logical design of IoT.
2.   Discuss the application areas of IoT.
3.   Explain the network management protocols and M2M system management.
4.   Design IoT applications using Raspberry Pi.

Course Content:

UNIT I   [CO1]   12 periods

Introduction & Concepts: Introduction to Internet of Things, Physical Design of IOT.

Design of IOT: Logical Design of IOT, IOT Enabling Technologies, IOT Levels.

UNIT II   [CO2]   12periods

Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail.

Applications: Logistics, Agriculture, Industry, Health & Life Style.

UNIT III   [CO3]   12 periods

M2M & System Management: M2M, Difference between IOT & M2M, SDN & NFV for IOT, Software defined Networking, Network Function Virtualization, Need for IOT Systems Management.

NETCONF-YANG: Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems, management with NETCONF-YANG

UNIT IV   [CO4]   `   12 periods

Logical Design using Python:
Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations, Classes, Python Packages
IOT Physical Devices:What is IOT Device, Exemplary Device, Board, Linux on Raspberry Pi.

Endpoints: Interfaces, and Programming & IOT Devices.

Learning Resources:

Text Book:

1. Vijay Madisetti, ArshdeepBahga, Internet of Things A Hands-On-Approach, 2014, ISBN: 9780996025515

Reference Books:

1.   Adrian McEwen, Designing the Internet of Things, Wiley Publishers, 2013, ISBN: 978-1- 118-43062-0
2.   Daniel Kellmereit, The Silent Intelligence: The Internet of Things, 2013, ISBN: 0989973700
3.   Internet of Things: Design Principles and Applications

Web References:

1.   https://en.wikipedia.org/wiki/Internet_of Things.
2.   www.iot-a.eu/.

ECOL01   **APPLIED ELECTRONICS**   **L T P C Int Ext**

COURSE OUTCOMES:
1   Describe working, types and applications of microphones and loudspeakers.
2   Discuss the features of commercial, theatre sound recording and colour TV standards
3   Describe the working of various electronic systems, telecommunication and switching systems.
4   Detail the working of various applications like digital clocks, fiber optics, microprocessor and mobile radio systems.
5   Describe consumer electronic equipment and systems like washing machines.

UNIT I   *Text Book - 1* [CO:1,2] **(12)**

Microphones : Characteristics of microphones, Types: Carbon microphones, moving coil microphones, ribbon microphones, electret microphones and wireless microphones. Headphones : Headphones and Headsets, Types of headphones. Loud Speakers: Ideal loudspeaker, Types: Crystal loudspeaker, electrostatic loudspeaker, permanent magnet loudspeaker, High frequency loudspeakers: Horn type tweeters, Equalizers and Mixers.

UNIT II   *Text Book - 1* [CO:1,2,4] **(10)**

Commercial Sound: Recording, manual synthesizer, programmed synthesizer, public address systems, speaker matching systems, PA-system characteristics, Theatre Sound System. Color TV standards and Systems : Primary and secondary colors, Luminance signal, Chrominance signal, color TV camera tube, color TV picture tube, NTSC system PAL system SECAM system.

UNIT III   *Text Book - 1* [CO:1,2,3] **(12)**

Audio systems, Video Systems, Remote Controls, Modulation Techniques, Carrier Systems,Telecommunication Systems: telephone receivers and handsets, signalling-CCITT NO7, modes of operation, Switching Systems : principle, Read relay and cross bar switching, PBX switching, stored program control.

UNIT IV   *Text Book - 1* [CO:1,2,3,4] **(14)**

Fiber Optics, Data Services, digital clocks, microprocessor, microcontroller, Mobile radio systems: wireless local loop (WLL), role of WLL, radio paging service, digital cellular block diagram, establishing a call, Fascimile (FAX).IN-CAR Computers : Electronic ignition, electronic ignition lock system, ABS, Electronically controlled suspension (ECS), instrument pannel display, air-bag system.

LEARNING RESOURCES:

TEXT BOOK:

S.P.Bali - Consumer Electronics-Pearson Education, ISBN: 9788131717592, first impression-2008

REFERENCE BOOK(s):

1. Philip Herbert Hoff - Consumer Electronics for Engineers, Cambridge University Press, 1998, ISBN-10: 0521582075.
2. Ronald K.Jurgen - Digital Consumer Electronics Handbook, McGraw Hill Professional Publishing, 1997. ISBN-10: 0070341435

WEB RESOURCES:

1. http://www.newagepublishers.com/samplechapter/000969.pdf
2. http://www.bits-pilani.ac.in:12354/qp1-9-10/EEE_C414_851_C_2009_1.pdf
3. http://nptel.iitm.ac.in

ECOL02   **BASIC COMMUNICATION**   **L T P C Int Ext**

COURSE OUTCOMES:
1. Demonstrate knowledge in
    1. Amplitude Modulation
    2. Telephone & Television working
    3. Coaxial Cables, Fiber optic & Microwave links,
2. Examine about various communication systems and Television fundamentals.
3. Discuss type of modulation techniques required for a specific application.
4. Understand various wireless and cellular, mobile and telephone communication systems.

UNIT I   *Text Book - 1* [CO:1,3,4] **(12)**

Communications: Communications systems, Information, Transmitter, Channel - noise, Receiver, Modulation, Description, Need for modulation, Bandwidth Requirements, Frequency spectra of nonsinusoidal waves.

Amplitude Modulation: Amplitude Modulation Theory, Frequency spectrum of the AM wave, Representation of AM, Power relations in the AM wave, Generation of AM, Basic requirements - comparison of levels, Grid - modulated class C amplifier, Plat - modulated class C amplifier, Modulated transistor amplifiers, System summary.

UNIT II   *Text Book - 1* [CO:1,3,4] **(12)**

Digital Communications: Digital Technology, Digital fundamentals, The binary number system, Digital electronics, Fundamentals of Data Communications Systems, The emergence of data communications systems, Characteristics of data transmission circuits, Digital codes, error detection and correction, Data Sets and Interconnection Requirements, Modem classification, Modem interfacing, Interconnection of data circuits to telephone loops, Network and Control Considerations, Network organization, Switching systems, network protocols, Summary.

UNIT III   *Text Book - 1* [CO:1,2,3,4] **(12)**

Broadband Communications Systems: Multiplexing, Frequency division multiplex, Time - division multiplex, Short and Medium - Haul Systems, Coaxial Cables, Fiber optic links, Microwave links, tropospheric Scatter links, Long Haul Systems, Submarine cables, SatelliteCommunications, Elements of Long-Distance Telephony, Routing codes and signaling systems, Telephone exchanges (switches) and routing, Miscellaneous practical aspects, Introduction to traffic engineering.

UNIT IV   *Text Book - 1* [CO:1,2,4] **(12)**

Television Fundamentals : Requirements and Standards, Introduction to television, Television systems and standards, Black and White Transmission, fundamentals, Scanning, Banking and synchronizing pulses, Black and white Reception, Fundamentals, Common, video and sound circuits, Synchronizing circuits, Vertical deflection circuits, Horizontal deflection circuits, Color Transmission and Reception, Introduction, Color transmission, Color reception.

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LEARNING RESOURCES:

TEXT BOOK:

George Kennedy, Tata McGraw-Hill Publishing , Fourth Edition 2009.

REFERENCE BOOK:

Introduction to Analog and Digital Communication, Simon Hykin S 2edition-2012

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ECOL03   **BASIC ELECTRONICS & COMMUNICATION ENGINEERING**   L T P C Int Ext

COURSE OUTCOMES:

1. Understand the working, types and applications of microphones and loudspeakers.
2. Describe the features of commercial, theatre sound recording and colour TV standards.
3. Discuss the fundamental concepts of Digital Communication and Public telephone networks
4. Detail the fundamental concepts of Cellular Communication

UNIT I   *Text Book - 1* [CO:1] **(12)**

Microphones: Characteristics of microphones, Types: Carbon microphones, moving coil microphones, ribbon microphones, electret microphones and wireless microphones. Headphones: Headphones and Headsets, Types of headphones. Loud Speakers: Ideal loudspeaker, Types: Crystal loudspeaker, electrostatic loudspeaker, permanent magnet loudspeaker, High frequency loudspeakers: Horn type tweeters, Equalizers and Mixers.

UNIT II   *Text Book - 1* [CO:2] **(13)**

Commercial Sound : Recording, manual synthesizer, programmed synthesizer, public address systems, speaker matching systems, PA-system characteristics, Theatre Sound System. Color TV standards and Systems : Primary and secondary colors, Luminance signal, Chrominance signal, color TV camera tube, color TV picture tube, NTSC system PAL system SECAM system(Basic Concepts).

UNIT III   *Text Book - 2* [CO:3] **(13)**

Digital Modulation: Introduction, Information Capacity, Bits, Bit Rate, Baud rate, Introduction to ASK,FSK and PSk(Basic Principles),The Local Subscriber Loop and Voice frequency Circuits. The Public Telephone Network: Telephone Transmission System Environment, Instruments, Local Loops, Trunk Circuits, and Exchanges, Automated Central Office Switches and Exchanges.

UNIT IV   *Text Book - 2* [CO:4] **(12)**

Cellular Telephone Concepts: Introduction, Cellular Telephone, Frequency Reuse, Interference, Cell Splitting, Sectoring and Segmentation. Cellular System Topology, Roaming and Handoffs

LEARNING RESOURCES:

TEXT BOOK(s):

1. S.P.Bali - Consumer Electronics-Pearson Education, ISBN: 9788131717592, first impression-2008.
2. Wayne Tomasi - Advanced Electronic Communications Systems, 6th Edition, Pearson, 2004.

ECOL04   **MICROPROCESSORS & INTERFACING**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Demonstrate knowledge in (a) Internal Hardware details of Intel 8086 and programming devices like 8255,8257,8259,8279 and 8251.
   (b) Interfacing various peripherals to build standalone systems.
2. Analyze various peripherals and interfacing techniques.
3. Design application based Microcomputer system using8086.
4. Solve problems by providing microcomputer-based real time solutions.

UNIT I   *Text Book - 1,2* [CO:1,4]   **(9)**

INTEL 8086 ARCHITECTURE AND PROGRAMMING: Evolution of Microprocessors, Architecture of 8086 microprocessor, Register organization, Physical Memory Organization, Signal Description of 8086, General Bus Operation Minimum and Maximum mode operation of 8086, Timing diagram Addressing modes.

UNIT II   *Text Book - 1,2* [CO:1,2] **(11)**

ASSEMBLY LANGUAGE PROGRAMMING WITH 8086AND INTERRUPTS: Instruction set of 8086, Assembler directives and Operators; Interrupts and Interrupt service routines, Interrupt Cycle of8086, Non Maskable interrupt, Maskable interrupt (INTR), Interrupt Programming, Passing Parameters to procedures, MACROS.

UNIT III   *Text Book - 1* [CO:1,2,4]   **(8)**

BASIC PERIPHERALS AND THEIR INTERFACINGWITH 8086: Semiconductor memory Interfacing, Dynamic RAM interfacing, Interfacing I/O ports, Programmable Input-Output Port (PIO)8255, Modes of operations of 8255, Interfacing analog to digital and digital to analog converters, stepper motor interfacing.

UNIT IV   *Text Book - 1* [CO:1,3]   **(9)**

SPECIAL PURPOSE PROGRAMMABLE PERIPHERALDEVICES : Programmable Interrupt Controller 8259A; The keyboard/Display Controller 8279-Architecture, Signal Description, Modes of operations; Programmable Communication Interface 8251USART; DMA Controller 8257, DMA Transfers and Operations.

LEARNING RESOURCES:

TEXT BOOK(s):

1. A.K. Ray & K.M.Bhurchandi, Advanced Microprocessors and Peripherals- Architecture, Programming and Interfacing

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2. Douglas V.Hall, Microprocessors and Interfacing: Programming and Hardware, revised 2nd Edition, TMH, TMH, 2002 reprint.

REFERENCE BOOK:

Yu-cheng Liu, Glenn A. Gibson, Microcomputer systems: The 8086/8088 Fami l y architecture, Programming and Design, PHI, 2006.

ECOL05   **DIGITAL IMAGE PROCESSING**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Demonstarte knowledge in Image Fundamentals, Image Enhancement & Restoration Techniques, Image Segmentation & Compression Techniques
2. Analyze different images using various processing techniques.
3. Design and develop various image processing algorithms to process the images in Real Time Applications.
4. Understand the impact of the image processing for societal needs.

UNIT I   *Text Book - 1* [CO:1,2,3,4] **(12)**

INTRODUCTION: Origin of Digital Image Processing, Fields that uses Digital Image Processing, Fundamental steps in Digital Image Processing, Components of an Image Processing System.DIGITAL IMAGE FUNDAMENTLS: Elements of Visual perception, Image sampling and Quantization, Basic relationships between Pixels, Linear and Non-linear operations, Arithmetic/Logic operations.

UNIT II   *Text Book - 1* [CO:1,2,3,4] **(12)**

IMAGE ENHANCEMENT IN SPATIAL DOMAIN: Some basic intensity transformations, histogram processing, Smoothing Spatial Filters, Sharpening Spatial Filters.IMAGE ENHANCEMENT IN FREQUENCY DOMAINBasics of filtering in frequency domain, Correspondence between filtering in the spatial and frequency domains, Image smoothing using frequency domain filters, Image sharpening using frequency domain filters, Homomorphic filtering

UNIT III   *Text Book - 1* [CO:1,2,3,4] **(12)**

IMAGE RESTORATION: Noise models, Restoration in the presence of Noise only- Spatial Filtering, Periodic Noise reduction by Frequency Domain Filtering, Linear Position-Invariant Degradation, Inverse Filtering, Wiener Filtering.IMAGE COMPRESSION: Fundamentals, Image Compression methods-Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Bit-Plane coding,

UNIT IV   *Text Book - 1,2* [CO:1,2,3,4] **(12)**

IMAGE SEGMENTATION: Fundamentals - Point, Line and Edge Detection, Thresholding-basic Global Thresholding, Optimum Global Thresholding, Region based segmentation.IMAGE REPRESENTATION AND DESCRIPTION : Representation schemes, Boundary Descriptors, Regional Descriptors.

LEARNING RESOURCES:

TEXT BOOK(s):

1. R C Gonzalez and Richard E Woods - Digital Image Processing, Pearson Education, Third Edition, 2015

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2. R C Gonzalez and Richard E Woods - Digital Image Processing, Pearson Education, Second Edition

EEOL01   **RENEWABLE ENERGY SOURCES**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Illustrate the national scene of energy production, utilization, consumption and energy storage systems
2. Describe about the basics of solar energy, generation of electricity from solar energy & photovoltaic's
3. Assess wind energy potential, wind turbines and wind generators
4. Outline the details of ocean energy, temperature differences & principles, extraction of energy from waves, geothermal, biogas

UNIT I   *Text Book - 1* [CO:1] **(8)**

Principle of Renewable Energy: Comparison of Renewable and Conventional energy sources - Ultimate energy sources - natural energy currents on earth - primary supply to end use - Spaghetti & Pie diagrams - Energy planning - Energy Efficiency and Management

UNIT II   *Text Book - 2* [CO:2] **(12)**

Solar Radiation: Extra terrestrial solar radiation - terrestrial solar radiation - solar thermal conversion-Solar Thermal Central Receiver system - Photovoltaic energy conversion - solar cell. (only theoretical analysis)

UNIT III   *Text Book - 2* [CO:3] **(12)**

Wind energy: Planetary and local winds - Vertical axis and Horizontal axis wind mills - principles of wind power - maximum power – actual power - wind turbine operation. (only theoretical analysis

UNIT IV   *Text Book - 2* [CO:4] **(12)**

Energy from Oceans: Ocean temperature differences - principles of OTEC plant operations - wave energy - devices for energy extraction - tides - Simple single pool tidal system.Geothermal Energy: Origin and types - Bio fuels - classification – Direct combustion for heat and electricity generator - anaerobic digestion for biogas - biogas digester - power generation.(only theoretical analysis)

LEARNING RESOURCES:

TEXT BOOK(s):

1. John Twidell & Toney Weir "Renewable Energy Sources" E&F.N. Spon.
2. G.D.Rai"Non-Conventional Energy Sources"Khanna Publishers.

REFERENCE BOOK(s):

1. EL-Wakil"Power Plant Technology" McGraw-Hill Publications.
2. Abbasi&Abbasi"Renewable Energy Sources" Their impact on global warming and pollution by - PHI.

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WEB RESOURCES:

1. https://www.eia.gov/energyexplained/renewable-sources/
2. https://www.justenergy.com/blog/7-types-of-renewable-energy-the-future-of-energy/
3. https://www.studentenergy.org/topics/renewable-energy

EEOL02   **UTILIZATION OF ELECTRICAL ENERGY**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Categorize different types of lamps & lighting schemes
2. Investigate the mechanisms of electrical heating
3. Design heating elements such as furnaces and ovens
4. Illustrate the types and requirements of welding
5. Outline the types, principles, applications and characteristics of storage batteries

UNIT I   *Text Book - 1* [CO:1] **(12)**

Illumination: Introduction- terms used in illumination-laws of illumination - Square law methods of calculation.Gas discharge lamps - Fluorescent lamps - Arc lamps - Filament lamps - Comparison between filament and fluorescent lamps

UNIT II   *Text Book - 1* [CO:2] **(12)**

Electric Heating element Design and types of furnaces : Design of heating element - Constructionand working of different types of induction furnaces -resistance furnace - arc furnaces.Dielectric heating, Dipole formation, generation of dielectric heat and applications

UNIT III   *Text Book - 1* [CO:3] **(12)**

Welding : Introduction- Types of welding - resistance and arc welding -Characteristics of Carbon and metallic arc welding - comparison, welding equipment.Requirements of good weld, comparisons of A.C and D.C weld (Excluding electronic controls)

UNIT IV   *Text Book - 1* [CO:4] **(12)**

Storage batteries : Types of cells. Lead acid cell, Nickel Iron cell, Chemical changes during charging and discharging. Applications - rating - classification-dry cell and wet cells.Methods of charging & common troubles : Charging and discharging of lead acid cells, methods of charging lead acid batteries - over discharging common troubles with lead acid batteries and remedies - Nickel cadmium batteries

LEARNING RESOURCES:

TEXT BOOK(s):

1. J.B. Gupta - Utilization Electric Power and Electric Traction, Katson books publishers, Tenth Edition, 2012
2. Utilization, generation & conservation of electrical energy by Sunil S Rao, Khanna publishers, Sixth Edition, 2005

REFERENCE BOOK(s):

1. Partab H - Art and Science of Utilization of Electrical Energy, Dhanpat Rai and Sons, New Delhi, Second Edition, 2009

2. R.K.Rajput - Utilization of Electric Power, Laxmi publications Private Limited, Second Edition, 2013
3. G.C.Garg - Utilization of Electric Power and Traction, Kanna publishers, Ninth Edition, 2014

WEB RESOURCES:

1. http://nptel.iitm.ac.in/video.php?subjectId=108105060
2. http://web.mit.edu/lien hard/www/ahttv201.pdf
3. http://www.comp-as.com/pdf/Article03.pdf
4. www.srmuniv.ac.in/downloads/welding.doc

EEOL03   **POWER CONVERTERS**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Compare characteristics of switching devices
2. Evaluate the performance of AC-DC converters
3. Illustrate the details of DC-AC Inverters
4. Analyse and evaluate the operation of AC-AC converters
5. Illustrate the principle of DC-DC converters, SMPS, UPS

UNIT I   *Text Book - 1* [CO:1] **(15)**

Power devices: SCR - Theory of operation of SCR - Static Characteristics - SCR turn on methods - Basic structure, operation and characteristics of IGBT and MOSFET.Principles of phase controlled converter operation - single phase half wave rectifier with R type of load - single phase fully controlled converter with R type of load

UNIT II   *Text Book - 1* [CO:2] **(15)**

Single Phase Inverters: Principle of inverter operation - single phase half bridge inverter and full bridge inverter with R type of load. Applications of inverters. Single phase PWM Techniques-single, multiple and sinusoidal PWM

UNIT III   *Text Book - 1* [CO:3] **(15)**

Cycloconverters: Principle and operation of single - phase mid-point and Bridge type cycloconverters with R type of load, Applications. AC Voltage Controllers: Single phase AC voltage controllers-two SCR's in anti-parallel - With R load (Principle of operation), Applications

UNIT IV   *Text Book - 1,2* [CO:4] **(15)**

Choppers: Principle of choppers - step up and step down choppers (Principle of operation).Working principle of switched mode power supplies (SMPS), applications. Working principle of UPS, applications

LEARNING RESOURCES:

TEXT BOOK(s):

1. Power Electronics by P.S. Bhimbra Khanna publications, 3rd Edition 2006
2. Power Electronics by M.D.Singh and Khanchandani TMH, 2nd Edition

REFERENCE BOOK(s):

1. Power Electronics, circuits, devices and applications by M.H. Rashid Pearson 3rd edition, 2005
2. Power Electronics by W. Launder 2ndedition,1993
3. Power Electronics - by VedamSubramanyam, New Age International (P) Limited, 2ndedition 2006

WEB RESOURCES:

1. www.powerelectronics.com; % reference for applications
2. www.mypptsearch.com/search-ppt/High%l % Reference for design problem
3. www.ieee.org/conferences_events/confe % for additional references

EEOL04   **ENERGY CONSERVATION**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Describe the concepts of energy management
2. Analyze energy saving and conservation in electrical and mechanical utilities
3. Use the knowledge for efficient electricity utilization, saving and recovery in different electrical systems
4. Develop audit report for different energy conservation instances

UNIT I   [CO:1]   ()

Reasons for Energy Management, Overview of Energy Management, The Systems Concept, Energy Basics, The Building Structure, Heat Loss and Gain, Energy Use in Buildings, Factors That Affect Building Construction, Products for Energy Conservation, Energy Conservation Checklist for Building Structures

UNIT II   [CO:2]   ()

Lighting systems:Introduction, Characteristics of Light, Types of Lighting, Incandescent Lighting, Fluorescent Lighting, Street Lighting LED Lighting, Lighting Design, Light Dimming, Tips for Energy Conservation Products for Energy Conservation, Energy Conservation Checklist. Cooling systems: Introduction, Air-Conditioning-System Classifications, Air-Conditioning Systems, Cooling System Applications, Split Systems, Air-Conditioning-System, Components   Efficiencies in Air Conditioning, Refrigerants, Indoor Air Quality, Energy Conservation Checklist for Air Conditioning Systems

UNIT III   [CO:3]   ()

Electrical power systems:Power Distribution Systems, Electrical Power Control, Electrical Power Conversion (Loads), Power-Factor Correction, Electrical Motors, Products for Energy Conservation, Energy Conservation Checklist for Electrical Systems.Introduction, Types of Solar Energy Systems, Solar Air-Conditioning Systems, Photovoltaic Systems, Domestic Solar Hot-Water Heating, Products for Energy Conservation, Future of Solar Energy, Energy Conservation Checklist for Solar Systems

UNIT IV   [CO:4]   ()

Energy management systems: Introduction, Energy Use in Buildings, Considerations for Effective Energy Management Developing an Energy Management Program, Suggestions for Building Owners and Operators Energy Audit, Energy Audit Checklist, Energy Saving Through Preventative Maintenance, Equipment Scheduling, Computerized Energy Management Systems, Computer Networked Controls, Checklist for Energy Management Systems

LEARNING RESOURCES:

TEXT BOOK(s):

1. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press
2. G. G. Rajan, "Optimizing Energy Efficiencies in Industry", Tata McGraw Hill, 2001
3. Charles M. Gottschalk, "Industrial Energy Conservation", John Wiley and Sons, 1996

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4. LC Witte, PS Schmidt and DR Brown: Industrial Energy Management and Utilization (Hemisphere Publishing Corporation,Washington,1998)

REFERENCE BOOK(s):

1. Kreith, Economics of Solar Energy and Conservation Systems, Vol -3
2. Sumper Andreas and Baggini Angelo: Electrical Energy Efficiency: Technologies and Applications (John Wiley 2012)
3. WC Turner and Steve Doty: Energy Management Handbook, Seventh Edition, (Fairmont Press Inc., 2007)
4. Energy Conservation and Audit by Mr. Amit L. Nehete
5. Craig B. Smith, "Energy Management Principles", Pergamon Press, 2015
6. Barney L. Capehart, Wayne C. Turner and William J. Kennedy, "Guide to Energy Management", Seventh   Edition, The Fairmont Press Inc., 2012

WEB RESOURCES:

1. http://nptel.iitm.ac.in/
2. National Productivity Council (http://www.npcindia.gov.in)
3. Bureau of Energy Efficiency (https://www.beeindia.gov.in)
4. www.powermin.nic.in

EEOL05   **ELECTRIC VEHICLES**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Explain the functioning details of Electric Vehicles and recent trends in EV technologies
2. Illustrate the details of electrical machines used in electric vehicles
3. Develop the electric propulsion unit and its control for application of electric vehicles
4. Examine the details and characteristics of different energy storage systems with specific application to EVs

UNIT I   [CO:1]   ()

Introduction to Electric VehiclesElectric Vehicle System, Components of an EV, EV Advantages, EV Market, Vehicle Mechanics, Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Velocity and Acceleration, Propulsion System Design (Basic Principles only

UNIT II   [CO:2]   ()

DC and AC Electric MachinesMotor Ratings, EV Motor Requirements, DC Machines, Types of AC Machines, Induction Machines, PM Synchronous Motor, PM Brushless DC Motor, Switched Reluctance Machines. (Principle of operation only)

UNIT III   [CO:3]   ()

Motor Drives and EV Drive TrainElectric Drive Components, Power Converters, Drive Controller, DC Drives, Two-Quadrant Chopper, AC Drives, VSI, PMSM Drive Structure (Block Diagram only), Converter Topologies for SRM, EV Transmission Configurations, Transmission Components- Gears, Automobile Differential, Clutch, Brakes

UNIT IV   [CO:4]   ()

Alternative Energy SourcesTypes of Batteries, Parameters - Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Targets and Properties of Batteries, Fuel Cells, Fuel Cell Characteristics, Types of Fuel Cells, Supercapacitors and Ultracapacitors

LEARNING RESOURCES:

TEXT BOOK(s):

1. Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2005
2. M. Ehsani, Y. Gao, S. Gay and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, CRC Press, 2005
3. James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, 2003

REFERENCE BOOK(s):

1. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013

2. C.C. Chan and K.T. Chau, Modern Electric Vehicle Technology, OXFORD University Press, 2001
3. Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Wiley Publication, 2011

WEB RESOURCES:

1. Sandeep Dhameja, "Electric Vehicle Battery Systems", Newnes, 2000
2. http://nptel.ac.in/courses/108103009/
3. MATLAB (Trial version): Software is useful for simulation and analysis of electrical systems

ITOL01   **DATA STRUCTURES & ALGORITHMS**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Select and Implement Appropriate Linear data structures as applied to specified problem definition.
2. Implement Non-Linear data structures and Develop solutions for complex problem using Divide and Conquer.
3. Develop solutions for complex problems using Greedy and Dynamic Programming.
4. Design and Improve all possible solutions for a problem using Backtracking and Branch and Bound.

UNIT I   *Text Book - 1* [CO:1] **(14)**

Analysis of an Algorithm, Asymptotic Notations, Singly Linked lists - Representation in Memory, Abstract Data Types (ADTs) - singly linked lists, doubly - linked lists and circularly linked lists.Stack ADT and its operations using array and linked list, Queue ADT and its operations using array and linked list.

UNIT II   *Text Book - 1* [CO:2] **(12)**

Basic Tree Terminologies, Different types of trees: Binary Tree, Binary Search Tree, tree traversals, Graph representation and traversals.Divide and Conquer - Control Abstraction, Merge sort, Quick sort, Binary Search.

UNIT III   *Text Book - 2* [CO:3] **(12)**

Greedy Method - Control Abstraction, Knapsack Problem, Minimum Cost Spanning Trees, Single Source Shortest Paths.Dynamic Programming - General Method, Multi-stage Graph, All Pairs Shortest Paths, String Editing, Single Source Shortest Paths (General Weights).

UNIT IV   *Text Book - 2* [CO:4] **(14)**

Backtracking - General Method, 8-Queens Problem, and Graph Coloring.Branch and Bound - General Method, Travelling Sales Person Problem, Knapsack problem.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,1997.
2. E. Horowitz, S. Sahni and S.Rajsekaran, "Fundamentals of Computer Algorithms", Galgotia Publication.

REFERENCE BOOK(s):

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mc Graw Hill, 2002.
2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson ducation,1983.

3. Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.

4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008

5. Reema Thareja, "Data Structures Using C", Second Edition , Oxford University Press, 2011

ITOL02	**OPERATING SYSTEMS**	**L T P C Int Ext**

COURSE OUTCOMES:

1. Compare different types of operating systems and describe operating system structure and its functions.
2. Design algorithms on CPU scheduling and classical problems of process synchronization.
3. Describe and Analyze dead lock handling mechanisms, memory management techniques and page replacement polices.
4. Identify and compare different file allocation, disk free space management methods and disk scheduling mechanisms.

UNIT I   *Text Book - 1* [CO:1] **(12)**

Introduction: What Operating Systems Do, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security.**System Structures:** Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls.**Process Concept:** Process Concept, Process Scheduling, Operations on Processes, Inter process Communication.

UNIT II   *Text Book - 1* [CO:2] **(12)**

Multithreaded Programming: Overview of Multithreading, Multithreading Models, Implicit Threading. **Process Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling.**Synchronization:** Background, The Critical-Section Problem, Peterson 'solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization.

UNIT III   *Text Book - 1* [CO:3] **(12)**

Dead Locks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock**Memory-Management Strategies:** Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging. **Virtual-Memory Management:** Background, Demand Paging, Page Replacement algorithms.

UNIT IV   *Text Book - 1* [CO:4] **(10)**

Files System: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File sharing, Protection.**Implementing File-Systems:** File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, and Free-Space Management.**Mass-Storage Structure:** Overview of Mass-Storage Structure, Disk Structure, Disk Scheduling.

LEARNING RESOURCES:

TEXT BOOK:

Operating System Concepts-Abraham Silberchatz, Peter B, Galvin, Greg Gange 9th Edition, John Wiley.

REFERENCE BOOK(s):

1. Operating Systems, Internal and Design Principles, Stallings, 8th Edition-2015, Pearson education/PHI.
2. Operating system A Design Approach-Crowley, TMH.
3. Modern Operating Systems, Andrew S Tenenbaum 4th Edition Pearson/PHI.
4. "An Introduction to Operating Systems, Concepts and Practice", 4th Edition, PHI, 2013-Pramod Chandra P. Bhatt.
5. Operating Systems- A concept based approach - DM Dhamdhere -3rd Edition TMH.

ITOL03   **BIG DATA ANALYTICS**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Classify key issues in big data management and its associated applications.
2. Apply fundamental enabling techniques and scalable algorithms in big data analytics.
3. Interpret models for similarity and distance measures.
4. Use mining data stream models and apply analytics principles.

UNIT I   *Text Book - 1* [CO:1] **(10)**

Overview of Big Data: What is Big Data, Structuring Big Data, Elements of Big Data, Big Data Analytics. **Understanding Hadoop Ecosystem:** Hadoop EcoSystem, Hadoop Distributed File System, Hadoop YARN, Introducing HBase, Combining HBase and HDFS, Hive, Pig, Sqoop, ZooKeeper, Flume.

UNIT II   *Text Book - 2* [CO:2] **(10)**

Data Mining: What is Data Mining?, Statistical Limits on Data Mining. Things useful to know.**Map Reduce Software Stack:** Distributed File Systems, MapReduce, Algorithms Using Map Reduce, Extensions to MapReduce, The Communication Cost Model. **Finding Similar Items:** Applications of Near-Neighbor Search, Shingling of Documents, Similarity-Preserving Summaries of Sets, Locality-Sensitive Hashing for Documents, Distance Measures

UNIT III   *Text Book - 2* [CO:3] **(10)**

Mining Data Streams: The Stream Data Model, Sampling Data in a Stream, Filtering Streams. Mining, Counting Distinct Elements in a Stream. **Link Analysis:** Page Rank, Efficient Computation of Page Rank, Topic-Sensitive Page Rank, Link Spam.

UNIT IV   *Text Book - 1* [CO:4] **(10)**

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics, Points to consider during Analysis, Developing an Analytic Team, Understanding Text Analytics. **Exploring R:** Variables in R, Working with Vectors, Storing and Calculating values in R, Creating and using objects, Executing Scripts,, Creating Plots.**Reading Dataset and Exporting Data from R:** c() command, scan() Command, Reading multiple data values from large files, exporting data from R, creating subsets in data frames.

LEARNING RESOURCES:

TEXT BOOK(s):

1. BIG DATA Black Book, Dreamtech Press, 2015.
2. Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, Mining of Massive Datasets, 2nd Edition, 2014.

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REFERENCE BOOK(s):

1. Taming the Big Data Tidal Wave: Finding Opportunities in huge data streams with advanced analytics, Bill Franks, Wiley Publishers, 2010.
2. Understanding Big data: Analytics for enterprise class Hadoop and streaming data, Paul Zikopoulos, Chiris Eaton, McGraw Hill Education.

WEB RESOURCES:

1. Big Data computing course of Dr. Rajiv Misra is available @ https://nptel.ac.in/courses/106104189/
2. Yahoo! Hadoop Tutorial available @ https://developer.yahoo.com/hadoop/tutorial/
3. Googld Apache tools Tutorials available @ https://cloud.google.com/dataproc/docs/tutorials
4. IBM Hadoop Dev Tutorials available @ https://developer.ibm.com/hadoop/docs/biginsights-ibm-open-platform/getting-started/tutorials/

ITOL04   **WEB TECHNOLOGIES**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Create web pages with HTML, CSS, and JavaScript.
2. Design dynamic webpages using client side scripting.
3. Create XML documents and work with web servers to develop Server side web applications with Java Servlets.
4. Design and develop server side programs with Java Server Pages.

UNIT I   *Text Book - 1* [CO:1] **(12)**

Introduction to HTML5 Part - I & II. Cascading Style Sheets (CSS) Part - I & II.JavaScript: Introduction to Scripting, Control Statements Part - I & II.

UNIT II   *Text Book - 1* [CO:2] **(14)**

JavaScript: Functions, Arrays, Objects. DOM Objects and Collections JavaScript Event Handling

UNIT III   *Text Book - 2* [CO:3] **(12)**

XML: XML Basics, XML Namespaces, DTD, XML Schema, MathML, XSL & XSLT. Web Servers (IIS and Apache). Introduction to Java Servlets, Static and Dynamic contents, Servlet life Cycle and Life cycle methods, Servlet Request and Response Model, Deploying a Servlet, Servlet State Transitions, Servlet Config and ServletContext, Servlet Redirection and Request Dispatch, Servlet Synchronization and Thread Model. Maintaining Client State: Cookies, URL rewriting, Hidden form fields, Session Tracking.

UNIT IV   *Text Book - 2* [CO:4] **(12)**

Introduction to JSP, JSP & Servlet as Web Components, Servlets vs. JSP, JSP Lifecycle, JSP Page Lifecycle Phases, General Rules of Syntax, JSP syntactic elements, JSP element syntax, Template content. JSP elements-directives, declarations, expressions, scriptlets, actions. JSP Standard Actions: jsp:useBean, jsp:getPreoperty, jsp:setProperty, jsp:include, jsp:forward, jsp:plugin, jsp:param,java Server Pages Standard Tag Library(JSTL).

LEARNING RESOURCES:

TEXT BOOK(s):

1. Harvey M. Deitel and Paul J.Deitel, "Internet & World Wide Web How to Program", 4/e, Pearson Education.
2. Subrahmanyam Allamaraju and Cedric Buest, "Professional Java Server Programming: J2EE".

REFERENCE BOOK(s):

1. Jason Cranford Teague "Visual Quick Start Guide CSS, DHTML & AJAX", 4/ e, Pearson Education.

2. Tom Nerino Doli Smith "JavaScript & AJAX for the Web" Pearson Education, 2007.
3. Bill Dudney, Johathan Lehr, Bill Willies, Lery Mattingly "Mastering Java Server Faces" Wiely India, 2006.
4. Web Technology - Uttam K.Roy, Oxford University Press, 2010.

WEB RESOURCES:

1. www.deitel.com
2. www.w3schools.com
3. www.tutorialspot.com

MEOL01   **AUTOMOTIVE ENGINEERING**   **L T P C Int Ext**

COURSE OUTCOMES:
1. Identify the components and fuel supply system of an automobile.
2. Analyze the working of each of the components.
3. Modify the design of the components.
4. Analyse various possible alternative sources to the IC engines.

UNIT I   [CO:1] **(12)**

Introduction: Classification of vehicles - applications, options of prime movers, arrangements of drive. I.C.Engines: Introduction, Engine nomenclature, Classification of I.C.Engines, Working principles of S.I. and C.I. Engines (both 4 stroke and 2-stroke)-Valve Timing and Port Timing diagrams - Differences between S.I. & C. I. and 2 Stroke & 4 stroke engines.Fuel Supply Systems: S.I. Engines- Carburetion, Simple float type carburetor, Fuel injection System for SI engines, MPFI. C.I.Engines- Air- fuel requirements, fuel injection systems, Electronic injection system, CRDI.

UNIT II   [CO:2] **(12)**

Cooling Systems: Need for cooling system, Air and water cooling. Lubricating Systems: Objects of lubrication, Requirements of lubricants, various lubricating systems for I.C. Engines.Ignition System: Battery Ignition system, Ignition advance, ignition advance methods, Spark plugs, Magneto ignition system, Electronic Ignition system.

UNIT III   [CO:3] **(12)**

Clutches: Single-plate and Multi-plate clutches, Centrifugal clutches, actuating mechanisms.Transmission: Gear Box - Theory, Four Speed and Five Speed Sliding mesh, Constant mesh & Synchro-mesh type, selector mechanism, propeller shaft, differential – principle of working. Suspension Systems: Need for suspension systems, springs, shock absorbers.

UNIT IV   [CO:4] **(12)**

Alternative energy sources: natural gas, LPG, biodiesel, gasohol and hydrogen in automobiles and modification needed.Options of prime movers: Electric Vehicle, Hybrid vehicle, Fuel cell vehicle.

LEARNING RESOURCES:

TEXT BOOK(s):

1. I.C. Engines - V.Ganesan - T.M.H., New Delhi, 3rd Edition.
2. Automobile Engineering - S.Srinivasan, 2007, TMH.
3. Automobile Engineering - Vol I & II - Kirpal Singh, Standard Publishers, 2011.

REFERENCE BOOK(s):

1. Automobile Engineering   - G.B.S.Narang, Khanna Publishers, 7th Reprint, 2011
2. Automobile Engineering - K. Ramakrishna, PHI, New Delhi, 2012.

1. Automobile Engineering   - G.B.S.Narang, Khanna Publishers, 7th Reprint, 2011
2. Automobile Engineering - K. Ramakrishna, PHI, New Delhi, 2012.

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MEOL02   **ROBOTIC ENGINEERING**   **L T P C Int Ext**

COURSE OUTCOMES:
1. Understand the basic components of robotics, classification of robots and their applications.
2. Describe robot grippers, their usage and design considerations.
3. Discuss various types of sensory devices their working and applications.
4. Apply basic transformations related to the movement of manipulator.
5. Design a robot mechanism to meet kinematics requirements and to write simple programs

UNIT I   [CO:1] **(12)**

Introduction to Robotics, major component of a robot, robotic like devices, classification of robots Classification by coordinate system and by control method, Specifications of robots, fixed versus flexible automation, economic analysis and overview of robot application.

UNIT II   [CO:2] **(12)**

Robot End Effectors: Introduction, end effectors, interfacing, types of end effectors, grippers and tools, considerations in the selection and design of remote centered devices, Requirements of End effectors. Robot Actuators: Pneumatic Drives Hydraulic Drives Mechanical Drives Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives

UNIT III   [CO:3] **(12)**

Robotic Sensory Devices: Objective, Non optical position sensors potentiometers, synchros, inductosyn, optical position sensors opto interrupters, optical encoders (absolute & incremental)Proximity Sensors: Contact type,non-contact type inductive,capacitive proximity sensor, fibre optic proximity sensor, laser scanning proximity sensor, and reflected light sensor.Touch & Slip Sensors: Touch sensors proximity rod & photo detector sensors, slip sensors Forced oscillation slip sensor, interrupted type slip sensors.

UNIT IV   [CO:4] **(12)**

Robot Programming: Methods of robot programming, generation of Robot programming Languages Motion Commands, Sensor Commands, End effector commands, and Simple programs.Transformations and Kinematics:Objectives,homogenous coordinates, basic transformation operations, homogeneous transformation, Forward solution   Denavit Hartenberg procedure. Problems involving 2 and 3 DOF manipulators.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Robotic Engineering by Richard D.Klafter, Prentice-Hall of India Pvt Ltd, 2010.
2. Industrial Robotics by Mikell P. Groover, Tata McGraw-Hill Int. Edition 2, 2012.
3. Robotics and Control, R.K. Mittal and I.J. Nagarath, TMH, 2005.

REFERENCE BOOK(s):

1. Introduction To Robotics: Mechanics And Control, John J. Craig 3rd edition, pearson ,2008
2. Robotics: Control, Sensing, Vision, and Intelligence, K. S. Fu, R. C. Gonzales, and C. S. G. Lee, Tata McGraw-Hill, NY, 2008.
3. Introduction to Robotics: Analysis, Systems, Applications, Saeed B. Niku, Prentice Hall, NJ, 2010.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses.php?branch=Mechanical
2. http://academicearth.org/courses/introduction-to-roboticsVideo references
3.   http://nptel.iitm.ac.in/video.php?courseId=1052

MEOL03   **INTRODUCTION TO OPERATIONS RESEARCH**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Recognize the importance and value of Operations Research and linear programming in solving practical problems in industry.
2. Interpret the transportation models' solutions and infer solutions to the real-world problems.
3. Recognize and solve queuing and game theory problems
4. Acquire knowledge of drawing project networks for quantitative analysis of projects and know when simulation can be applied in real world problems

UNIT I   [CO:1] **(12)**

Linear Programming : Definition and Scope of Operations Research, Mathematical formulation of the problem, graphical method, Simplex method, artificial basis technique, dual Simplex method, Degeneracy, alternative optima, unbounded solution, infeasible solution.

UNIT II   [CO:2] **(12)**

Transportation Problem: Introduction to the problem, LP formulation of a transportation problem. Basic feasible solution by north-west corner method, Vogel's approximation method, least cost method. Finding optimal solution by MODI method, degeneracy, unbalanced transportation matrix and Maximization in transportation model.Assignment Problem: One to one assignment problem, optimal solutions, unbalanced assignment matrix, travelling sales man problem, maximization in A.P.

UNIT III   [CO:3] **(12)**

Queuing   Theory: Queuing   systems   and   their   characteristics.   Classification,   Models -(M/M/1:FCFS/∞/∞), (M/M/1:FCFS/N/∞).Theory of Games: Introduction, rectangular two person zero sum games, solution of rectangular games in terms of mixed strategies, solution of 2x2 games without saddle point, concept of dominance to reduce the given matrix, Graphical method for 2xn and nx2 games

UNIT IV   [CO:4] **(12)**

Project Planning through Networks: Introduction, Basic steps in PERT/CPM techniques, Network diagram presentation, Rules of drawing network diagram, Fulkerson's rule, Time estimates and Critical path in network analysis, floats, Project evaluation and review technique, Application areas of PERT/CPM techniques. Simulation: Introduction, Monte-Carlo Simulation, Application to Inventory Control, Application to Queuing Problems

LEARNING RESOURCES:

TEXT BOOK(s):

1. S.D. Sharma, 'Operations Research' Kedarnath, Ramnath & Co.,Meerut , 11th   Edition , 2002..

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2. Gupta and Hira, 'Operations Research' , S.Chand Publishers, 2011.
3. H.A. Taha, 'Operations Research', Pearson, 7th Edition, June 2002

REFERENCE BOOK(s):

1. S.S. Rao, 'Optimization Theory and Applications,, John Wiley & Sons , 1996
2. Phillips, Ravindran, James Soldberg, 'Introduction to Operations Research', Wiley 1976
3. Hiller and Liberman ,'Introduction to Operations Research' , MGH, 7th Edition, 2002

WEB RESOURCES:

1. http://www2.informs.org/Resources/
2. http://www.mit.edu/~orc/
3. http://www.ieor.columbia.edu/

MEOL04   **MECHATRONICS**   **L T P C Int Ext**

COURSE OUTCOMES:

1. Describe how mechatronics integrates knowledge from different disciplines
2. Identify sensors, transducers and actuators to monitor and control the behavior of a system
3. Realize the concepts of real time interfacing and data acquisition
4. Discuss concepts of design of Mechatronics system through case studies

UNIT I   [CO:1] **(12)**

Introduction: Key elements. Mechatronics design process , design parameters , mechatronics and traditional design. Advanced approaches in mechatronics design , Introduction to industrial design, modelling, simulation and analysis , Ergonomics and safety.

UNIT II   [CO:2] **(12)**

Sensors and Transducers: Introduction, sensor for motion and position measurement, force, torque and tactile sensors, sensor for flow measurement, temperature sensing devices. Actuating Devices: DC Motors, Stepper motors, fluid power Actuation, fluid power design elements: Input devices, Modulation Devices, Output Devices, graphical representation of hydraulic and pneumatic elements and equipments.

UNIT III   [CO:3] **(12)**

Signal Conditioning : Introduction , Hardware , Digital I/O , Analog input , ADC , resolution, Filtering Noise using passive components , Registors, capacitors , Amplifying signals using OP amps software - Digital Signal Processing , Low pass , high pass , notch filteringReal Time Interfacing: Introduction , Selection of interfacing standards, elements of data acquisition and control systems

UNIT IV   [CO:4] **(12)**

Programmable Logic Controllers : Basic Structure Programming : Ladder diagram Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls, Data Handling ,Analog input / output ,PLC Selection Application.CASE STUDIES: Pick and place robot, Car park barriers, car engine management.

LEARNING RESOURCES:

TEXT BOOK(s):

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering/
   W Bolton/ Pearson.
2. Devdas shetty, Richard A. Kolk, Mechatronics System Design, 2nd Edition,Cengage Learning

REFERENCE BOOK(s):

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1. Bishop, Robert H, Mechatronics Hand book, CRC Press, 2002.
2. Bradley, D.Dawson, N.C. Burd and A.J. Loader, Mechatronics: Electronics in Products and Processes, CRC Press 1991 , First Indian print 2010.
3. De Silva, Mechatronics: A Foundation Course, Taylor & Francis, Indian Reprint, 2013

1. Bishop, Robert H, Mechatronics Hand book, CRC Press, 2002.
2. Bradley, D.Dawson, N.C. Burd and A.J. Loader, Mechatronics: Electronics in Products and Processes, CRC Press 1991 , First Indian print 2010.

MEOL05　　　　　　**APPLIED MECHANICS & MECHANICAL ENGINEERING**　　　L　T　P　C　Int Ext

COURSE OUTCOMES:

1. Understand different coplanar forces and determine the resultant forces. He/she is also able to estimate centre of gravity and moment of inertia for simple objects.
2. Estimate the tensile, compressive, shear and thermal stresses in a body when subjected for different forces, change in temperature etc., He/she can also understand the difference between thick and thin cylinders and able to estimate hoop and longitudinal stresses, changes
3. Understand the formation of steam, working principles of Babcock and Wilcox boilers, different mountings and accessories used in the boilers and the principles of Refrigeration & Air-Conditioning.
4. Discuss how the power is transmitted through belt and gear drives, estimate the tensions, power transmitted, length of the belt required etc.

UNIT I　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[CO:1] **(12)**

Forces: Concurrent Forces, Composition and Resolution of coplanar Forces, Equilibrium of Coplanar forces.Section Properties: Centre of gravity and Moment of Inertia of simple and composite elements (Problems related to simple objects only).

UNIT II　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[CO:2] **(12)**

Stress and Strain: Simple stress and strain, Hooke's Law, Stress strain diagram for brittle and ductile materials- Factor of safety, Thermal stresses, Lateral strain, Modulus of rigidity, Bulk modulus-Relation between G,K and C, (Problems on simple stresses, elongations only)Thin and Thick Cylinders: Thin and thick circular cylinders subjected to internal and external pressure.　Thin and thick cylinders with spherical ends. Lame's theorem and application to thick cylinders.

UNIT III　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[CO:3] **(12)**

Steam: Generation of steam, Properties of steam, Use of steam tables and Mollier chart-(Problems related to enthalpy, entropy, specific volume calculations for different conditions of steam only- No problems on non flow processes).　Steam Generators: Classification – Working of Cochran and Babcock-Wilcox boilers only- Accessories and mountings (Listing and functions only).Refrigeration & Air-Conditioning Basics: Principles of Refrigeration & Air-Conditioning –Applications – COP – Turn of Refrigeration – Measures of Refrigeration – Air-Refrigeration System – Vapour Compression Refrigeration System – Psychrometry – Psychometric properties – Psychometric Processes, Psychometric Chart – Summer Air-conditioning Systems.

UNIT IV   [CO:4] **(12)**

Drives: Belts Classification, Expression for the ratio of tensions on the slack and tight side, Power transmitted, V-belts, Chain drives-Simple problems only.Gears: Classification –Spur, Bevel, Helical gears and applications.Bearings: Purpose of bearings, Slipper bearing, Thrust bearing, Ball and Roller bearings.Couplings: Flange, Flexible couplings, Hook's joint, Universal coupling

LEARNING RESOURCES:

TEXT BOOK(s):

1. Strength of Materials, S. Ramamrutham, 17thEdition, Dhanpath Rai Publishers, Delhi (Unit – I, II) (2011)
2. Elements of Mechanical Engineering, Mathur, and Mehta Jain Brothers, Delhi (Unit – III, IV), (2005)
3. Treatise on Heat Engineering, V. P.Vasandhani&Kuma, Metropolitan Publishers.
4. Refrigeration & Air-Conditioning by R.S.Kurmi & Gupta, Chand & Company.

REFERENCE BOOK(s):

1. Applied Mechanics & Strength of Materials, R. S. Khurmi, 13thEdition, S. Chand & Co. (1977).
2. Basic Mechanical Engineering, T.J.Prabhu & Others, 1stEdition, SciTech Publishers (2010).

CE V01   **ENGLISH COMPETENCY DEVELOPMENT PROGRAMME**   **L T P C Int Ext**
                              [NON-CREDIT COURSE - ACTIVITY BASED]   **2 - - - 100 -**

LECTURE PLAN

Session	Topic
1.	Self Introduction
2.	Self Introduction
3.	Introducing Others
4.	Mind Mapping -Small Talk
5.	Random Operation
6.	JAM & Extempores
7.	Starting a Conversation-Rapid Fire
8.	Story Telling
9.	Narrating Life Stories
10.	Tense Buster
11.	Describing people
12.	Picture Perception & Description
13.	Movie Reviews
14.	News Articles-Open Discussion & Debate
15.	Everyday Life-Communicative Activities
16.	Role Plays
17.	Short Versions
18.	Contemporary Novels-Critical Appreciation Round

References :
* Contemporary Novels-Critical Appreciation Round
* eslflow.com/Personality Vocabulary Survey
* eslflow.com/Celebrity Interview
* eslflow.com/Telling stories
* eslflow.com/ First Impressions/speaking activity
* Speaking work sheets/Out & About 1 - PHOTOCOPIABLE, Cambridge University Press 2015
* Speaking Unplugged: 30 activities for one-to-one classes by online TEFL training
* Think Teen work book
* The guardian weekly/News based English language activities
* Walkietalkie https://www.teacherspayteachers.com/Store/Walkietalkie
* Alen Maley's Conversation/Rob Nolasco & Lois Arthur/Oxford University Press
* Alen Maley's Project Work/Diana L.Fried-Booth/Oxford University Press
* Cambridge English/Objective PET/Louise Hashemi & Barbara Thomas
* Cambridge English Business Benchmark/Guy Brook-Hart
* British Council / Learn English Select Face-to-Face Course / APSCHE Communication Skills Project
* Self- Designed Handouts