ACHARYA NAGARJUNA UNIVERSITY

A State Government University, Accredited with "A" Grade by NAAC

Nagarjuna Nagar - 522 510, Guntur, Andhra Pradesh, India.

B.Tech. CIVIL ENGINEERING

SYLLABUS

2020 - 2021 onwards

Dr. Y.S.R. ANU COLLEGE OF ENGINEERING & TECHNOLOGY

PROGRAM CODE:

ANUCET01

ABOUT UNIVERSITY

ACHARYA NAGARJUNA UNIVERSITY (ANU)

- A Brief Profile

Acharya Nagarjuna University, a State University established in 1976, has been constantly striving towards achieving progress and expansion during its existence for over four decades, in terms of introducing new courses in the University Colleges, affiliated colleges and professional colleges. Spread over 300 acres of land on the National High Way (NH-16) between Vijayawada and Guntur of Andhra Pradesh, the University is one of the front ranking and fastest expanding Universities in the state of Andhra Pradesh. The University was inaugurated on 11th September, 1976 by the then President of India, Sri Fakruddin Ali Ahmed and celebrated its Silver Jubilee in 2001. The National Assessment and Accreditation Council (NAAC) awarded "A" grade to Acharya Nagarjuna University and also has achieved 108 International ranks, 39 National ranks UI Green Metrics rankings and many more It is named after Acharya Nagarjuna – one of the most brilliant preceptors and philosophers, whose depth of thought, clarity of perception and spiritual insight were such that even after centuries, he is a source of inspiration to a vast number of people in many countries. The University is fortunate to be situated on the very soil where he was born and lived, a soil made more sacred by the aspiration for light and a state of whole someness by generations of students. With campus student strength of over 5000, the University offers instruction for higher learning in 68 UG & PG programs and guidance for the award of M.Phil. and Ph.D. in 48 disciplines spread over six campus colleges and one PG campus at Ongole. It also offers 160 UG programs in 440 affiliated colleges in the regions of Guntur and Prakasam Districts. It has a Centre for Distance Education offering 87 UG & PG programs. Characterized by its heterogeneous students and faculty hailing from different parts of the state and the country, the University provides most hospitable environment for pursuing Higher Learning and Research. Its aim is to remain connected academically at the forefront of all higher educational institutions. The University provides an excellent infrastructure and on- Campus facilities such as University Library with over one lakh books & 350 journals; Computer Centre; University Scientific Instrumentation Centre; Central Research Laboratory with Ultra-modern Equipment; Well-equipped Departmental Laboratories; Career Guidance and Placement Cell; Health Centre; Sports Facilities with Indoor & Outdoor Stadiums and Multipurpose Gym; Sports Hostel; Separate hostels for Boys, Girls, Research Scholars and International Students; Pariksha Bhavan (Examinations Building); Computers to all faculty members; Wi-Fi connectivity to all Departments and Hostels; Canteen, Student Centre & Fast-food Centre; Faculty Club; Dr. H.H. Deichmann & Dr. S.John David Auditorium cum Seminar Hall; Post office; Telecom Centre; State Bank of India; Andhra Bank; Energy Park; Silver Jubilee Park; Fish ponds; internet center; xerox center; cooperative stores; Water harvesting structures.

VISION, MISSION & OBJECTIVES OF THE UNIVERSITY

ACHARYA NAGARJUNA UNIVERSITY

VISION

To generate sources of knowledge that dispels ignorance and establish truth through teaching, learning and research.

MISSION

To promote a bank of human talent in diversified faculties – Commerce & Management Studies, Education, Engineering & Technology, Humanities, Law, Natural Sciences, Pharmacy, Physical Education & Sports Sciences, Physical Sciences and Social Sciences that would become an investment for a prosperous society.

OBJECTIVES

- To inspire and encourage all who would seek knowledge through higher education and research.
- To provide quality instruction and research for the advancement of science and technology.
- To promote teaching and research studies in disciplines of societal relevance.
- To bridge the gap between theory and practice of the principles of higher education.
- To develop human talent necessary for the industry.
- To open up avenues of higher education and research through non-formal means.
- To invite and implement collaborations with other institutes of higher learning on a continuous basis for mutual academic progress.
- To motivate and orient each academic department/centre to strive for and to sustain advanced levels of teaching and research so that the university emerges as an ideal institute of higher learning.
- To focus specially on the studies involving rural economy, justifying its existence in the rural setting.

VISION

&

MISSION OF THE COLLEGE

ACHARYA NAGARJUNA UNIVERSITY
Dr. Y.S.R. ANU COLLEGE OF ENGINEERING & TECHNOLOGY

ABOUT ANUCET:

The ANU college of Engineering & Technology is established in the academic year 2009-2010 in the University campus under the able leader ship of the Vice-chancellor, Prof. Hara Gopal Reddy. The College offers UG and PG courses that include B.Tech. and M.Tech. The college commenced its operations with an annual intake of 60 into 5 branches of B.Tech. (Civil Engineering, Computer Science Engineering, Electronics & Communication Engineering, Electrical & Electronics Engineering & Mechanical Engineering) and 20 into 5 branches of M.Tech. The institution has been growing from strength to strength and got recognition in limited period.

VISION OF THE COLLEGE:

ANU College of Engineering & Technology is started with an aim of imparting technical values in the students, who can change the shape of global scenario in engineering arena.

MISSION OF THE COLLEGE:

- To educate students for careers of leadership, innovation in engineering and its related fields.
- To expand the base of engineering knowledge through original research and by developing technology to serve the needs of society.

OBJECTIVES:

- To inspire and encourage all knowledge seekers of higher education and research.
- To provide quality instruction and research for the advancement of science and technology.
- To promote teaching and research studies in disciplines of societal relevance.
- To bridge the gap between theory and practice.
- To develop human talent necessary for the industry.

VISION & MISSION OF THE DEPARTMENT

ACHARYA NAGARJUNA UNIVERSITY

Dr. Y.S.R. ANU COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

B.Tech. CIVIL ENGINEERING

VISION OF THE DEPARTMENT:

To give an exposure to the centre of excellence that bring ups technically competent civil engineers and promotes high-end research and innovation, to meet the global challenges.

MISSION OF THE DEPARTMENT:

Provide fundamental and emerging technical skills to design, build, operate and manage the infrastructure requirements of the society through education, training, research and consultancy.

ACHARYA NAGARJUNA UNIVERSITY
Dr. Y.S.R. ANU COLLEGE OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING
B.Tech. CIVIL ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEO's):

PEO1- TECHNICAL AND ABILITY SKILLS:

Core competence of students will improve their chances of employability and theses are acquires during and after completion of their under graduations course and enable the students to solve problems of industrial and research area.

PEO2- SELF LEARNING & PROBLEM SOLVING:

Engineering education imparts theoretical and experimental capabilities to their students and helps in solving problems at the work situations & core competence, team working abilities developed during their education will improve the problems in solving abilities

PEO3- LEADERSHIP QUALITIES & PROFESSIONAL ETHICS:

During their education students acquires virtues such as sincerity honest etc and also core competence and enable them to take initiative in their work situations. They adhere to principles like intellectual honesty during their professional carrier in industries and research institutes.

PROGRAMME OUTCOMES (PO's):

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, societal, 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 modeling 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 teamwork**: 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 (PSO's):

On completion of the Civil Engineering degree the graduates will be able to

PSO1	Graduate will build professional career in the engineering industry and/or higher studies by acquiring knowledge in mathematical, scientific and engineering fundamentals
PSO2	Graduate will plan, analyze & design of structures and execution of quality construction work, irrigation works, and soil stabilizations in civil engineering systems with safety, health, cultural, environmental.
PSO3	Graduate shall have the propensity to excel in portfolio of waste management, sanitation, and provide innovative solutions for different modes of transportation facilities.
PSO4	Graduate exhibits professional ethics, communication skills, team work and adapts to changing environments of engineering and technology by engaging in lifelong learning.

ACHARYA NAGARJUNA UNIVERSITY
FACULTY OF ENGINEERING
ACADEMIC REGULATIONS 2020 (R20) FOR B. TECH (REGULAR)
(APPLICABLE FOR THE STUDENTS ADMITTED DURING THE ACADEMIC YEAR 2020-2021 AND ONWARDS)

1. ELIGIBILITY FOR ADMISSION:

Admission to the above program shall be made subject to the eligibility, qualification and specialization prescribed by the University for each program from time to time.

Admission shall be made either on the basis of merit/rank obtained by the qualifying candidates in EAMCET/ECET or otherwise specified, whichever is relevant.

The duration of B.Tech. program is of four academic years divided into eight semesters comprising of two semesters in each academic year. A student is required to choose a branch of study at the time of admission. Students under lateral entry will be admitted straightaway into Third semester of B.Tech. course in the respective branch. No change of branch shall be allowed after the admissions are closed.

2. AWARD OF B.TECH. DEGREE:

A student will be declared eligible for the award of the B.Tech. degree if he/she fulfils the following academic regulations:

i) Regular entry students shall pursue a course of study for not less than four academic years and in not more than eight academic years.

ii) Students who fail to fulfill all the academic requirements for the award of the degree within eight academic years (for Regular Entry) / six academic years (for Lateral Entry) from the year of their admission, shall forfeit their seat in B.Tech. course and their admission is cancelled.

Completing the course of study shall mean not only satisfying the attendance requirements but also passing of all the subjects within the respective stipulated period.

3. BRANCHES OF STUDY:

The following Branches of study are offered at present for B. Tech. degree and any other branch as approved by the authorities of the University from time to time.

S.No.	Branch
1	Civil Engineering
2	Computer Science and Engineering
3	Electrical and Electronics Engineering
4	Electronics and Communication Engineering
5	Mechanical Engineering

Each Branch will have a curriculum with syllabi that shall consist of the following:

i) General Core Courses
   1) Basic Sciences
   2) Engineering Sciences
   3) Humanities and Social Sciences

ii) Program Core Courses in Engineering / Technology

iii) Elective courses of Engineering / Technology / Management Entrepreneurship / Business Communication and allied fields.

iv) Open Electives/CBCS

v) Mandatory learning courses

vi) Project work.

4. CREDITS:

i) Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year.

ii) Choice Based Credit System (CBCS): The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses).

iii) Credit: A unit by which the course work is measured.

5. DISTRIBUTION AND WEIGHTAGE OF MARKS (INTERNAL & EXTERNAL):

i) The performance of a student in each semester shall be evaluated subject-wise with a maximum of 100 marks for theory and 100 marks for practical subject. In addition internship & Project work shall be evaluated for 100 and 150 marks respectively.

ii) For both theory and lab subjects the distribution shall be 30 marks for Internal Evaluation and 70 marks for the External Evaluation.

iii) There shall be five units in each of the theory subjects.

iv) For theory subjects, there shall be two midterm examinations during the semester. Each midterm examination shall consist of assignment for 10 marks and sessional test for 20 marks with duration of 135 minutes respectively.

First midterm examination shall be conducted for 50% coverage of syllabus and second midterm examination shall be conducted for remaining 50% of syllabus. Both the midterm exams are compulsory. Final midterm examination marks for a TOTAL of 30 marks shall be arrived at, by considering the 80% weightage (24 marks) to that midterm examination in which the student scores more marks and the remaining 20% (6 marks) for other midterm exam.

*Note 1: The assignment test paper shall contain 6 questions of equal weightage and student is asked to answer any 2 questions randomly and shall be condensed for 10 marks, any fraction rounded off to the next higher mark.

*Note 2: The sessional examination shall contain 3 questions out of which first question is objective(6marks) and compulsory and remaining two questions(7 marks each) having internal choice and shall be considered for 20 marks, any fraction rounded off to the next higher mark.

v) For theory subjects, there will be 5 questions with following pattern in the End-Examination.

a) All Questions have to be answered compulsorily.
b) All five questions, EITHER/OR type shall be followed with 14 marks for each.
c) In each question as mentioned in (c), one, two or more bits can be set.

vi) Further, whenever any theory subject with two parts is offered (combined subject), for ex: Electrical & Mechanical Technology, then there shall be only two parts Part A, Part B in the question paper.

First question objective can be equally divided into two parts.

Part – A: shall contain two questions, EITHER/OR type shall be followed with 14 marks for each.

Part – B: shall also contain two questions, EITHER/OR type shall be followed with 14 marks for each.

vii) Model Question paper for each theory course shall be prepared by the teacher within 15 days from the commencement of the semester and the same shall be forwarded to the Controller of Examinations through the Chairman, BOS concerned.

viii) For practical subjects there shall be a continuous evaluation during the semester for 30 internal marks and 70 end examination marks. Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the report of experiments/jobs (10 marks for the record submitted and 5 marks for day to day work). The end examination for 15 marks (10 marks for experiment and 5 marks for viva-voce) shall be conducted by the laboratory teacher and another examiner from the same department.

*Note: Day to day performance shall be recorded in student record (each experiment carries 15 marks, at least ten experiments should be done and average marks must be taken at the end of semester).

ix) For the subject having design and / or drawing, such as Engineering Drawing, Machine Drawing and Estimation, the distribution shall be 30 marks for internal evaluation and 70 marks for end examination. The Internal evaluation will be 20 marks for day-to-day work in the class that shall be evaluated by the concerned subject teacher based on the reports/submissions prepared in the class. Further, there shall be two midterm exams in a Semester for a duration of 2 hrs each; evenly distributed over the syllabi for 20 marks and the average marks of both the mid examinations shall be considered as internal test marks. The sum of day to day evaluation and the internal test marks will be the final internal marks for the subject.

x) Out of a TOTAL of 150 marks for the project work, 50 marks shall be for Internal Evaluation and 100 marks for the End Semester Examination (Viva-voce). The viva-voce shall be conducted by a committee consisting of Head of the Department, Project Supervisor and an External Examiner nominated by the Principal from the panel of 3 members proposed by Head of the Department. The project work shall start in IV year II semester. The evaluation of project work shall be conducted at the end of the IV year II semester. The Internal Evaluation shall be made on the basis of weekly progress (a minimum of 12 weeks and 3 marks for each week progress) and at least two seminars (one at the beginning of IV B.Tech. II semester (30 marks) and the other before submission of project work (20 marks) given by each student on the topic of his project.

xi) The laboratory records and internal test papers shall be preserved for minimum of 2 years in the respective departments and shall be produced to the Committees of the college as and when the same are asked for.

xii) A student shall be permitted to pursue up to a maximum of ONE elective courses under MOOCs during the Programme. The courses must be of minimum 12 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to pursue and acquire a certificate for a MOOC course only from the organizations/agencies approved by the BoS in order to earn the 2 credits. The Head of the department shall notify the list of such courses at the beginning of the semester.

6. ATTENDANCE REQUIREMENTS:

i) A student shall be eligible to appear for end examinations if he/she acquires a minimum of 75% of attendance in aggregate of all the subjects in a semester.

ii) Shortage of Attendance below 65% in aggregate shall in NO case be condoned.

iii) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

iv) Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

v) A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester, as applicable. They may seek readmission for that semester when offered next.

vi) A stipulated fee shall be payable towards condonation of shortage of attendance to the college.

7. MINIMUM ACADEMIC REQUIREMENTS (FOR REGULAR ENTRY STUDENTS):

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.6

i) A student who could not secure a minimum of 50% aggregate from midterm examination marks is not eligible to appear for the semester end examination and shall have to repeat that semester.

ii) A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, design, drawing subject or project if he secures not less than 40% of marks in the end examination and a minimum of 50% of marks in the sum TOTAL of the internal evaluation and end examination taken together. In the internship & project he/she should secure 40%. For practical examination if he secures not less than 50% of marks in the semester end examination.

iii) A student shall be promoted from I to II year only if he/she fulfils the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 irrespective of back log subjects in I/IV B.Tech.

iv) A student shall be promoted from II to III year only if he/she fulfils the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 and also must secure 70% of the credits of the subjects that have been studied up to I year II semester from irrespective of whether the candidate takes the end examination or not as per the normal course of study. At the time of commencement of class work, he must attain the required credits.

v) A student shall be promoted from third year to fourth year only if he fulfills the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 and also must secure 70% of the credits of the subjects that have been studied upto II year II semester. At the time of commencement of class work, he must attain the required credits.

And in case of getting detained for want of credits by sections ii and iii above, the student may make up the credits through supplementary exams of the above exams before the date of class work commencement of Third or Fourth year I semester respectively.

8. MINIMUM ACADEMIC REQUIREMENTS (FOR LATERAL ENTRY STUDENTS):

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.6.

i) A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 40% of marks in the end examination and a minimum of 50% of marks in the sum TOTAL of the internal evaluation and end examination taken together. In the Seminar & Comprehensive viva-voce he/she should secure 40%.

ii) A student who could not secure a minimum of 50% aggregate from midterm examination marks is not eligible to appear for the semester end examination and shall have to repeat that semester.

iii) A student shall be promoted from II to III year only if he/she fulfils the academic requirements of attendance and internal marks as stipulated in clause 6 and 7 irrespective of back log subjects in II/IV B.Tech.

iv) A student shall be promoted from III to IV year only if he/she fulfils the academic requirement of attendance and internal marks as stipulated in clause 6 and 7 and also must secure 70% of the subjects that have been studied up to III year I semester.

9. GRADING:

After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Table – Conversion into Grades and Grade Points assigned

Range in which the marks in the subject fall	Grade	Grade points assigned
≥ 90	O (Outstanding)	10
80-89	A+ (Excellent)	9
70-79	A (Very Good)	8
60-69	B+ (Good)	7
50-59	B (Above Average)	6
45-49	C (Average)	5

40-44	D (Pass)	4
< 40	F (Fail)	0
Absent	Ab (Absent)	0

i) A student obtaining Grade F shall be considered failed and will be required to reappear for that subject when the next supplementary examination offered.

ii) For non credit courses 'Satisfactory' or "Unsatisfactory' shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

9.1. SEMESTER GRADE POINT AVERAGE (SGPA) AND CUMULATIVE GRADE POINT AVERAGE (CGPA):

i. The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$SGPA = \Sigma\,(Ci \times Gi)/\,\Sigma\,Ci$$

Where, Ci is the number of credits of the i^{th} subject and Gi is the grade point scored by the student in the i^{th} course.

ii. The Cumulative Grade Point Average (CGPA) will be computed in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$$CGPA = \Sigma\,(Ci \times Si)/\,\Sigma\,Ci$$

Where 'Si' is the SGPA of the ith semester and Ci is the TOTAL number of credits in that semester.

iii. Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

iv. While computing the GPA/CGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, D and F.

10. GAP - YEAR:

Gap Year – concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I year/II year/III year to pursue entrepreneurship full time. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. An evaluation committee shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for having the Gap Year.

11. TRANSITORY REGULATIONS: (OLD REGULATIONS CHANGED)

i. Candidates who admitted into the four year B.Tech. degree course under R-15 regulations but who got detained in any year for want of attendance/minimum aggregate sessional marks may join the appropriate year /semester in the semester system applicable for that batch and be governed by the regulations of that batch from then onwards unless otherwise specified.

ii. A student admitted under credit based regulations(CR) detained due to lack of sessional marks/attendance at the end of the first semester of II/IV B.Tech. shall join II/IV first semester of R-15 batch . Such students will study all the courses prescribed for that R-15 in which the student joins. However the student has to clear all the first year backlog subjects by appearing the supplementary examination. Such candidates will be governed by the regulations applicable to lateral entry candidates of R-15 batch for the award of the degree.

iii. A student admitted under CR, detained due to lack of sessional marks/attendance at the end of the second semester of II/IV B.Tech. /at the end of subsequent semesters shall follow the credit based regulations only (CR).

12. WITH–HOLDING OF RESULTS:

If the candidate has any dues not paid to the college or if any case of indiscipline or malpractice is pending against him, the result of the candidate shall be withheld and he will not be allowed / promoted into the next higher semester. The issue of awarding degree is liable to be withheld in such cases.

13. AWARD OF CLASS:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree he shall be placed in one of the following four classes:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 8.0
First Class	≥ 6.5 < 8.0
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 4.0 < 5.5

14. MINIMUM INSTRUCTION DAYS:

The minimum instruction period for a semester is 16 weeks. The minimum instruction days including exams for each semester shall be for 90 days.

15. BRANCH TRANSFER:

There shall be no branch transfers after the completion of admission process.

16. GENERAL:

i. The academic regulations should be read as a whole for purpose of any interpretation.

ii. Malpractice rules - nature and punishments is appended

iii. Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the BOS is final.

v. The University may from time to time, revise, amend or change the Regulations, Schemes of Examinations, and/or Syllabi.

17. CONDUCT AND DISCIPLINE:

a) Students shall conduct themselves within and outside the premises of the institute in a manner befitting the students of our institution.

b) 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.

c) 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.

   i) Lack of courtesy and decorum, indecent behavior anywhere within or outside the campus.
   ii) Willful damage of college / individual property.
   iii) Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.
   iv) Mutilation or unauthorized possession of library books.
   v) Noisy and unseemly behavior, disturbing studies of fellow students.
   vi) 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.)
   vii) Usage of camera / cell phone in the campus.
   viii) Plagiarism of any nature
   ix) Any other acts of gross indiscipline as decided by the academic council from time to time.

d) 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.
e) 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.
f) Cases of adoption of unfair means and / or any malpractice in an examination shall be reported to the principal for taking appropriate action.
g) All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the academic council.
h) 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.
i) 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.
j) "Grievance and Redressal Committee" (General) constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters.

18. PUNISHMENTS FOR MALPRACTICE CASES – GUIDELINES:

The examinations committee may take the following guidelines into consideration while dealing with the suspected cases of malpractice reported by the invigilators/squad members etc, during end examinations. The punishment may be more severe or less severe depending on the merits of the individual cases.

S. No.	Nature of Malpractices/Improper conduct	Punishment
1.	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palmcomputers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.

2	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks	Cancellation of the performance in that subject.
3	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project workof that semester/year examinations.
4	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any other student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the registered against him police and a case.
5	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects including practical examinations and project work of that semester/year.
6	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects including practical examinations and project work of that semester/year.
7	Smuggles in the Answer book or takes out or arranges to send out the question paper during the examination or answer book during or after the examination	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects including practical examinations and project work of that semester/year. The student is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.

8	Refuses to obey the orders of the Chief Superintendent /Assistant Superintendent/ any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether bywords, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
9	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects including practical examinations and project work of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
10	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects including practical examinations and project work of that semester/year. The student is also debarred and forfeits the seat.

11	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 7 to 9.	For Student of the college: Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects including practical examinations and project work of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
12	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is debarred from writing the remaining exams, and rusticated from the college fur one academic year during which period the student will not be permitted to write any exam. If the imposter is an outsider, he will be handed over to the police and a case is registered against him. The performance of the original student who has been impersonated, shall be cancelled in all the subjects of the examination including practical's and project work of that semester/year. The student is rusticated from the college for two consecutive years during which period the student will not be permitted to write any exam. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
13	If any malpractice is detected which is not covered in the above clauses 1 to 12 it shall be reported to the college academic council for further action to award suitable punishment	
14	Malpractice cases identified during sessional examinations will be reported to the examination committee nominated by Academic council to award suitable punishment.	

CURRICULAR FRAMEWORK FOR REGULAR AND HONORS B.TECH. PROGRAMMES OF ALL BRANCHES:

AWARD OF THE DEGREE:

A student will be declared eligible for the award of B. Tech. degree if he/she fulfills the following:

i) Pursues a course of study in not less than four and not more than eight academic years.
ii) After eight academic years from the year of their admission, he/she shall forfeit their seat in B. Tech course and their admission stands cancelled.
iii) Registers for 160 credits and must secure all the 160 credits.
iv) A student shall be eligible for the award of B.Tech. degree with Honors or Minor if he/she earns 20 credits in addition to the 160 credits. A student shall be permitted to register either for Honors or for Minor and not for both simultaneously.

CURRICULAR FRAMEWORK FOR HONORS PROGRAMME:

1) Students of a Department/Discipline are eligible to opt for Honors Programme offered by the same Department/Discipline.
2) A student shall be permitted to register for Honors program at the beginning of 4th semester provided that the student must have acquired a minimum of 8.0 SGPA upto the end of 2nd semester without any backlogs. In case of the declaration of the 3rd semester results after the commencement of the 4th semester and if a student fails to score the required minimum of 8 SGPA, his/her registration for Honors Programme stands cancelled and he/she shall continue with the regular Programme.
3) Students can select the additional and advanced courses from their respective branch in which they are pursuing the degree and get an honors degree in the same. e.g. If a Mechanical Engineering student completes the selected advanced courses from same branch under this scheme, he/she will be awarded B.Tech. (Honors) in Mechanical Engineering.
4) In addition to fulfilling all the requisites of a Regular B.Tech. Programme, a student shall earn 20 additional credits to be eligible for the award of B. Tech (Honors) degree. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).
5) Of the 20 additional Credits to be acquired, 16 credits shall be earned by undergoing specified courses listed as pools, with four courses, each carrying 4 credits. The remaining 4 credits must be acquired through two MOOCs, which shall be domain specific, each with 2 credits and with a minimum duration of 8/12weeks as recommended by the Board of studies.
6) It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. The courses offered in each pool shall be domain specific courses and advanced courses.

7) The concerned BOS shall decide on the minimum enrolments for offering Honors program by the department. If minimum enrolments criteria are not met then the students shall be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BOS.
8) Each pool can have theory as well as laboratory courses. If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall explore the possibility of introducing virtual labs for such courses with lab component.
9) MOOC courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Students have to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned will be as decided by the university/academic council.
10) The concerned BOS shall also consider courses listed under professional electives of the respective B. Tech programs for the requirements of B. Tech (Honors). However, a student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.
11) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a “pass (P)” grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.
12) In case a student fails to meet the CGPA requirement for Degree with Honors at any point after registration, he/she will be dropped from the list of students eligible for Degree with Honors and they will receive regular B.Tech. degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
13) Honors must be completed simultaneously with a major degree program. A student cannot earn Honors after he/she has already earned bachelor’s degree.

CURRICULAR FRAMEWORK FOR MINOR PROGRAMME:

1) a) Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering
b) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech. Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

2) The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE, CE, ME etc or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.
3) The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BOS.
4) There shall be no limit on the number of programs offered under Minor. The University/Institution can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.
5) The concerned BOS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BOS.
6) A student shall be permitted to register for Minors program at the beginning of 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 8 SGPA (Semester Grade point average) upto the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 8 SGPA upto 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An SGPA of 8 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.
7) A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).
8) Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BOS along with prerequisites. It is the responsibility of the student to acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Programme.
9) In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 4 credits. If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academic council.

10) Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BOS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.
11) A committee should be formed at the level of College/Universities/department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BOS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.
12) If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript.
13) In case a student fails to meet the CGPA requirement for B.Tech. degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.
14) Minor must be completed simultaneously with a major degree program. A student cannot earn the Minor after he/she has already earned bachelor's degree.

STRUCTURE

ACHARYA NAGARJUNA UNIVERSITY

Dr. Y.S.R. ANU COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

B.Tech. CIVIL ENGINEERING

COURSE STRUCTURE

SEMESTER-I

S. No.	Course Details		Cate gory	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**CE111 (R20)**	Mathematics-I	BS	3	0	0	30	70	3
2	**CE112 (R20)**	Engineering Chemistry	BS	3	0	0	30	70	3
3	**CE113 (R20)**	Basic Electrical Engineering	ES	3	0	0	30	70	3
4	**CE114 (R20)**	Engineering Graphics	ES	3	0	0	30	70	3
5	**CE115 (R20)**	Computer Programming With C	ES	3	0	0	30	70	3
6	**CE151 (R20)**	Mechanical Workshop Lab	ES	0	0	3	30	70	1.5
7	**CE152 (R20)**	Engineering Chemistry Lab	BS	0	0	3	30	70	1.5
8	**CE153 (R20)**	Computer Programming Lab	ES	0	0	3	30	70	1.5
TOTAL CREDITS									**19.5**

S.No.	Category	Abbrevation	Required Credits Criteria
1	BS	Basic Science Course	7.5
2	ES	Engineering Science Course	12

SEMESTER-II

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**CE121(R20)**	Mathematics-II	BS	3	0	0	30	70	3
2	**CE122(R20)**	Engineering Physics	BS	3	0	0	30	70	3
3	**CE 123(R20)**	Professional Communication Skills	HS	3	0	0	30	70	3
4	**CE 124(R20)**	Python	ES	3	0	0	30	70	3
5	**CE 125(R20)**	Engineering Mechanics	ES	3	0	0	30	70	3
6	**CE 126(R20)**	Environmental Science	MC	3	0	0	30	70	0
7	**CE 161(R20)**	Engineering Physics Lab	ES	0	0	3	30	70	1.5
8	**CE 162(R20)**	Communication Skills Lab	HS BS	0	0	3	30	70	1.5
9	**CE 163(R20)**	Python Lab	ES	0	0	3	30	70	1.5
TOTAL CREDITS									**19.5**

S.No.	Category	Abbrevation	Required Credits Criteria
1	BS	Basic Science Course	6
2	ES	Engineering Science Course	9
3	HS	Humanities & Social Course	4.5
4	MC	Mandatory Course	0

SEMESTER-III

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**CE 211 (R20)**	Mathematics-III	BS	3	0	0	30	70	3
2	**CE 212 (R20)**	Building Materials & Construction	PC	3	0	0	30	70	3
3	**CE 213 (R20)**	Surveying and Geomatics	PC	3	0	0	30	70	3
4	**CE 214 (R20)**	Solid Mechanics -I	PC	3	0	0	30	70	3
5	**CE 215 (R20)**	Fluid Mechanics	PC	3	0	0	30	70	3
6	**CE 216 (R20)**	Constitution of India	MC	2	0	0	30	70	0
7	**CE 251 (R20)**	Surveying Lab	PC	0	0	3	30	70	1.5
8	**CE 252 (R20)**	Building Planning & Drawing Lab	PC	0	0	3	30	70	1.5
9	**CE 253 (R20)**	Civil Workshop	PC	0	0	3	30	70	1.5
10	**CE 254 (R20)**	Auto CAD Lab	SC	0	0	3	30	70	2
TOTAL CREDITS									**21.5**

S.No.	Category	Abbreviation	Required Credits Criteria
1	MC	Mandatory Course	0
2	BS	Basic Science Course	3
3	PC	Program Core Course	16.5
4	SC	Skill Oriented Course	2

SEMESTER-IV

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**CE221 (R20)**	Engineering Geology	ES	3	0	0	30	70	3
2	**CE 222 (R20)**	Concrete Technology	PC	3	0	0	30	70	3
3	**CE 223 (R20)**	Solid Mechanics -II	PC	3	0	0	30	70	3
4	**CE 224 (R20)**	Hydraulics and Hydraulic Machinery	PC	3	0	0	30	70	3
5	**CE 225 (R20)**	Professional Ethics And Human Values	HS	3	0	0	30	70	3
6	**CE 261 (R20)**	Engineering Geology Lab	ES	0	0	3	30	70	1.5
7	**CE 262 (R20)**	H & HM Lab	PC	0	0	3	30	70	1.5
8	**CE 263 (R20)**	Material Testing Lab	PC	0	0	3	30	70	1.5
9	**CE 264 (R20)**	Advanced Surveying Lab	SC	0	0	3	30	70	2
TOTAL CREDITS									**21.5**
Internship 2 Months (Mandatory) during Summer vacation									
Honors/Minor Courses (The hours distribution can be 3-0-2 or 3-1-0 also)									**4**

S.No.	Category	Abbreviation	Required Credits Criteria
1	ES	Engineering Science Course	4.5
2	PC	Program Core Course	12
3	HS	Humanities and Social Science	3
4	SC	Skill Oriented Course	2

SEMESTER-V

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**CE 311 (R20)**	Structural Analysis-I	PC	3	0	0	30	70	3
2	**CE 312 (R20)**	Design of Concrete Structures	PC	3	0	0	30	70	3
3	**CE 313 (R20)**	Geo-Technical Engineering –I	PC	3	0	0	30	70	3
4	**CE 314 (R20)**	Water Resource Engineering	PEC-I	3	0	0	30	70	3
5	**CE 315 (R20)**	Environmental Engineering	OE/JOC-I	3	0	0	30	70	3
6	**CE 316 (R20)**	Fundamentals of Research Methodology	MC	2	0	0	30	70	0
7	**CE 351 (R20)**	Environmental Engineering Lab	PC	0	0	3	30	70	1.5
8	**CE 352 (R20)**	Concrete Technology Lab	PC	0	0	3	30	70	1.5
9	**CE 353 (R20)**	Advanced Communication Skill Lab	SC	0	0	3	30	70	2
10	**CE 354 (R20)**	Summer Internship	MC	0	0	0	100	0	1.5
TOTAL CREDITS									**21.5**
Honors/Minor Courses (The hours distribution can be 3-0-2 or 3-1-0 also)									**4**

PROFESSIONAL ELECTIVE COURSE-I			OPEN ELECTIVES/JOB ORIENTED COURSE-I		
1	**CE 314/1 (R20)**	Water Resource Engineering	1	**CE 315/1 (R20)**	Environmental Engineering
2	**CE 314/2 (R20)**	Advanced Concrete Technology	2	**CE 315/2 (R20)**	Remote Sensing &GIS
3	**CE 314/3 (R20)**	Advanced Hydraulics	3	**CE 315/3 (R20)**	Infrastructure planning & management
4	**CE 314/4 (R20)**	Climatology	4	**CE 315/4 (R20)**	Building Services

S.No.	Category	Abbreviation	Required Credits Criteria
1	PC	Program Core Course	12
2	PEC	Professional Elective Course	3
3	OE/JOC	Open elective/Job oriented Course	3
4	SC	Skill Oriented Course	2
5	MC	Mandatory Course	1.5

SEMESTER-VI

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**CE 321 (R20)**	Structural Analysis-II	PC	3	0	0	30	70	3
2	**CE 322 (R20)**	Design of Steel Structures	PC	3	0	0	30	70	3
3	**CE 323 (R20)**	Geo-Technical Engineering –II	PC	3	0	0	30	70	3
4	**CE 324 (R20)**	Transportation Engineering	PEC-II	3	0	0	30	70	3
5	**CE 325 (R20)**	Estimation, Specification & Costing	OE/JOC-II	3	0	0	30	70	3
6	**CE 326 (R20)**	Managerial Economics & Finance Analysis	MC	2	0	0	30	70	0
7	**CE 361 (R20)**	Geo-Technical Engineering Lab	PC	0	0	3	30	70	1.5
8	**CE 362 (R20)**	Transportation Engineering Lab	PC	0	0	3	30	70	1.5
9	**CE 363 (R20)**	Detailing And Drawing Of Structures	PC	0	0	3	30	70	1.5
10	**CE 364 (R20)**	STAAD PRO Lab	SC	0	0	3	30	70	2
TOTAL Credits									**21.5**
Industrial Research Internship (2 Months) after 3rd Year during Summer Vacation									
Honors/Minor Courses (The hours distribution can be 3-0-2 or 3-1-0 also)									**4**

PROFESSIONAL ELECTIVE COURSE -II				OPEN ELECTIVE/JOB ORIENTED COURSE-II	
1	**CE 324/1(R20)**	Transportation Engineering	1	**CE 325/1 (R20)**	Estimation, Specification & Costing
2	**CE 324/2(R20)**	Ground Water Development & Management	2	**CE 325/2 (R20)**	Geo-Synthetics
3	**CE 324/3(R20)**	Low Cost Housing	3	**CE 325/3 (R20)**	Construction Safety Management
4	**CE 324/4(R20)**	Basics Of Interior Design	4	**CE 325/4 (R20)**	Construction Economic and Finance

S.No.	Category	Abbreviation	Required Credits Criteria
1	PC	Program Core Course	13.5
2	PEC	Professional Elective Course	3
3	OE/JOC	Open elective/Job oriented Course	3
4	SC	Skill Oriented Course	2

SEMESTER-VII

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
				Hours in a Week			Marks		Credits
	Code	Subject Name		L	T	P	Internal	External	
1	**CE 411 (R20)**	Liquid & Solid Waste Management	PE-III	3	0	0	30	70	3
2	**CE 412 (R20)**	Repair & Rehabilitation of structures	PE-IV	3	0	0	30	70	3
3	**CE 413 (R20)**	Disaster Management	PE-V	3	0	0	30	70	3
4	**CE 414 (R20)**	Open Elective course /Job Oriented Course	OE /JOC-III	3	0	0	30	70	3
5	**CE 415 (R20)**	Essence of Indian Traditional Knowledge	BS	3	0	0	30	70	3
6	**CE 416 (R20)**	Open Elective course /Job Oriented Course(MOOC)	OE /JOC-IV	3	0	0	100	0	3
7	**CE 451 (R20)**	Quantity, Estimation & Project Management Lab	SC	0	0	3	30	70	2
8	**CE 452 (R20)**	Industrial/ Research Internship after 3rd year	MC	0	0	0	100	0	3
TOTAL CREDITS									**23**
Honors/Minor Courses (The hours distribution can be 3-0-2 or 3-1-0 also)									**4**

Professional Elective Course-III			Professional Elective Course-IV		
1	**CE411/1 (R20)**	Liquid & Solid waste management	1	**CE412/1 (R20)**	Repair & Rehabilitation of structures
2	**CE411/2 (R20)**	Air Port & Harbor Engineering	2	**CE412/2 (R20)**	Water shed Management
3	**CE411/3 (R20)**	Advanced Foundation Engineering	3	**CE412/3 (R20)**	Structural Health Monitoring
4	**CE411/4 (R20)**	Bridge Engineering	4	**CE412/4 (R20)**	Advanced Structural Design

PROFESSIONAL ELECTIVE COURSE-V			OPEN ELECTIVE / JOB ORIENTED COURSE-III		
1	**CE413/1 (R20)**	Disaster Management	1	**CE414/1 (R20)**	Construction & Project Management
2	**CE413/2 (R20)**	Structural Systems	2	**CE414/2 (R20)**	Artificial Intelligence
3	**CE413/3 (R20)**	Urban Hydrology	3	**CE414/3 (R20)**	Infrastructure for Smart City Planning
4	**CE413/4 (R20)**	Earthquake Resistance Design of Structures	4	**CE414/4 (R20)**	Green Technology

S.No.	Open Elective / Job Oriented Course-IV	
1	**CE 416 (R20)**	MOOC

S.No.	Category	Abbreviation	Required Credits Criteria
1	PEC	Professional Elective Course	9
2	OE/JOC	Open elective/Job oriented Course	6
3	BS	Basic Science	3
4	SC	Skill Oriented Course	2
5	MC	Mandatory Course	3

SEMESTER-VIII

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1.	**CE461 (R20)**	Project work	Major Project	0	0	0	50	100	8
2.	**CE462 (R20)**	Seminar	Seminar	0	0	0	50	0	2
3.	**CE463 (R20)**	MOOC	MOOC	0	0	0	100	0	2
TOTAL CREDITS									**12**

MINOR DEGREE COURSES [R20]

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**CEM001 (R20)**	Basics of Civil Engineering	Minor	3	0	0	30	70	4
2	**CEM002 (R20)**	Modern Construction Materials	Minor	3	0	0	30	70	4
3	**CEM003 (R20)**	Functional Efficiency of Buildings	Minor	3	0	0	30	70	4
4	**CEM004 (R20)**	Construction Management	Minor	3	0	0	30	70	4
5	**CEM005 (R20)**	Smart cities	Minor	3	0	0	30	70	4
6	**CEM006 (R20)**	Urban Planning	Minor	3	0	0	30	70	4

HONOR DEGREE COURSES [R20]

STRUCTURAL ENGINEERING DOMAIN

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**CEHT101 (R20)**	Alternative Building Materials & Technologies	Honor	3	0	0	30	70	4
2	**CEHT102 (R20)**	Pre stressed concrete	Honor	3	0	0	30	70	4
3	**CEHT103 (R20)**	Stability of Structures	Honor	3	0	0	30	70	4
4	**CEHT104 (R20)**	Advanced Theory And Design of RCC Structures	Honor	3	0	0	30	70	4

HONOR DEGREE COURSES [R20]

GEO-TECHNICAL ENGINEERING DOMAIN

S. No.	Course Details		Category	Scheme of Instruction			Scheme of Examination		
	Code	Subject Name		Hours in a Week			Marks		Credits
				L	T	P	Internal	External	
1	**CEHT201 (R20)**	Alternative Building Materials & Technologies	Honor	3	0	0	30	70	4
2	**CEHT202 (R20)**	Ground Improvement Techniques	Honor	3	0	0	30	70	4
3	**CEHT203 (R20)**	Design of Earth Retaining Structures	Honor	3	0	0	30	70	4
4	**CEHT204 (R20)**	Soil Dynamics and Machine Foundation	Honor	3	0	0	30	70	4

HONOR DEGREE COURSES [R20]

TRANSPORTATION ENGINEERING DOMAIN

S. No.	Course Details		Cate gory	Scheme of Instruction			Scheme of Examination		
				Hours in a Week			Marks		Credits
	Code	Subject Name		L	T	P	Internal	External	
1	**CEHT301 (R20)**	Alternative Building Materials & Technologies	Honor	3	0	0	30	70	4
2	**CEHT302 (R20)**	Urban Transportation & planning	Honor	3	0	0	30	70	4
3	**CEHT303 (R20)**	Traffic Engineering	Honor	3	0	0	30	70	4
4	**CEHT304 (R20)**	Pavement Analysis & Design	Honor	3	0	0	30	70	4

HONOR DEGREE COURSES [R20]

ENVIRONMENTAL ENGINEERING DOMAIN

S. No.	Course Details		Cate gory	Scheme of Instruction			Scheme of Examination		
				Hours in a Week			Marks		Credits
	Code	Subject Name		L	T	P	Internal	External	
1	**CEHT401 (R20)**	Air pollution & Control	Honor	3	0	0	30	70	4
2	**CEHT402 (R20)**	Environmental Impact Assessment	Honor	3	0	0	30	70	4
3	**CEHT403 (R20)**	Advanced Environmental Engineering	Honor	3	0	0	30	70	4
4	**CEHT404 (R20)**	Urban Waste Management	Honor	3	0	0	30	70	4

SEMESTER I

ACHARYA NAGARJUNA UNIVERSITY

Dr. Y.S.R. ANU COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

B.Tech. CIVIL ENGINEERING

SEMESTER-I

CE111 (R20): MATHEMATICS-I

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Using Matrix method find the inverse of matrix, and using other methods solving Homogeneous and non-homogeneous equations. Determining the eigen values and eigen vectors.
CO2	Finding the approximate real root of given equation.
CO3	Finding partial derivatives of first and higher orders and maxima and minima of functions of two variables.
CO4	Evaluate double integrals techniques over a region of two dimensional and with polar coordinates.
CO5	Familiarize with special functions to evaluate some proper and improper integrals using beta and gamma functions.

UNIT I:

MATRIX OPERATIONS AND SOLVING SYSTEMS OF LINEAR EQUATIONS

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigen vectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

Unit II:

Mean Value Theorems

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof);

Unit III:

Multivariable calculus

Partial derivatives, TOTAL derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Unit IV:

Double Integrals

Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves.

Unit V:

Special Functions

Beta and Gamma functions and their properties, relation between beta and gamma functions.

TEXT BOOKS:

1) Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2) B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

REFERENCE BOOKS:

1) R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2) George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3) Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.

CO-PO/PSO MATRIX MAPPING:

CE111 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO2	1	3	-	-	-	-	-	-	-	1	3	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	2	2	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	3	2	-	-	-	-	-
CO5	2	3	-	-	-	-	-	-	-	1	3	-	-	-	-	-
TOTAL	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**-**

CE112 (R20): ENGINEERING CHEMISTRY

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Develop innovative methods to produce soft water for industrial use and potable water at cheaper cost
CO2	Substitute metals with conducting polymers and also produce cheaper biodegradable polymers to reduce environmental pollution. Design economically and new methods of synthesis nano materials.
CO3	Identify electronic components that can provide protection and specify a minimum set of protections needed - Compute stored energy in a battery pack - List the manufacturing steps of different types of lithium-ion cells and possible failure modes and apply their knowledge for protection of different metals from corrosion
CO4	Ability to understand, explain and select instrumental techniques for analysis
CO5	Develop the technique involved in the manufacturing process of cement Apply the knowledge about the properties of chemical fuels for the generation of power Apply the knowledge of various polymeric material, their synthesis and applications and synthesize medicinal compounds and the physical chemical properties of drugs using drug design software

UNIT-I:

WATER TECHNOLOGY

Various impurities of Water, WHO guidelines, Hardness unit sand determination by EDTA method, water treatment for drinking purpose-sedimentation, coagulation, filtration (slow sand filter), various methods of chlorination, breakpoint chlorination.

Water treatment for industrial purpose: Boiler troubles, scales, sludges, caustic embrittlement, boiler Corrosion, priming and foaming- causes and prevention, Internal conditioning - Phosphate, Calgon and Carbonate treatment, External conditioning-Lime Soda process (simple problems), softening by ion- Exchange process, Desalination of Brackish water by Electro dialysis and Reverse osmosis.

UNIT-II:

POLYMER CHEMISTRY

Introduction to polymers, Functionality of monomers, chain growth and step growth polymerization, Co-polymerization (Stereo specific polymerization) with specific examples and mechanisms of polymer formation.

PLASTICS: Thermoplastics and Thermosetting, preparation, properties and applications of Bakelite, Elastomers, Preparation, properties and applications of BUNA-S and BUNA-N Rubbers. **Conducting**

Polymers- Introduction, examples, general applications and mechanism of Conduction on Polyacetylene.

Chemistry of Nano materials: Introduction to nano chemistry, preparation of nano materials - carbon nanotubes and fullerenes and their engineering applications.

UNIT-III:

ELECTRO CHEMISTRY AND APPLICATIONS

Electrodes-concepts, types of cells, electro chemical series, Nernst equation.

BATTERIES: Primary cell (Dry cell), Secondary cell (Lead-acid), Lithium batteries and their advantages, Fuel cell (H_2-O_2 cell).

Corrosion: Types of corrosions- chemical corrosion, dry corrosion, electro chemical corrosion and wet corrosion, galvanic series, pitting and differential aeration of corrosion, factors affecting corrosion.

Corrosion control: Cathodic protection, Corrosion Inhibitors, Electro plating (Au) & (Ni).

UNIT-IV:

INSTRUMENTAL METHODS

Electromagnetic spectrum-Absorption of Radiation: Beer-Lambert's law-Principle and applications of Ultra-Violet, Infra-Red and Nuclear Magnetic Resonance Spectroscopy. Principle and applications of Gas Chromatography and HPLC Techniques.

UNIT-V:

(i) Cement and Concrete Chemistry: Introduction to Building Materials, Portland Cement, Constituents, Manufacturing Process, Setting and Hardening Cement.

(ii) Organic reactions and synthesis of a drug molecule: Introduction to reactions involving substitution (SN_1 and SN_2), elimination reactions (E_1 and E_2), Synthesis of commonly used drug molecule – Aspirin and Paracetmol.

TEXT BOOKS:

1) Engineering Chemistry, P.C. Jain and M. Jain - Dhanapathi Rai & Sons, Delhi
2) A text book of Engineering Chemistry, S.S. Dara - S. Chand & Co. New Delhi
3) Engineering Chemistry, B.K. Sharma - Krishna Prakashan, Meerut
4) Shashi chawla,A text book of engineering chemistry, 3rdEdition, Dhanpat rai & co new delhi, 2007.
5) Gurudeep raj & chatwalanand, "Instrumental methods of analysis "7thedition, CBS publications, 1986.
6) Quantitative analysis by day & underwood.
7) A Text book of Instrumental methods by Skoog and West.

8) H.W. Wilard and demerit, “Instrumental methods of analysis “, 7th edition, CBS publications,1986.
9) Text book of Nano Science and Nano technology, B.S. Murthy and P. Shankar, University press.

CO-PO/PSO MATRIX MAPPING:

CE112 (R20)	Program Outcomes (PO’s)												Program Specific Outcomes (PSO’s)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	-	1	2	-	-	1	-	3	-	-	-	-
CO2	3	2	1	1	-	-	2	-	-	1	-	3	-	-	-	-
CO3	3	2	1	2	1	-	-	-	-	1	-	3	-	-	-	-
CO4	3	3	2	1	1	-	-	-	-	1	-	2	-	-	-	-
CO5	3	3	2	2	-	1	-	-	-	1	-	3	-	-	-	-
TOTAL	**3**	**3**	**2**	**1**	**1**	**1**	**2**	**-**	**-**	**1**	**-**	**3**	**-**	**-**	**-**	**-**

CE113 (R20): BASIC ELECTRICAL ENGINEERING

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Understand the fundamental concepts of DC and AC circuits, including Kirchhoff's laws, series and parallel connections, and nodal and loop analysis
CO2	Analyze single-phase AC circuits consisting of RL, RC, and RLC series circuits, including series resonance and band width
CO3	Demonstrate knowledge of magnetic circuits and their properties, including Faraday's laws of electromagnetic induction, dynamically and statically induced EMF, and self and mutual inductance
CO4	Explain the principle and operation of DC machines, including DC generators and motors, and understand their performance characteristics and speed control methods.
CO5	Describe the principle, operation, and construction of AC machines, including single-phase transformers and three-phase induction motors, and understand their losses, efficiency, and testing methods.

UNIT – I

DC & AC CIRCUITS: Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Nodal and loop analysis. Thevenin's and Superposition Theorems, Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits. Series Resonance and band width.

UNIT-II

POLY PHASE & MAGNETIC CIRCUITS: Generation of 3-phase voltages - phase sequence - star & delta connections - voltage, current & power in star & delta connected systems - analysis of 3-phase balanced circuits - measurement of 3-phase power by 2 wattmeter method. Faraday's Laws of Electromagnetic Induction. Dynamically induced EMF –Statically induced EMF – Self Inductance – Mutual Inductance - Coefficient of coupling – Inductances in Series – Inductances in parallel – Dot convention.

UNIT-III

DC MACHINES: Principle and operation of DC Generator - EMF equation - OCC characteristics of DC generator – Principle and operation of DC Motor – Performance Characteristics of DC Motors - Speed control of DC Motors.

UNIT-IV

AC MACHINES: Principle and operation of Single Phase Transformer - EMF equations-losses in transformers, regulation and efficiency. OC and SC test on transformer – auto transformer. Principle, operation and construction of Three phase Induction Motor –torque equation and torque slip characteristics-power losses and efficiency.

UNIT-V

SEMICONDUCTOR DEVICES: Characteristics of Semiconductor junction Diode, Zener diode, transistor, JFET, UJT, SCR and their applications. Half-wave, Full-wave rectifiers and Bridge rectifier, with (L and LC) and without filters.

BIPOLAR JUNCTION TRANSISTOR: Transistor operation, Common base configuration, Common emitter configuration, Transistor amplifying action, Common collector configuration, Operating point.

TEXT BOOKS:

1) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2) E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.

REFERENCE BOOKS:

1) L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
2) D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

CO-PO/PSO MATRIX MAPPING:

CE113 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	-	-	-	-	-	-	-	3	3	3	-	2	2
CO2	-	-	-	2	2	-	-	1	-	3	3	3	-	-	-	-
CO3	2	2	2	-	-	-	-	-	-	-	-	-	3	3	2	2
CO4	-	-	-	-	-	2	2	2	2	2	-	3	3	-	-	-
CO5	-	-	2	-	-	1	1	-	-	-	3	1	2	-	-	-
TOTAL	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**1**	**1**

CE114 (R20): ENGINEERING GRAPHICS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	To understand how to construct and analyze different types of curves used in engineering design and manufacturing to study conic sections, cycloids, helixes, spirals, and involutes.
CO2	To analyze their drawing skills through regular practice of the different techniques taught in the course, including freehand sketching, orthographic and isometric projections.
CO3	Applying of their drawing skills through regular practice of the different techniques taught in the course, including orthographic projections, section views, and dimensioning.
CO4	To understand various topics such as projections of lines in different planes, true length and true inclination of lines, and projection of planes in different planes, true shape and true size of planes, and the concept of auxiliary planes.
CO5	To evaluate various topics such as sectioning of solids, different types of sections, and the application of sectioning in engineering design and manufacturing.

UNIT-I

INTRODUCTION TO ENGINEERING GRAPHICS: Principles of Engineering Graphics and their significance-Conventions in drawing-lettering - BIS conventions. Dimensioning principles and conventional representations

a) Conic sections including the rectangular-hhyperbola- general method only,

b) Cycloid, epicycloids and hypocycloid

c) Involutes

UNIT-II

PROJECTION OF POINTS, LINES AND PLANES: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces.

UNIT-III

PROJECTIONS OF SOLIDS: Projections of regular solids inclined to one or both planes by rotational.

SECTIONS OF SOLIDS: Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

UNIT-IV

DEVELOPMENT OF SURFACES: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

ISOMETRIC PROJECTIONS: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, figures, simple and compound solids.

UNIT-V

Orthographic Projections: Systems of Projections, Orthographic Projection (Simple Figures).

TEXT BOOKS:

1) K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2) N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

REFERENCE BOOKS:

1) Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009
2) Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
3) Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000
4) K.C.John, Engineering Graphics, 2/e, PHI, 2013
5) BasantAgarwal&C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.
6) Youtube: http-sewor,Carleton.cag,kardos/88403/drawings.html conic sections-online, red woods.edu

CO-PO/PSO MATRIX MAPPING:

CE114 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	2	-	-	-	-	-	2	3	3	-	-
CO2	3	3	3	3	3	2	-	-	-	-	-	2	3	3	-	-
CO3	3	3	3	3	3	2	-	-	-	-	-	3	3	3	-	-
CO4	3	3	3	3	3	2	-	-	-	-	-	2	3	3	-	-
CO5	3	3	3	3	3	2	-	-	-	-	-	3	3	3	-	-
TOTAL	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**3**	**-**	**-**

CE115 (R20): COMPUTER PROGRAMMING WITH C

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Design and develop flowcharts using Raptor to solve simple problems related to basic programming constructs
CO2	Write basic programs in C using different data types, operators, and control structures
CO3	Develop programs using functions and understand concepts like scope, storage classes, and recursion
CO4	Implement programs using arrays, pointers, and strings for solving problems related to data manipulation.
CO5	Understand the concept of structures and files in C programming, and develop programs using structures and file handling functions.

UNIT – 1:

FLOWCHART DESIGN THROUGH RAPTOR

Flow chart symbols, Input /Output, Assignment, operators, conditional if, repetition, function and sub charts. Example problems (section 1) – Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD of 2 numbers

Example problems (section 2) - Fibonacci generation, prime number generation. Minimum, Maximum and average of n numbers, Linear search, Binary Search.

UNIT 2:

C BASICS

C-Basics: C-character set, Data types, Constants, Expressions, Structure of C program, Operators and their precedence & associatively, Simple programs in C using all the operators, Type casting, type coercion.

UNIT 3: CONTROL STRUCTURES AND FUNCTIONS

Control Structures, Basic input and output statements, Preprocessor directives.

Functions: Concept of a function, passing the parameters, automatic variables, scope and extent of variables, storage classes, recursion, iteration vs recursion, types of recursion, Simple recursive and non recursive programs, Towers of Hanoi problem.

UNIT 4: ARRAYS AND POINTERS

Arrays: Single and multidimensional Arrays, Character array as a string, string functions, Programs using arrays and string manipulation.

Pointers: Pointers declarations, Pointer expressions, Pointer parameters to functions. Pointers, Pointers and array, Pointer arithmetic.

UNIT 5: STRUCTURES AND FILES

Structures: Declaring and using structures, operations on structures, structures and arrays, user defined data types, pointers to structures.Command line arguments.

Files: Introduction, file structure, file handling functions, file types, file error handling, Programs using file functions.

TEXT BOOKS:

1) https: //raptor.martincarlisle.com/
2) Programming with C-Gottfried-Schaums Outline Series-TMH
3) C Programming – Anitha Goel/Ajay Mittal/E.Sreenivasa Reddy-Pearson India

REFERRENCE BOOKS:

1) Problem Solving with C- Somasekharan-PHI.
2) C Programming- Behrouz A forouzan – CENGAGE Learning
3) Test your c skills-Yaswanthkanithker
4) Let us C- Yaswanthkanithker.

CO-PO/PSO MATRIX MAPPING:

CE115 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	-	-	2	-	2	-	-	-	-	-	1	1	-	-
CO2	2	-	-	2	-	-	-	1	-	2	2	2	2	2	-	-
CO3	-	-	2	-	2	2	-	-	-	-	3	3	3	3	-	-
CO4	-	2	-	-	2	2	-	-	2	-	3	-	3	3	-	-
CO5	1	-	-	2	-	-	-	2	-	-	-	3	1	2	-	-
TOTAL	1	1	1	1	1	1	1	1	1	1	2	2	2	2	-	-

CE151 (R20): MECHANICAL ENGINEERING WORKSHOP

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES (COs) :

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

CO1: Select tools and machinery according to job

CO2: Use hand tools in different shops for performing different operations

CO3: Operate equipment and machines in various shops

CO4: Prepare composite / utility jobs according to drawing.

CO5: Maintain workshop related tools, instruments and machines

Foundry Practice: (2 Sessions)

i) a) Determination of average grain size for sand sample using sieve shaker
   b) Preparation of a green sand mould using single piece pattern

ii) Preparation of a green sand mould using split piece pattern with core and demonstration of casting.

Welding Practice: (2 Sessions)

i) Lap joint, butt joint and T joint using arc welding.

ii) Lap joint using resistance spot welding

iii) Lap and butt joints using gas welding

Assembling/Disassembling Practice: (3 Sessions)

i) Bicycle

ii) Clutch and carburetor

iii) Two wheeler engine

Manufacture of a Plastic Component (2 Sessions)

i) Use of injection moulding machine

ii) FRP composite using hand layup method

iii) Joining of plastic components

Design and manufacture any two domestic utility products with any material (2 Sessions)

Use of Power Tools (2 Sessions)

CO-PO/PSO MATRIX MAPPING:

CE151 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	2	3	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	2	3	-	-	-	-	-	-	-	-	-	-	-
CO5	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**2**	-	-	**1**	-	-	-	-	-	-	-	-	-	-	-	-

CE152 (R20): ENGINEERING CHEMISTRY LABORATORY

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to:

CO1	Explain various methods of volumetric analysis i.e. Redox, Iodometric, complexometric, Neutralization etc. and use of conductivity meter for measurement of conductance of water sample.
CO2	Apply the use of internal and external indicators and their comparison for redox titrations and mechanisms of iodometric titrations and use of double indicator method in a single titration.
CO3	Estimate the % values of moisture, volatile matter, ash and carbon of fuel by Proximate analysis and instrument handling
CO4	Analyse the properties of lubricants viz. Flash & fire point, viscosity, cloud & pour point and their significance.
CO5	Produce a coherent paragraph interpreting a figure/graph/chart/table (L4) Explain synthetic technique of drug like Aspirin, Paracetamol etc.

LIST OF EXPERIMENTS:

1) Determination of hardness of water by EDTA method
2) Estimation of Mohr's salt by Permanganometry
3) Estimation of Mohr's salt by Dicrometry
4) Determination of alkalinity of water
5) Percentage of purity of washing soda
6) Determination of available chlorine in bleaching powder
7) Preparation of Urea-formaldehyde resin
8) Determination on strength of NaoH using HCl conductometrically
9) Acid-Base titration by P^H meter
10) Acid-Base titration by Potentiometer
11) Determination of viscosity of lubricating oil
12) Determination of Surface tension

CO-PO/PSO MATRIX MAPPING:

CE152 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	-	2	3	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	2	3	-	-	-	-	-	-	-	-	-	-	-
CO5	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**2**	-	-	**1**	-	-	-	-	-	-	-	-	-	-	-	-

CE153 (R20): COMPUTER PROGRAMMING LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

CO 1	Understand and apply fundamental programming concepts such as variables, data types, operators, control structures, functions, arrays, pointers, and structures in C language.
CO 2	Develop efficient algorithms and use appropriate data structures to solve programming problems in C
CO 3	Demonstrate the ability to write and debug C programs using appropriate tools and techniques, including integrated development environments (IDEs) and debugging utilities
CO 4	Evaluate the efficiency and complexity of C programs in terms of time and space complexity, and apply appropriate techniques to optimize program performance.
CO 5	Work collaboratively in teams to develop complex C programs, and effectively communicate technical information and programming solutions to others.

CYCLE 1:

1. Construct flowcharts to
a. Calculate the maximum, minimum and average of N numbers
b. Develop a calculator to convert time, distance, area, volume and temperature from one unit to another.
2. Construct flowcharts with separate procedures to
a. Calculate simple and compound interest for various parameters specified by the user
b. Calculate the greatest common divisor using iteration and recursion for two numbers as specified by the user
3. Construct flowcharts with procedures to
a. Generate first N numbers in the Fibonacci series
b. Generate N Prime numbers
4. Design a flowchart to perform Linear search on list of N unsorted numbers (Iterative and recursive)
5. Design a flowchart to perform Binary search on list of N sorted numbers (Iterative and recursive)
6. Design a flowchart to determine the number of characters and lines in a text file specified by the user

CYCLE 2:

1. Exercises on data types and operators?

a) Practice exercises 3.1 to 3.16 and 4.1 to 4.17 and 14.1 to 14.20 Test your C Skills -yaswanthkanitkartext book.
b) Write a program which determines the largest and the smallest number that can be stored in different data types of like short, int., long, float and double. What happens when you add 1 to the largest possible integer number that can be stored?
c) Write a program to find greatest of three numbers using conditional operator?
d) Write a program to swap two numbers with and without temp variable?
e) Practice a program using multiple unary increment and decrement operators in arithmetic expressions?

2. Exercises on control structures?

a) Practice exercise 2.1 to 2.15 Test your C Skills – yaswanth kanitkar text book.
b) Write a program to find greatest of three numbers? Use nested if, if else if and switch statements?
c) Write a program to read marks of a student and print the sum and average?
d) Display the grade based on the sum of marks?
e) Write a program to count the digits of a number? Use for loop
f) Write a program to check whether a number is perfect or not? Use do-while
g) Write a program to check whether a number is strong or not? Use while
h) Write a program to check whether a number is amstrong or not? Use for
i) Write a program to check whether a number is palindrome or not? Use for
j) Write a program to find the Fibonacci series upto the given number? Use while
k) Write a program to print the pascals triangle? Used do-while
l) Write a program to print the result of the series 1+x^2/2+x^3/3+….+x^n/n

3. Exercises on functions?

a) Practice exercise 5.1 to 5.14 Test your C skills -yaswanthkanitkartext book.
b) Write program to swap two variables using functions? Write a program to perform menu driven arithmetic operations using functions?
c) Write a program to find the factorial of a number using recursive and non- recursive functions?
d) Write a program to find the Fibonacci series using recursive functions?
e) Write a program to find the solution for towers of Hanoi using recursive function?
f) Write a program to pass parameters to a functions using call by value and call by reference?

4. Exercises on Arrays?

a) Practice exercise 9.1 to 9.17 Test your C skills – yaswanth kanitkar text book.

b) Write a program to read n numbers and sort them?
c) Write a program to find the minimum and maximum numbers of the array?
d) Write a program to read two matrices and find their sum, difference and product of them?
e) e)Find the transpose of a matrix?
f) Write a program to print upper and lower triangle of a given matrix?

5. Exercises on strings?

a) Practice exercise 10.1 to 10.15 yaswanth kanitkart ext book.
b) Write a program to demonstrate the use of string manipulation functions?
c) Write a program to compare two strings?
d) Write a program to sort the names in Alphabetical order?

6. Exercises on pointers?

a) Practice exercise 7.1 to 8.26 yaswanth kanitkart ext book.
b) Write a program to read dynamic array and sort the elements?
c) Write a program to read dynamic array and find the minimum and maximum of the elements?
d) Write a program to perform pointer arithmetic?
e) Write a program on pointers for strings?
f) Write a program to use array of pointers?

7. Exercises on structures?

a) Practice exercise 11.1 to 11.30 yaswanth kanitkar text book.
b) Write a program to create student structure and read marks of three subjects and find the sum and TOTAL of the student?
c) Write a program on arrays of structures for 60 student's record using the above student structure?
d) Write a program for complex structure? Perform addition, subtraction and multiplication of two complex numbers?
e) Write a program for addition and multiplication of two polynomials?

8. Write a program on Files?

a) Practice exercise 12.1 to 12.20 yaswanth kanitkar text book.
b) Write a program to append content of a file?
c) Write a program to display the content of a file?
d) Write a program to copy content of one file to other file?
e) Write a program to count the no of characters in a file?
f) Write a program to compare the contents of two files?

REFERENCE BOOKS:

1) Test your C Skills by – Yaswanth Kanithkar-BPB Publishers
2) C programming; Test your skills-A.N.Kamthane-Pearson India

CO-PO/PSO MATRIX MAPPING:

CE153 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	2	2	2	-	-	2	2	2	1	2	-
CO2	-	2	2	2	-	-	1	2	-	2	2	2	3	1	-	2
CO3	1	-	2	1	-	-	1	-	1	-	2	2	3	1	1	-
CO4	2	-	-	2	-	-	-	1	1	2	2	2	3	1	2	-
CO5	-	2	1	-	2	-	-	1	-	-	2	2	2	1	-	2
TOTAL	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1

SEMESTER II

B.Tech. CIVIL ENGINEERING

SEMESTER-II

CE121 (R20): MATHEMATICS-II

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

CO1	Using variable separable method and using other methods solving the higher order differential equation.
CO2	Reducing the given differential equations and solving for the required solutions.
CO3	Student should be known about first order partial differential equations and its solutions obtained by using different methods.
CO4	Student should able to understand about vectors, vector differentiation methods.
CO5	Student should able to find vector integration by using different methods and also applications of vectors in various fields.

UNIT I: LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER

Definitions, complete solution, operator D, rules for finding complimentary function, inverse operator, rules for finding particular integral, method of variation of parameters.

UNIT II: EQUATIONS REDUCIBLE TO LINEAR DIFFERENTIAL EQUATIONS AND APPLICATIONS

Cauchy's and Legendre's linear equations, simultaneous linear equations with constant coefficients,

UNIT III: PARTIAL DIFFERENTIAL EQUATIONS – FIRST ORDER

First order partial differential equations, solutions of first order linear and non-linear PDEs. Solutions to homogenous and non-homogenous higher order linear partial differential equations.

UNIT IV: MULTIVARIABLE CALCULUS (VECTOR DIFFERENTIATION)

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT V: MULTIVARIABLE CALCULUS (VECTOR INTEGRATION)

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

TEXT BOOKS:

1) Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2) B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

REFERENCE BOOKS:

1) Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2) Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3) George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4) R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
5) Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.

CO-PO/PSO MATRIX MAPPING:

CE121 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	-	-	-	-	-	-	-	2	3	-	-	-	1	2
CO2	1	3	-	-	-	-	-	-	-	1	3	-	-	-	1	3
CO3	2	3	-	-	-	-	-	-	-	2	2	-	-	-	2	3
CO4	2	2	-	-	-	-	-	-	-	3	2	-	-	-	2	2
CO5	1	2	-	-	-	-	-	-	-	3	3	-	-	-	1	2
TOTAL	1	2	-	-	-	-	-	-	-	2	3	-	-	-	1	2

CE122 (R20): ENGINEERING PHYSICS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

CO1	Distinguish the phenomena of light- Interference, diffraction, and determination of the wavelength of given light using these phenomena.
CO2	Apply the concepts of light in optical fiber and lasers in communication system. Use of fibers in communication system. Major applications of fibers and Lasers in medical field.
CO3	Classify the magnetic materials and apply the magnetic, dielectric materials for given engineering applications.
CO4	Classify the semiconductors and study the properties of Semiconductors. Hall effect.
CO5	Calculate the energy of quantum particle at different energy levels, de Broglie's hypothesis, Schrodinger's wave function and its applications, study of the properties of superconductors. BCS

UNIT-I

INTERFERENCE: Principle of Superposition-Interference of light-Theory of Interference fringes-Conditions for sustained Interference-Interference in thin films by reflected light-Newton's Rings-Determination of Wavelength.

DIFFRACTION: Fraunhofer Diffraction-Single slit Diffraction -Diffraction Grating – Grating Spectrum -Determination of Wavelength.

UNIT-II

LASERS: Laser characteristics, Spontaneous and Stimulated emissions, Basic requirements of a laser, Population inversion – Solid state laser (Ruby laser), Gas (He-Ne) laser, Semiconductor (GaAs) laser, applications of lasers.

FIBER OPTICS: Introduction to Optical Fibers-Principle of optical fiber-Critical angle, Acceptance angle-Numerical Aperture-Classification of fibers based on Refractive index profile, Modes-Propagation of electromagnetic wave through optical fiber - Fiber optic Communication system-applications of Optical fibers.

UNIT – III

DIELECTRICS: Introduction to Dielectrics--Electric polarization-Dielectric polarizability, Susceptibility and Dielectric constant- Types of polarizations-Lorentz (internal) field - Claussius -Mossotti equation.

MAGNETICS: Introduction to Magnetics-Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability-Origin of permanent magnetic moment-Classification of Magnetic materials-Hysteresis-soft and hard magnetic materials-applications of magnetic materials.

UNIT – IV

SEMICONDUCTORS:

Origin of energy band formation in solids-Classification of materials into conductors, semi-conductors & insulators – Semiconductors-Intrinsic semiconductors-dependence of Fermi level on carrier concentration and temperature(Qualitative)- Extrinsic semiconductors - P-type & N-type-dependence of Fermi level on carrier concentration and temperature (Qualitative)- Direct and Indirect band gap semiconductors-Hall effect- applications of Semiconductors.

UNIT-V

PRINCIPLES OF QUANTUM MECHANICS: Dual nature of light, Matter waves & properties, de Broglie's concept of matter waves, Davisson and Germer experiment, Heisenberg's uncertainty principle and application (non-existence of electron in nucleus). One dimensional time independent Schrodinger's wave equation, Physical significance of the wave function, Particle in a box (one dimensional).

SUPERCONDUCTIVITY: First experiment, critical parameters (Tc, Hc, Ic), Meissner effect, BCS Theory (in brief) and Applications of superconductors.

TEXT BOOKS:

1) M.N. Avadhanulu, P.G.Kshirsagar "A Text book of Engineering Physics"-S.Chand Publications,2017
2) H.K.Malik & A.K.Singh "Engineering Physics",- McGraw Hill Publishing Company Ltd, 2018
3) Gaur R.K. and Gupta S.L., "Engineering Physics"- Dhanpat Rai publishers, 2012

REFERENCE BOOKS:

1) Gerd Keiser "Optical Fiber Communications"- 4/e, Tata Mc Graw Hill,2008
2) S.M.Sze "Semiconductor devices-Physics and Technology"-Wiley,2008
3) D.K. Bhattacharya and A. Bhaskaran, "Engineering Physics"- Oxford Publications-2015

CO-PO/PSO MATRIX MAPPING:

CE122 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3	3
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	3	3
TOTAL	**3**	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-	**3**	**3**

CE 123 (R20): PROFESSIONAL COMMUNICATION SKILLS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English (L3)
CO2	Formulate sentences using proper grammatical structures and correct word forms (L3)
CO3	Speak clearly on a specific topic using suitable discourse markers in informal discussions
CO4	Write summaries based on global comprehension of reading texts (L3)
CO5	Produce a coherent paragraph interpreting a figure/graph/chart/table (L4)

UNIT-1:

1) **Reading**: Listening Skills – The Boy who broke the Bank (English & Soft Skills)
2) **Writing**: Paragraph Writing
3) **Grammar:** Common Errors in Nouns- Pronoun Agreement
4) **Vocabulary Building**: Functional word list -100

UNIT- II:

1) **Reading:** Assertive Skills – The Verger (English & Soft Skills)
2) **Writing:** Letter Writing (Formal and Informal)
3) **Grammar:** Correction of Errors in Subject- Verb Agreement
4) **Vocabulary Building:** Sign Post

UNIT - III:

1) **Reading:** Learning Skills – Three Questions (English & Soft Skills)
2) **Writing:** Note Making, Note Taking
3) **Grammar:** Correction of in Tense Usage
4) **Vocabulary Building:** One Word Substitutes

UNIT - IV:

1) **Reading:** Adaptability Skills – Senor Payroll (English & Soft Skills)
2) **Writing**: Pictorial Description
3) **Grammar**: Correction of Errors in Adjectives, Articles, Prepositions
4) **Vocabulary Building**: Synonyms and Antonyms.

UNIT - V:

1) **Reading**: Written Communication Skills - Gateman's Gift (English & Soft Skills)
2) **Writing**: Information Transfer
3) **Grammar**: Correction of Errors in Wh- questions, Question Tags
4) **Vocabulary Building:** Idioms and Phrasal Words (200)

TEXT BOOKS:

1) Dhanavel S. P. English and Soft Skills, Orient Black Swan Pvt. Limited, 2013.
2) Barun K Mitra, Effective Technical Communication, Oxford University Publication, 2014.

REFERENCE BOOKS:

1) Bailey, Stephen. *Academic writing: A handbook for International Students*. Routledge, 2014.
2) Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
3) Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
4) Michael Swan. *Practical English Usage*, OUP. 1995.
5) F.T. Wood. *Remedial English Grammar,* Macmillan.2007
6) Liz Hamp-Lyons and Ben Heasly. *Study Writing,* Cambridge University Press. 2006.
7) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad.
8) Sharon J.Gerson, Steven M.Gerson, *Technical Writing*, New Delhi: Pearson education, 2007.
9) Sanjay Kumar and Pushp Lata, *Communication Skills*, Noida: Oxford University Press, 2012.
10) Dr. Shalini Verma, *Word Power Made Handy*, S. Chand & Co Ltd., 2009.

CO-PO/PSO MATRIX MAPPING:

CE123 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	2	2	-	-	2	3	-	3	3	-	-	-	-
CO2	-	-	-	2	2			2	3	-	3	3	-	-	-	-
CO3	-	-	-	2	2	-	-	2	3	-	3	3	-	-	-	-
CO4	-	-	-	2	2			2	3	-	3	3	-	-	-	-
CO5	-	-	-	2	2	-	-	2	3	-	3	3	-	-	-	-
TOTAL	**-**	**-**	**-**	**2**	**2**			**2**	**3**	**-**	**3**	**3**	**-**	**-**	**-**	**-**

CE 124 (R20): PYTHON

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Understand the basic building blocks in python programming language to construct different applications.
CO2	Apply the necessary data structures to solve a given problem
CO3	Extract and import packages for developing different solutions for real time problems.
CO4	Implement the problems in terms of real -world objects using concept of OOPS.

UNIT-I

CONTEXT OF SOFTWARE DEVELOPMENT: Software, Development tools, Learning programming with Python, Writing a python program.

VALUES AND VARIABLES: Variables and assignments, identifier, Control codes within Strings, User Input, The eval function, the print function.

EXPRESSIONS AND ARITHMETIC: Expressions, Operator precedence and Associativity, Comments, Errors, More arithmetic operators.

UNIT-II

CONDITIONAL EXECUTION: Boolean Expressions, Simple if and if else, nested conditionals, multiway decision statements, conditional expressions, errors in conditional statements.

ITERATION: While statements, for statement, definite loops and indefinite loops, nested loops, abnormal loop termination, infinite loops, iteration examples: computing square root, drawing a tree, printing prime numbers.

UNIT-III

FUNCTIONS: Introduction, standard mathematical functions, time functions, Random numbers, main function, parameter passing, Function examples: Better organized prime number, Command Interpreter, Restricted Input, Better Die rolling simulator, Tree-Drawing Function, Floating –Point equality, Custom functions Vs Standard functions.

MORE ON FUNCTIONS: Global variables, Default Parameters, recursion, Making functions reusable, documenting functions and modules, functions as data.

UNIT-IV

LISTS: Using Lists, List assignment and equivalence, list bounds, Slicing, Lists and functions, Prime generation with a list

LISTS PROCESSING: Sorting, flexible sorting, search, list permutations, randomly permuting a list, reversing a list.

UNIT-V

OBJECTS: Using Objects, String Objects, List Objects.

CUSTOM TYPES: geometric points, Methods, Custom type examples, Class inheritance.

HANDLING EXCEPTIONS: Motivation, Exception examples, Using Exceptions, Custom Exceptions.

TEXT BOOKS:

1) LEARNING TO PROGRAM WITH PYTHON Richard L. Halterman
2) Core Python Programming by Dr.R.Nageswara Rao, dreamtech, second edition.

CO-PO/PSO MATRIX MAPPING:

CE124 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	2	-	-	3	2	1	3	2
CO2	2	2	2	-	-	-	-	-	2	-	-	3	1	2	2	2
CO3	2	2	2	-	-	-	-	-	2	-	-	3	3	2	2	2
CO4	2	2	2	-	-	-	-	-	2	-	-	3	3	1	2	2
CO5	2	2	2	-	-	-	-	-	2	-	-	3	2	2	2	2
TOTAL	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**2**	**1**	**3**	**2**

CE125 (R20): ENGINEERING MECHANICS

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Determine resultants and apply conditions of static equilibrium to plane force systems.
CO2	Develop complete and correct free body diagrams and Write the appropriate equilibrium equations from the free body diagrams.
CO3	Analyze systems that include frictional forces.
CO4	Locate the centroid of area, moment of inertia, product of inertia of various shape.
CO5	Apply the theorem of virtual work on beam, frame and link problem.

UNIT I

INTRODUCTION TO ENGINEERING MECHANICS: Composition and resolution of forces, parallelogram law, principle of transmissibility, types of force systems - concurrent and concurrent coplanar forces, resultant of coplanar force systems couple, moment of a force Varignon's theorem, concept of free body diagrams, concept of equilibrium of coplanar force systems.

FRICTION: Laws of friction, types of friction, equilibrium of force systems involving frictional forces, wedge friction. Free body diagrams involving frictional forces.

UNIT II

ANALYSIS OF STRUCTURES: Introduction to plane trusses, analysis of plane trusses by method of joints and method of sections.

PROPERTIES OF SURFACES AND VOLUMES: Centroid and center of gravity, derivation of centroids from first moment of area, centroids of composite sections, center of gravity of common volumes - cylinder, cone, sphere, theorem of Pappus-guidinus.

UNIT III

MOMENT OF INERTIA: Area moment of inertia of plane and composite shapes, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, mass moment of inertia of common volumes -thin plates, thin rod, cylinder, cone, sphere, rectangular prism, radius of gyration.

UNIT IV

KINEMATICS: Equations of motion for rigid bodies, constant and variable acceleration, rectilinear and curvilinear motion, motion under gravity -projectile motion, use of rectangular coordinates, tangential and normal coordinates.

UNIT V

KINETICS: Principles of dynamics - Newton's Laws of motion, D'Alembert's principle in rectilinear translation, principle of work and energy.

IDEAL SYSTEMS: Principle of conservation of energy, concept of power, conservation of linear and angular momentum, principle of momentum and impulse.

TEXT BOOKS:

1) N H Dubey, Engineering Mechanics: Statics and Dynamics, McGraw Hill, 2014.
2) S Timoshenko, DH Young, JV Rao, SukumarPati, Engineering Mechanics (in SI units), 5/e, McGraw Hill, 20
3) S SBhavikatti, Engineering Mechanics, 4/e, New Age International, 2008.

REFERENCE BOOKS:

1) Basudeb Bhattacharya., Engineering Mechanics, 2/e, Oxford University Press (India), 2015.
2) Irving Shames, G K M Rao, Engineering Mechanics: Statics and Dynamics, 4/e, Pearson, 2009.
3) K L Kumar, Veenu Kumar, Engineering Mechanics, 4/e, Tata McGraw Hill, 2010

CO-PO/PSO MATRIX MAPPING:

CE125 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-	3	2
CO2	2	2	1	-	-	-	-	-	-	-	-	1	-	-	2	2
CO3	2	2	1	-	-	-	-	-	-	-	-	1	-	-	2	2
CO4	2	2	1	-	-	-	-	-	-	-	-	1	-	-	2	2
CO5	2	2	1	-	-	-	-	-	-	-	-	1	-	-	2	2
TOTAL	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**2**	**2**

CE 126 (R20): ENVIRONMENTAL SCIENCE

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Gain knowledge about environment and importance of Environmental Studies in the life. They have to know about resources, its importance and environmental impacts of human activities on natural resources.
CO2	Students will learn about the Ecosystem functioning and Importance of biodiversity and its Conservation.
CO3	Gain knowledge about the environmental pollution control, management of waste and pollution related aspects
CO4	Aware students about social issues and natural calamities, constitutional tools provisions for human welfare.
CO5	Students will learn about increase in population growth and its impact on environment and study of different ecosystems through field visit.

UNIT – I:

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, Scope and Importance – Need for Public Awareness.

NATURAL RESOURCES: Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT – II:

ECOSYSTEMS, BIODIVERSITY, AND ITS CONSERVATION

ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a) Forest ecosystem.
b) Grassland ecosystem
c) Desert ecosystem
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

BIODIVERSITY AND ITS CONSERVATION: Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III:

ENVIRONMENTAL POLLUTION AND SOLID WASTE MANAGEMENT

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of:

a) Air Pollution.
b) Water pollution
c) Soil pollution
d) Marine pollution
e) Noise pollution
f) Thermal pollution
g) Nuclear hazards

SOLID WASTE MANAGEMENT: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV:

SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V:

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

FIELD WORK: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

TEXT BOOKS:

1) Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2) Environmental Studies by Palaniswamy – Pearson education
3) Environmental Studies by Dr.S.AzeemUnnisa, Academic Publishing Company.

REFERENCE BOOKS:

1) Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Publications.
2) Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
3) Comprehensive Environmental studies byJ.P.Sharma, Laxmi publications.
4) Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Prentice hall of India Private limited.
5) A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Publishing House
6) Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Prentice hall of India Private limited.

CO-PO/PSO MATRIX MAPPING:

CE126 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2	C	3	3	1	1	1	1	3	2	3	3
CO2	3	2	2	2	2	2	3	3	1	1	1	1	3	2	3	2
CO3	3	2	2	2	2	2	3	3	1	1	1	1	3	2	3	2
CO4	3	3	2	2	3	2	3	3	1	1	1	1	3	2	3	3
CO5	3	3	2	2	3	2	3	3	1	1	1	1	3	2	3	3
TOTAL	**3**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**1**	**1**	**1**	**1**	**3**	**2**	**3**	**2**

CE161 (R20): ENGINEERING PHYSICS LABORATORY

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Examine the physical properties of light using interference and diffraction.
CO2	Calculate the numerical aperture and acceptance angle of optical fiber
CO3	Analyze the characteristics of semiconducting material
CO4	Demonstrate the magnetizing behavior of magnetic materials
CO5	Calculate the dielectric constant of a material

LIST OF PHYSICS EXPERIMENTS:

1) Determination of the radius of curvature of the lens by Newton's ring method.
2) Determination of wavelength by plane diffraction grating method.
3) Dispersive power of a Prism.
4) Resolving power of a grating.
5) Photo cell – I-V Characteristic curves and determination of stopping potential.
6) Magnetic field along the axis of a circular coil carrying current.
7) B-H Curve
8) To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle.
9) Hall Effect.
10) Photo voltaic cell - Determination of fill-factor.
11) To determine the energy gap of a semiconductor.
12) Determination of Acceleration due to gravity by using compound Pendulum.
13) Poisson's ratio of aluminium and rubber.
14) Rigidity modulus of material by wire-dynamic method (torsional pendulum).
15) Determination of a.c. Frequency – Sonometer.
16) Determine the wavelength of Laser source.

CO-PO/PSO MATRIX MAPPING:

CE161 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	-	3	-	-	-	3	-	-	-	-	-	-	-
CO2	3	-	-	-	3	-	-	-	3	-	-	-	-	-	-	-
CO3	3	3	-	-	3	-	-	-	3	-	-	-	-	-	-	-
CO4	3	-	-	-	3	-	-	-	3	-	-	-	-	-	-	-
CO5	3	-	-	-	3	-	-	-	3	-	-	-	-	-	-	-
TOTAL	**3**	**1**	**-**	**-**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

CE162 (R20): COMMUNICATION SKILLS LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Identify the sounds of English and use of stress and intonation in connected speech
CO2	Able to listen carefully to communicate effectively in cross- cultural contexts
CO3	Capable to make the students communicate in Daily life situations
CO4	Capable to read for content/ main idea.
CO5	Able to communicate confidently in oral presentations

LIST OF ACTIVITIES:

1) Identifying phonic sounds, listening to the sounds, practice and record the sounds from the English learning software
2) Common mispronounced words
3) Listening to the short audios and complete the tasks based on the audios
4) Listening to motivational speeches and answering the questions
5) Comprehending Spoken material in British English & American English
6) Situational Dialogues
7) Role plays
8) Reading comprehension exercises for GRE, TOEFL, GATE etc
9) Reading articles from newspaper
10) Specific reading for enhancing vocabulary
11) Vocabulary building exercises
12) Extempore
13) JAM sessions
14) Small talks
15) Oral presentations.

CO-PO/PSO MATRIX MAPPING:

CE162 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	2	2	-	-	2	3	3	-	3	-	-	-	-
CO2	-	-	-	2	2	-	-	2	3	3	-	3	-	-	-	-
CO3	-	-	-	2	2	-	-	2	3	3	-	3	-	-	-	-
CO4	-	-	-	2	2	-	-	2	3	3	-	3	-	-	-	-
CO5	-	-	-	2	2	-	-	2	3	3	-	3	-	-	-	-
TOTAL	-	-	-	2	2	-	-	2	3	3	-	3	-	-	-	-

CE 163 (R20): PYTHON PROGRAMMING LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Implement python programming constructs to build small to large scale applications.
CO2	Implement the problems in terms of real -world objects usingOOPs technology.
CO3	Evaluate and handle the errors during runtime involved in a program
CO4	Extract and import packages for developing different solutions for real time problems.

LIST OF PROGRAMES:

1) Design a Python script to convert a Binary number to Decimal number and verify if it is a Perfect number.
2) Design a Python script to determine if a given string is a Palindrome using recursion
3) Design a Python script to sort numbers specified in a text file using lists.
4) Design a Python script to determine the difference in date for given two dates in YYYY: MM: DD format(0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules.
5) Design a Python Script to determine the Square Root of a given number without using inbuilt functions in Python.
6) Design a Python Script to determine the time difference between two given times in HH: MM: SS format.(0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59)
7) Design a Python Script to find the value of (Sine, Cosine, Log, PI, *e*) of a given number using infinite series of the function.
8) Design a Python Script to convert a given number to words
9) Design a Python Script to convert a given number to roman number.
10) Design a Python Script to generate the frequency count of words in a text file.
11) Design a Python Script to print a spiral pattern for a 2 dimensional matrix.
12) Design a Python Script to implement Gaussian Elimination method.
13) Design a Python script to generate statistical reports (Minimum, Maximum, Count, Average, Sum etc) on public datasets.
14) Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorising them into distinction, first class, second class, third class and failed.
15) Design a Python script to search an element in the given list.
16) Design a Python script on *str* methods and *list* methods.

CO-PO/PSO MATRIX MAPPING:

CE163 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	2	-	-	-	-	-	2	-	-	3	2	1	-	-
CO2	3	2	2	-	-	-	-	-	2	-	-	3	1	2	-	-
CO3	2	2	2	-	-	-	-	-	2	-	-	3	3	2	-	-
CO4	2	2	2	-	-	-	-	-	2	-	-	3	3	1	-	-
CO5	2	2	2	-	-	-	-	-	2	-	-	3	2	1	-	-
TOTAL	3	-	2	-	-	-	-	-	2	-	-	3	2	1	-	-

SEMESTER III

B.Tech. CIVIL ENGINEERING

SEMESTER-III

CE 211 (R20): MATHEMATICS-III

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

CO1: Students will be able to define integral transform and explain the domain of the function and kernel for Laplace transforms.

CO2: Students will be able to apply Laplace transforms to find the solution of ordinary differential equations.

CO3: Students will be able to derive Fourier series expansion for periodic functions and apply it to typical waveforms.

CO4: Students will be able to explain Fourier integral theorem and Fourier transforms and apply them to find the solution of partial differential equations.

CO5: Students will be able to use numerical methods suchas Bisection method and Newton-Raphson method to solve algebraic and transcendental equations and solve linear simultaneous equations using iterative methods like Gauss-Seidel method.

UNIT – I

LAPLACE TRANSFORM AND ITS APPLICATIONS TO ORDINARY DIFFERENTIAL EQUATIONS:

Definition of Integral transform, Domain of the function and Kernel for the Laplace transforms. Existences of Laplace transform. Laplace transform of standard functions, first shifting Theorem, Laplace transform of functions when they are multiplied or divided by “t”. Laplace transforms of derivatives and integrals of functions. – Unit step function – second shifting theorem. Dirac’s delta function, Periodic function – Inverse Laplace transform by Partial fractions(Heaviside method) Inverse Laplace transforms of functions when they are multiplied or divided by “s”, Inverse Laplace Transforms of derivatives and integrals of functions, Convolution theorem –- Solving ordinary differential equations by Laplace transforms.

UNIT – II

FOURIER SERIES:

Introduction and Euler’s formulae, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Even and Odd functions, Half range series, Typical wave forms and Parseval’s formulae, Complex form of the Fourier series.

UNIT – III

INTEGRAL TRANSFORMS:

Introduction- Definition – Fourier integrals – Fourier integral theorem (without proof)- Fourier sine and cosine integrals – complex form of Fourier integral - Fourier Transforms - Properties of Fourier Transforms - Finite Fourier sine and cosine transforms - Convolution theorem (without proof), Parseval's Identity for Fourier Transforms(without proof)

UNIT-IV

NUMERICAL SOLUTIONS OF EQUATIONS:

Introduction - Solution of Algebraic and Transcendental Equations - Bisection method- Newton- Raphson Method - Solutions of linear Simultaneous Linear Equations: iterative Methods - Gauss-Seidel Method.

UNIT-V

FINITE DIFFERENCES AND INTERPOLATION:

Finite Differences – Differences of a polynomial – factorial notation – relations between operators – Newton's Interpolation formulae – central difference interpolation formulae - Gauss interpolation formulae – stirlings formula - interpolation with unequal intervals – Lagranges interpolation – inverse interpolation.

NOTE: Two questions of 14 marks each will be given from each unit out of which one is to be answered.

TEXT BOOK:

1) B.S. Grewal, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.

REFERENCE BOOKS:

1) N.P. Bali, A textbook of Engineering Mathematics, Laxmi publications
2) Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, New Age International (P) Ltd
3) N.P. Bali, Satyanarayana Bhavanari and Indrani Kelker Engineering Mathematics– I BY Laxmi publications, New Delhi.
4) Engineering Mathematics-II By T.K.V.IyengarandB.Krishna Gandhi Etc.

CO-PO/PSO MATRIX MAPPING:

CE211 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	-	1	1	-	-	2	-	-	-	3	3	1	2	1
CO2	2	2	1	3	2	-	-	2	-	-	-	2	3	2	2	2
CO3	-	2	-	1	-	-	-	2	-	-	-	3	2	1	-	2
CO4	3	2	-	3	2	-	-	2	-	-	-	2	3	2	3	2
CO5	2	3	2	3	-	-	-	-	-	-	-	2	3	1	2	3
TOTAL	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**2-**	**-**	**-**	**-**	**3**	**1**	**3**	**3**	**3**

CE 212 (R20): BUILDING MATERIALS & CONSTRUCTION

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- To teach students about the physical and mechanical properties of various construction materials and their testing procedure.
- To teach students about the principles and methods to be followed in constructing various components of a building.
- To make the students aware of precautionary measures to be taken during construction to avoid any damage to the structure at a later date.
- To teach students about assessment of damages and methods of repairs and restoration.

COURSE OUTCOMES:

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

CO1: Follow BIS and NBO codes for different components of building construction along with testing procedure of building materials with respect to relevant codes.

CO2: Supervise construction work with technical ability within the frame work of codal provision.

CO3: Select the modern construction materials appropriate to the climate and functional aspects of the buildings.

CO4: Supervise the construction technique to be followed in brick and stone masonry, concreting, flooring, roofing and plastering etc.

CO5: Understand the common lapses during the construction which results in the deterioration/damage to the structure at the later date.

CO6: Study the causes of deterioration, crack pattern and assessment of damage to the structure due to faulty construction or natural calamity.

CO7: Construction techniques in repairing and rehabilitation of structures.

UNIT – I:

STONES: Qualities of a good building stone, Common building stones of India.

BRICKS: General; Composition of good brick earth; Harmful ingredients in brick earth; Manufacture of bricks by clamp burning and kiln (only Hoffmans kiln) burning, Qualities of good bricks; Tests for bricks; Classification of bricks; Size and weight of bricks.

LIME: General; Some definitions; Sources of lime; Constituents of limestones; Classification of limes; Properties of fat lime and hydraulic lime

TIMBER: Definition; Structure of a tree; Qualities of good timber; Decay of timber; Preservation of timber; Advantages of timber construction; Uses of timber.

UNIT – II

GLASS: Manufacture and Classification, Treatment of glass, Uses of glass, testing for quality, Characteristics and Performance of glass, Glass fiber.

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.

UNIT –III

Plastering: Specifications for cement plastering, plastering method, Specifications for plastering with cement mortar.

Stone & Brick Masonry: Technical terms; Types of bonds in brickwork and their suitability. Classification of stone masonry.

Walls: Classification of walls.

UNIT – IV

FLOORS: Technical terms; Types of ground floors

ROOFS: Technical terms; Classification of roofs; Steel sloping roofs; Roof covering materials; Types of flat roofs;

STAIRCASES: Technical terms; Types of stair-cases, design considerations.

UNIT – V

DAMPNESS AND DAMP PROOFING: Causes of dampness; Methods of preventing dampness; damp proofing materials and their classification; Methods of providing DPC under different situations.

ACOUSTICS OF BUILDINGS: Important Technical terms; Factors to be considered in Acoustics of building; Sound absorbing materials; Sound insulation.

SCAFFOLDING, SHORING, UNDER PINNING AND FORM WORK: Types of scaffolding; Types of shoring; Methods of underpinning; Types of formworks; Centering.

TEXT BOOKS:

1) Engineering Materials by S. C. Rangwala; Charotar Publishing House, Anand.
2) Building construction by B. C. Punmia et. al; Laxmi Publications, New Delhi.
3) Planning and Designing Buildings by Yashwant S. Sane, Allies Book Stall.

REFERENCE BOOKS:

1) P.C.Varghese, Engineering Materials, 1st edition, PHI Learning.
2) S.K.Duggal, Building Materials, 3rd Edition, New Age International Publishers.
3) Sushil Kumar, Building Construction, Standard Publishers Distributors.
4) M.S.Shetty, Concrete Technology: Theory and Practice, S. Chand Publishers.
5) A.R.Santhakumar, Concrete Technology, Oxford University Press.

CO-PO/PSO MATRIX MAPPING:

CE212 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	3	-	-	-		3	-	3	-	-
CO2	3	3	3	3	3	3	-	-	-	-		3	-	3	-	-
CO3	3	3	3	3	3	3	-	-	-	-	3	3	-	3	-	-
CO4	3	3	3	3	3	3	-	-	-	-	3	3	-	3	-	-
CO5	3	3	3	3	3	3	-	-	-	-	3	3	-	-	-	-
CO6	3	3	3	3	3	3	-	-	-	-	3	3	-	-	-	-
CO7	3	3	3	3	3	3	-	-	-	-	3	3	-	3	-	-
TOTAL	3	3	3	3	3	3	3	-	-	-	3	3	-	3	-	-

CE 213 (R20): SURVEYING AND GEOMATICS

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

The object of the course student should have the capability to:

a) Know the principle and methods of surveying.
b) Measure horizontal and vertical- distances and angles
c) Recording of observation accurately
d) Perform calculations based on the observation
e) Identification of source of errors and rectification methods
f) Apply surveying principles to determine areas and volumes and setting out curves
g) Use modern surveying equipment's for accurate results

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Apply the concepts of surveying to measure the distance and directions.
CO2	Identify different methods of levelling to draw levels and contour maps.
CO3	Solve problems on areas and volumes, measures angles by the odolite.
CO4	Extend methods of trigonometry and design the simple curves.
CO5	Acquaint with EDM, GPS, TOTAL Station and photo grammetry.

UNIT– I

SURVEYING &MEASUREMENTS:

Definitions; Classification; Principles of Surveying; Basic measurements in surveying; Instruments used for different measurements; Units of measurement -linear & Angular Accuracy, Precision; Methods of distance measurement; Equipmentsfor distance measurement; Procedures for distance measurement -Ranging, Chaining/taping a line; Types and Sources of Errors in chaining, taping and their corrections; Degree of accuracy in chaining.

CHAIN SURVEYING:

Principle of Chain surveying; Basic definitions; Well-Conditioned & Ill-Conditioned triangles; Selection of stations and survey lines; Procedure of Field Work in Chain Surveying; Off-sets; Booking the survey (Field Book); Conventional Symbols; Problems encountered in chaining; Obstacles in chain Surveying.

UNIT–II:

COMPASS SURVEYING:

Angles andBearings; 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; Plotting of a Compass Traverse.

TRAVERSING:

Definition; Methods of Traversing; Selection of Traverse Stations; Marking of Stations; linear and angular (both bearings and angles) measurements; Compatibility of linear and angular measurements; Traverse Computations;

PLANE TABLE SURVEYING: Principle; Accessories of plane table; Orientation; Procedure of setting up plane table over a station; Methods of Plane Tabling - Radiation, Intersection, Traversing; Resection - Two point problem; Advantages and disadvantages.

UNIT–III:

SIMPLE LEVELING: Basic definitions; Curvature and Refraction; Different methods of leveling; Levels-Dumpy level, Tilting level, Auto level; Sensitivity of a Level tube; Levelingstaff; Level field book; Booking and reducing levels; Classification of direct differential levelingmethods- Fly leveling, Check leveling, Profileleveling and Cross sectioning, Reciprocal leveling and Precise leveling; Sources of errors &Difficulties in leveling.

CONTOURING: Methods of representing Relief; Contouring; contour interval; Characteristics of contours; Methods of locating contours; Direct and indirect methods of contouring; Interpolation and sketching of contours; Location of a contour gradient on map and ground; Uses of contour maps.

UNIT-IV:

COMPUTATION OF AREAS: Introduction; Simpson's rule; Boundaries with off sets at irregular intervals; Meridian methods; Coordinate method; Planimeter-Area of Zero circles. Area of cross sections-two level section only.

COMPUTATION OF VOLUMES: Trapezoidal rule; Prismoidal formula; Volume from spot levels; volume from contour plan; Capacity of a reservoir

THEODOLITE SURVEYING: Types of Theodolites; Vernier Theodolite - Essential Parts; Basic definitions; Fundamental lines and desired relations; Temporary and permanent adjustments; Field operations- Measurement of horizontal angles (Repetition & Reiteration), vertical angles,

TRIGONOMETRIC LEVELING: Introduction;When base of the vertical or inclined object accessible and when base of the objectis not accessible;

CURVES RANGING: Circular curves- Basic definitions; Design at ion 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; Problems in setting out curves; Compound and Reverse curves.

UNIT-V:

MODERN FIELD SURVEY SYSTEMS: Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, TOTAL Station – Parts of a TOTAL Station – Accessories –Advantages and Applications, Field Procedure for TOTAL station survey, Errors in TOTAL Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.

PHOTOGRAMMETRY SURVEYING: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes.

TEXT BOOKS:

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

REFERENCE BOOK:

1) Surveying Vol. I&II by B.C. Punmia, Laxmi Publications,2005.

CO-PO/PSO MATRIX MAPPING:

CE213 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	1	2	1	1	3	2	-	2	3	1	2	1
CO2	3	2	1	2	2	1	1	1	3	3	-	1	3	1	2	1
CO3	3	2	2	2	3	1	1	2	2	2	-	1	3	2	2	1
CO4	3	2	2	3	3	1	1	2	3	2	1	1	3	2	2	1
CO5	1	3	1	3	3	2	1	2	3	3	2	1	3	2	2	1
TOTAL	**3**	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**3**	**3**	**1**	**3**	**2**	**1**

CE214 (R20): SOLID MECHANICS – I

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- To provide the basic concepts and principles of strength of materials.
- To give an ability to calculate stresses and deformations of objects under external loadings.
- To give an ability the knowledge of strength of materials on engineering applications and design problems.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1	Appraise Stress, Strain & Strain Energy in Uniform, Varying cross section and Composite Bars.
CO2	Sketch Shear Force & Bending Moment diagrams, for different beams subjected to various types of loading.
CO3	Evaluate Bending stresses in beams of various cross sections for different loading Conditions.
CO4	Evaluate Shear stresses in beams of various cross sections for different loading conditions.
CO5	Apply the torsion equation to solid and hollow circular shafts for computing power Transmission.

UNIT –I

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

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

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

SHEAR STRESSES IN BEAMS:

Introduction; Shear flow; The shear stress formula for beams; Shear stress in beam flanges; Shear centre.

UNIT-V

TORSION

Introduction; Application of the method of sections; Torsion of circular elastic bars – Basic assumptions, the torsion formula; Power transmission by circular shafts.

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TEXT BOOKS:

1) Mechanics of Materials by Pytel and Kiusalaas, Cengage Learning

REFERENCE BOOKS:

1) Mechanics of materials by E.P. Popov, Prentice Hall of India
2) Engineering mechanics of solids by E.P.Popov, PHI Learining
3) Elements of strength of materials by S.P.Timoshenko and D.H.Young, Affiliated East-West Press Pvt.Ltd.

CO-PO/PSO MATRIX MAPPING:

CE214 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO3	2	3	3	1	-	-	-	-	-	-	-	-	1	3	-	-
CO4	2	3	3	1	-	-	-	-	-	-	-	-	1	3	-	-
CO5	3	3	2	1	-	-	-	-	-	-	-	-	1	3	-	-
TOTAL	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**-**	**-**

CE215 (R20): FLUID MECHANICS

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- To introduce and explain fundamentals of Fluid Mechanics and understanding about hydrostatic law.
- Understanding the basic laws and equations used for analysis of fluid kinematics.
- Understanding the basic laws and equations used for analysis of fluid dynamics.
- To inculcate the importance of fluid flow measurement and its applications.
- To determine the losses in a flow system and flow through pipes.

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Knowledge of Basic principles and concepts of fluid mechanics.
CO2	Utilize the conservation laws in differential forms for determining velocities, pressures and acceleration in a moving liquid.
CO3	Estimate the discharge and velocity by using Venturimeter, Orifice meter & Pitot tube in Pipe flows.
CO4	Estimate the discharge and velocity by using Orifices, Mouthpieces, Notches and Wiers in Pipe flows.
CO5	Apply the principles of fluid mechanics to solve pipe flow problems that incorporate individual pipes, pipes in series and parallel, pipe networks and pumps.

UNIT – I

INTRODUCTION

Dimensions and units – Physical properties of fluids- specific gravity, viscosity, surface tension, vapour pressure and their influences on fluid motion

FLUID STATICS

Variation of static pressure; Absolute and gauge pressure; Pressure measurement by manometers; Pressure on plane surfaces and curved surfaces, Buoyancy

UNIT – II

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; Vortex flow – free vortex and forced vortex flow.

UNIT –III

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.

FLOW MEASUREMENT IN PIPES

Discharge through venturi meter; Discharge through orifice meter; Discharge through flow nozzle; Measurement of velocity by pitot tube.

UNIT –IV

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 – V

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

TEXT BOOKS:

1) Hydraulics and Fluid Mechanics including Hydraulic Machines by P. N. Modi and S. M. Seth; Standard book house; New Delhi.

REFERENCE BOOKS:

1) Fluid Mechanics by A. K Jain, Khanna Publishers
2) Fluid Mechanics and Hydraulic Machines by R. K. Bansal; Laxmi Publications; New Delhi.
3) Fluid Mechanics by Streeter and wyile, Mc Grawhill Publications
4) Fluid Mechanics by S K Som and G Biswas,TataMcgraw Hill Publications
5) Fluid Mechanics by John F. Douglas, Janusz M Gasiorek, John A. Swaffield, Pearson Education Publishers
6) Fluid Mechanics, Hydraulics and Hydraulic Machines by K R Arora, Standard Publishers

CO-PO/PSO MATRIX MAPPING:

CE215 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	2	-	-	-
CO3	2	3	2	1	-	-	-	-	-	-	-	-	1	1	-	1
CO4	2	3	2	1	-	-	-	-	-	-	-	-	1	1	-	1
CO5	2	3	2	1	-	-	-	-	-	-	-	-	2	1	-	1
TOTAL	3	3	2	1	-	-	-	-	-	-	-	-	3	1	-	1

CE 216 (R20): CONSTITUTION OF INDIA

L-3	T-0	P-0	M-100	C-0

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Understand the historical context and sources of the Indian Constitution, including the Preamble, fundamental rights and duties and directive principles of state policy.
CO2	Analyze the structure of the Indian Union government and its administration, including federalism, the role of the President and Prime Minister, the Cabinet, Lok Sabha, Rajya Sabha and the powers and functions of the Supreme Court and High Court.
CO3	Examine the state government and its administration, including the role of the Governor,ChiefMinisterandCouncilofMinisters,StateSecretariat,andtheorganizationandfunctionsofdistrict and municipal administrations
CO4	Evaluate the importance of grass root democracy through an understanding of the functions and roles of Pachayati Raj, Zila Panchayat, and elected and appointed officials at the village, blockand district levels
CO5	Develop an understanding of the role and functions of the Election Commission, including the Chief Election Commissioner and Election Commissionerate, the State Election Commission and the Commissions for the welfare of SC/ST/OBC and women.

UNIT-I

INTRODUCTION TO INDIAN CONSTITUTION: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

UNIT-III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

UNIT-IV

A.Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

UNIT-V

ELECTION COMMISSION: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission: , Functions of Commissions for the welfare of SC/ST/OBC and women.

REFERENCE BOOKS:

1) Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.New Delhi
2) Subash Kashyap, Indian Constitution, National Book Trust
3) J.A. Siwach, Dynamics of Indian Government & Politics
4) D.C. Gupta, Indian Government and Politics
5) H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6) J.C. Johari, Indian Government and Politics Hans
7) J. Raj Indian Government and Politics
8) M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd. New Delhi
9) Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E-RESOURCES:

1) nptel.ac.in/courses/109104074/8
2) nptel.ac.in/courses/109104045/
3) nptel.ac.in/courses/101104065/
4) www.hss.iitb.ac.in/en/lecture-details
5) www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution.

CO-PO/PSO MATRIX MAPPING:

CE216 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	1	-	-	2	-	1	-	-	-	2	3	2	2
CO2	-	3	2	-	2	3	-	2	3	-	-	-	1	2	-	3
CO3	-	-	-	1	3	-	1	-	-	2	-	-	2	1	-	-
CO4	3	-	2	-	-	2	-	2	2	-	2	-	3	2	3	-
CO5	3	1	3	-	-	-	3	-	2	1	-	1	3	2	3	1
TOTAL	**3**	**3**	**3**	**1**	**2**	**2**	**2**	**2**	**3**	**1**	**2**	**1**	**3**	**3**	**3**	**2**

CE 251 (R20): SURVEYING FIELD WORK-I LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OBJECTIVES:

The object of the course student should have the capability to-

- The knowledge of equipments used for taking linear and angular measurements.
- Transferring points on ground and locating ground stations on map.

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Explain the Survey of an area by chain survey (closed traverse) & plotting.
CO2	Survey of an area by prismatic compass & Surveyor compass (closed traverse) and plotting after adjustment.
CO3	Determine the fly levelling, profile levelling by Height of instrument and Rise and Fall method
CO4	Elevation difference between two points by Reciprocal leveling method.
CO5	Estimate plane table survey by traversing, resection methods. Determine of distance between two inaccessible points with plane table surveying.

LIST OF EXPERIMENTS:

I. CHAIN & COMPASS SURVEY

a) Measurement of area – Cross staff survey

b) Traversing by compass and graphical adjustment.

c) Plotting of an area using Chain/Compass.

II. SIMPLE LEVELING

a) Measurement of elevation difference between two points using any leveling Instrument (Fly Leveling).

b) Elevation difference between two points by Reciprocal leveling method.

c) Profile Leveling – Plotting of Profile.

III. PLANE TABLE SURVEY

a) Determination of the distance between two inaccessible points.

b) Plotting of a building by plane table Traversing

c) Resection methods.

CO-PO/PSO MATRIX MAPPING:

CE251 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	2	1	1	-	-	-	2	2	2	1	1
CO2	2	1	1	1	-	1	-	-	-	-	-	2	2	2	1	1
CO3	2	1	2	1	3	1	2	1	1	1	1	2	2	3	2	1
CO4	2	1	1	1	1	1	2	1	-	1	1	2	2	3	1	1
CO5	2	1	1	1	1	1	3	1	-	1	1	2	2	2	1	1
TOTAL	**3**	**1**	**2**	**3**	**2**	**3**	**2**	**1**	**1**	**1**	**1**	**2**	**2**	**3**	**2**	**1**

CE252 (R20): BUILDING PLANNING & DRAWING

L-0	T-0	P-3	M-100	C-1.5

COURSE OBJECTIVES:

To make the students familiar with different types of materials, doors, windows in the field of construction and make the students learn about the basics of vaasthu, planning, bye laws and making of blue prints.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1	Apply the building bye laws and principles of planning for buildings.
CO2	Knowledge on conventional signs and symbols used in construction
CO3	Prepare the sections and elevations for various elements of the buildings.
CO4	Prepare the plan, sections and elevation for residential buildings.

AN APPROACH TO PLANNING

Site planning; Space requirement–Establishing areas for different units, Furniture requirements, Roominess, Flexibility, Sanitation, Lighting, Ventilation, Space for equipment for air– conditioning, Space for machinery etc.; Flow diagram and line plan–Grouping, Circulation, Orientation, Aspect and prospect, Privacy, Elegance and economy; Climatic considerations; Architectural composition–Unity, Mass composition, Contrast, Proportion, Scale, Accentuation and rhythm, Materials for the exterior and Expression; Colour.

BUILDING RULES AND BYE–LAWS

Zoning regulations; Regulations regarding layouts or sub-divisions; Building regulations; Rules for special type of buildings; Calculation of plinth, floor and carpet area; Floor space index.

BUILDING ELEMENTS

Signs; Guidelines for staircase planning; Guidelines for selecting doors and windows; Terms used in the construction of door and window; Specifications for the drawing of door and window.

MANUAL DRAWINGS BY USING THE DRAFTER

1) Draw Conventional signs for building materials and symbols for sanitary installations and fittings

2) Draw symbols for Doors & Windows and Electrical Installations
3) Draw Elevation and Sections of Door & Window
4) Draw Cross section of load bearing wall over spread footing
5) Draw plan & sectional elevation of Dog-Legged staircase
6) Draw Pitched roof (King post truss)
7) Draw plan of a single storied residential building showing furniture & cub-boards using layers and blocks.
8) Draw plan of a single storied residential building showing Electrical and Sanitary features using layers and blocks.
9) Draw Plan, Section & Elevation of single storied residential building.

CO-PO/PSO MATRIX MAPPING:

CE252 (R20)	PROGRAM OUTCOMES (PO'S)												PROGRAM SPECIFIC OUTCOMES (PSO'S)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	1	-	-	-	-	-	2	-	-	2	-	-	-
CO2	3	-	-	-	-	-	-	-	-	1	-	-	2	-	-	-
CO3	3	2	-	1	-	-	-	-	-	1	-	-	1	1	-	1
CO4	3	2	-	1	-	-	-	-	-	1	-	2	1	1	-	1
TOTAL	3	3	-	1	-	-	-	-	-	2	-	2	3	1	-	1

CE253 (R20): CIVIL WORKSHOP

L-0	T-0	P-3	M-100	C-1.5

COURSE OBJECTIVES:

The main objectives of this course are -

- To outline the process of identification of various building components
- To provide knowledge on operation of the various construction items used for constructions.
- To explain the basic concept of marking and alignments
- To demonstrate techniques for construction of various building components.

COURSE OUTCOMES:

CO1	Identify various components of a building and give lump-sum estimate
CO2	Determine centre of gravity and moment of inertia of channel and I-sections.
CO3	Set out a signal room building as per given plan
CO4	Write summaries based on global comprehension of reading texts (L3)
CO5	Know to the process of making cement mortar / concrete for nominal mix

LIST OF ACTIVITIES:

1) **Setting out of a building:** The student should set out a building (single room only) as per the given building plan using tape only.
2) **Setting out of a building:** The student should set out a building (single room only) as per the given building plan using tape and cross staff.
3) Construct a wall of height 50 cm and wall thickness 1 ½ bricks using English bond (no motor required). – Corner portion – length of side wall 60 cms.
4) Construct a wall of height 50 cm and wall thickness 2 bricks using English bond (no motor required). – Corner portion – length of side wall 60 cms.
5) Computations of center of gravity and moment of inertia of a given rolled steel section by actual measurements.
6) Installation of plumbing and fixtures of tap, T – joint, Elbow bend, threading etc.
7) Plastering and finishing of walls.
8) Application of wall putty and painting a wall.
9) Application of base coat and laying of tile flooring of 1 sq meter.
10) Preparation of soil cement blocks for masonry and testing for compressive strength.
11) Casting and testing of fly ash blocks.
12) Preparation of cover blocks for providing cover to reinforcement.

REFERENCE BOOK:

1) Laboratory Manual for Basic Civil Engineering workshops

CO-PO/PSO MATRIX MAPPING:

CE253 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	-	-	-	-	3	3	-	-	-	3
CO2	3	3	3	3	3	3	-	-	-	-	3	3	-	-	-	3
CO3	3	3	3	3	3	3	-	-	-	-	3	3	-	-	-	3
CO4	3	3	3	3	3	3	-	-	-	-	3	3	-	-	-	3
CO5	3	3	3	3	3	3	-	-	-	-	3	3	-	-	-	3
TOTAL	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**-**	**-**	**3**

CE254 (R20): AUTO CAD

L-0	T-0	P-3	M-100	C-2

COURSE OBJECTIVES:

- To learn software like Auto CAD, to produce basic concepts to make 2D drafting
- To apply basic concept to drawing, edit, dimension, hatching to develop 2D Modelling.
- How to draw plan, section and elevation for a single room and residential building.
- How to draw section, elevation for components involved in building like doors, windows, trusses.
- To make 3D Modelling and assembling.

COURSE OUTCOMES:

At end of the Course/Subject, the students will be able to:

CO1	Use software AUTO CAD
CO2	Learned basic concept of drawing, edit, dimension, hatching and to develop 2D Modelling.
CO3	Apply to draw plan, section and elevation for a single room and residential building.
CO4	Understand to draw section, elevation for components involved in building like doors, windows, trusses
CO5	To make 3D Modelling and assembling

Note: Any eight of the following shall be done using AutoCAD software

LIST OF ACTIVITIES:

1) Learning basic commands of CAD software & drawing various geometrical shapes
    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 line diagram and plan of a single room residential building
9) Draw plan of a single storied residential building 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

CO-PO/PSO MATRIX MAPPING:

CE254 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	3	-	-	-	-	-	-	1	2	-	-	-
CO2	3	2	-	-	3	-	-	-	-	-	-	1	2	-	-	-
CO3	2	3	-	-	3	-	-	-	1	1	-	1	1	1	-	1
CO4	2	2	-	-	3	-	-	-	1	1	-	1	1	1	-	1
CO5	2	2	-	-	3	-	-	-	1	1	-	1	2	1	-	1
TOTAL	3	3	-	-	3	-	-	-	1	1	-	3	1	3	-	1

SEMESTER IV

B.Tech. CIVIL ENGINEERING

SEMESTER-IV

CE211 (R20): ENGINEERING GEOLOGY

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- To enable the students, understand what minerals and rocks are and their formation and identification.
- To highlight significance/ importance/ role of Engineering Geology in construction of Civil Engineering structures.
- To enable the student, realise its importance and applications of Engineering Geology in Civil Engineering constructions.

COURSE OUTCOMES:

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

CO1: Identify and classify the geological minerals and Measure the rock strengths of various rocks

CO2: Classify and measure the earthquake prone areas to practice the hazard zonation. Classify, monitor and measure the Landslides and subsidence

CO3: Prepares, analyses and interpret the Engineering Geologic maps and Analyses the ground conditions through geophysical surveys.

CO4: Test the geological material and ground to check the suitability of civil engineering project construction.

CO5: Investigate the project site for mega/mini civil engineering

UNIT-I

INTRODUCTION: Branches of geology; Importance of geology in Civil engineering.

PHYSICAL GEOLOGY: Geological processes; Weathering, Erosion, and Civil engineering importance of weathering and Erosion:

MINERALOGY: Definition of mineral; Importance of study of minerals; 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

PETROLOGY: Introduction; Definition of Rock, Civil engineering importance of petrology; Rock cycle, Geological Classification of rocks:

IGNEOUS ROCKS: Forms, Structures and textures of igneous rocks. Megascopic description and civil engineering uses of Granite, Basalt, Dolerite, Pegmatite and Charnockite:

SEDIMENTARY ROCKS: Formation; Structures and textures of sedimentary rocks. Megascopic description and civil engineering uses of Laterite, Conglomerate, Sand stone, Lime stone and Shale:

METAMORPHIC ROCKS: Types of metamorphism; Structures and textures of metamorphic rocks. Megascopic Description and Civil engineering uses of Gneiss, Schist, Quartzite, Marble and Slate:

UNIT-III

STRUCTURAL GEOLOGY: Introduction; Out crop, Strike and dip, Causes for development of secondary structures: Classification of Structures associated with rocks like Folds, Faults, Joints, Unconformities and their Civil engineering importance:

EARTHQUAKES: 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 SLIDES: Classification; Causes and effects; Preventive measures of landslides: Ground water Introduction: Classification of rocks based on porosity and permeability; Types of aquifers; Effects of groundwater over draft:

UNIT- IV

GROUNDWATER

Introduction; Source and forms of Groundwater, Vertical distribution, factors controlling groundwater bearing capacity of rocks,

AQUIFERS; types and distribution in various physiographic regions, lowering of water table and subsidence

GROUNDWATER FLOW; Measurement, water holding capacity, Darcy's Law

UNIT- V

GEOPHYSICAL INVESTIGATIONS: Geophysical methods of investigation – Over view; Electrical resistivity method; Seismic refraction method:

DAMS: Types of Dams; Geological considerations for the selection of dam sites; Stages of investigation; Case histories of some dam failures; Geology of some Indian dam sites:

TUNNELS: Purpose of Tunneling; Geological considerations for tunneling; Effects of tunneling; Over break; Geology of some tunnel sites:

IMPROVEMENT IN THE PROPERTIES OF ROCK MASS: Materials and Methods of Grouting, Principles and mechanism of Rock bolting.

TEXT BOOK:

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

REFERENCE BOOKS:

1) Principles of Engineering Geology- KVGK Gokhale - B. S. Publication
2) Fundamentals of Engineering Geology, F.G.Bell - Butterworths Publications – New Delhi.
3) Principles of Engineering Geology and Geotechnics- CBS Publishers & Distribution.
4) Engineering Geology for Civil Engineers by D. Venkata Reddy; Oxford & IBM Publishing Company Pvt. Ltd., New Delhi.
5) Engineering and General Geology by Parbin Singh; S. K. Kataria & Sons, New Delhi.
6) Rock Mechanics for Engineers by Dr.B.P.Varma, Khana Publishers, Delhi-6.
7) Principles of Engineering Geology by K M Bangar, Standard Publishers and Distributers.

CO-PO/PSO MATRIX MAPPING:

CE221 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	2	-	-	-
CO3	2	3	2	1	-	-	-	-	-	-	-	-	1	1	-	1
CO4	3	3	2	3	3	-	3	-	-	-	-	-	1	1	-	1
CO5	3	3	2	2	-	3	-	-	3	-	-	-	2	1	-	1
TOTAL	3	3	3	3	1	1	1	-	1	-	-	-	1	1	-	1

CE222 (R20): CONCRETE TECHNOLOGY

L-3	T-0	P-0	M-100	C-3

COURSE LEARNING OBJECTIVES:

- To learn the concepts of cement, aggregates and various physical & chemical tests of ingredients of concrete.
- To learn concepts of Concrete production and behavior in various environments
- To learn test procedures for determination of properties of concrete.
- To understand durability properties of concrete in various environments.
- To understand the recent development in concrete as special concrete, admixture and recycled aggregates concrete.

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Understand the basic concepts of cement, aggregates and water & its properties.
CO2	Tests on fresh concrete and hardened concrete & its properties.
CO3	The students able to do the design of concrete mix, durability studies and production of concrete.
CO4	Familiarize the usage of admixtures and RMC &NDT testing.
CO5	Familiarize the basic concepts of special concrete and green house buildings.

UNIT-I

CEMENT:

General, Manufacture of Portland cement by dry process, Approximate oxide composition limits of OPC, Bogue's compounds, Hydration of cement, heat of hydration, structure of hydrated cement.

TYPES OF CEMENTS:

Ordinary Portland cement, low alkali cement, Rapid hardening cement, Sulphate resisting cement, Portland blast furnace slag cement, Portland pozzolana cement, air entraining cement, white cement, hydro phobic cement, oil well cement, low heat Portland cement.

TESTING OF CEMENT: Soundness test, Setting times test, Compressive strength test and Fineness test by air permeability apparatus.

AGGREGATES:

Classification of aggregates according to size and shape. Characteristics of aggregates-shape and texture, cleanliness, toughness, hardness.

TESTING OF AGGREGATES: Tests for bulking of fine aggregate, Fineness modulus and Zoning of fine aggregate, Fineness modulus of coarse aggregate.

UNIT-II

WATER: Tolerable concentrations of impurities in mixing water, Use of sea water for mixing concrete.

FRESH CONCRETE:

Workability, factors affecting workability, Segregation and Bleeding in concrete, measurement of workability using slump cone test, Kelly ball test, Vee-Bee test, compaction factor test.

HARDENED CONCRETE:

Factors affecting compressive strength of concrete, Cube compression test, split tensile strength test, flexural strength of concrete.

UNIT-III

Durability of concrete, factors affecting durability of concrete. Time dependent behavior of concrete- Shrinkage, creep, fatigue. Types & factors effecting of creep and shrinkage. Resistance to freezing sulphate and acid attacks.

PRODUCTION OF CONCRETE

Batching of materials, mixing, transportation, placing, compaction and finishing of concrete. Curing of concrete and methods of curing.

CONCRETE MIX DESIGN

Basic considerations for concrete mix design, factors influencing the choice of mix proportions, Indian standard method of concrete mix design

UNIT-IV

READY MIXED CONCRETE (RMC)

Advantages of RMC, components of RMC plant, distribution and transportation, handling and placing, specifications for ready mix concrete as per IS: 4926-2003.

INSPECTION AND TESTINGof concrete – concrete cracking, types of cracks, causes and remedies. Non-destructive tests on concrete – rebound hammer, ultra pulse velocity tests.

CHEMICAL AND MINERAL ADMIXTURES

Functions of admixtures, accelerators, retarders, air entraining admixtures, plasticizers and super plasticizers, water proofers, fly ash, silica fume, ground granulated blast furnace slag. Uses of ad mixtures

UNIT-V

SPECIAL MATERIALS IN CONSTRUCTION AND CONCRETING TECHNIQUES

Ferro-cement, self-compacting concrete, fiber reinforced concrete, high strength concrete. Shortcrete or guniting. Polymer concrete, high performance concrete, light weight concrete.

FUTURE TRENDS IN CONCRETE TECHNOLOGY

Recycled aggregate concrete, properties of recycled aggregate concrete, green building, maintenance, need for green buildings.

TEXT BOOKS:

1) Concrete technology by A.R.Santhakumar, Oxford University Press
2) Concrete technology by M.S.Shetty, S.Chand & Company Pvt. Ltd., New Delhi

REFERENCE BOOKS:

1) Properties of concrete by A.M.Neville, Longman Publishers
2) Concrete technology by M.L.Gambhir, Tata McGraw-Hill Publishing company Ltd., New Delhi.

CO-PO/PSO MATRIX MAPPING:

CE222 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	2	1	1	-	-	-	2	2	3	2	1
CO2	2	1	1	1	-	1	-	-	-	-	-	2	2	3	2	1
CO3	2	2	2	3	2	1	2	1	1	1	-	2	2	3	2	1
CO4	2	1	1	2	3	1	2	1	-	1	1	2	2	3	2	1
CO5	2	1	1	1	1	1	3	1	-	1	1	2	2	3	2	1
TOTAL	3	2	2	2	2	2	2	1	1	1	1	2	2	3	2	1

CE223 (R20): SOLID MECHANICS – II

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- Understand the behavior of materials under any structural systems.
- To deal with the effect of various types of loading including bending & torsion.

COURSE OUTCOMES:

CO1	Appraise Principal stresses & Strains analytically, Graphically & Examine Theories of Failures
CO2	Evaluate Shear stress, Torque & Power of circular shafts by using Torsional equation & Deflections of various types of Springs
CO3	Evaluate the strain energy in pure bending.
CO4	Examine the Crippling & Safe loads using Euler's &Rankine's theories for the columns with different end conditions &Laterally loaded struts.
CO5	Evaluate Moments of inertia, Stresses & Deflection of beams subjected to unsymmetrical bending and to locate shear centre for symmetrical and unsymmetrical sections.

UNIT – I

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 coiled helical springs

UNIT -II

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 circle

UNIT –III

WORK AND STRAIN ENERGY

Introduction; Elastic strain energy for uni-axial stress; elastic strain energy in pure bending; Strain energy of beams in shear; Strain energy of circular shafts in torsion; Work and strain energy method; Determination of displacements by work and strain energy methods

UNIT-IV

FAILURE THEORIES

Introduction; maximum normal stress theory; maximum shearing stress theory; maximum strain energy theory; maximum distortion energy theory; comparison of theories.

BUCKLING OF COLUMNS

Introduction; Examples of instability; Criteria for stable equilibrium; Euler load for column with pinned 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 –V

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 by Direct integration; Introduction to moment area method; Derivation of Moment area theorems; conjugate-beam method; slope and deflection of beams using moment area method.

TEXT BOOK:

1) Mechanics of Materials by Pytel and Kiusalaas, Cengage Learning

REFERENCE BOOKS:

1) Mechanics of materials by E.P. Popov, Prentice Hall of India
2) Engineering mechanics of solids by E.P.Popov, PHI Learining
3) Elements of strength of materials by S.P.Timoshenko and D.H.Young, Affiliated East-West Press Pvt.Ltd.

CO-PO/PSO MATRIX MAPPING:

CE223 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO3	2	3	3	1	-	-	-	-	-	-	-	-	1	3	-	-
CO4	2	3	3	1	-	-	-	-	-	-	-	-	1	3	-	-
CO5	3	3	2	1	-	-	-	-	-	-	-	-	1	3	-	-
TOTAL	3	3	3	1	-	-	-	-	-	-	-	-	1	3	-	-

CE224 (R20): HYDRAULICS AND HYDRAULIC MACHINERY

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- To introduce the concepts of uniform, non uniform flow and momentum principle.
- To impart the knowledge on hydraulic jumps.
- Knowledge of theoretical and technological aspects of hydrodynamic forces on jets.
- To introduce the concepts of the working and design aspects of hydraulic machines like turbines and pumps and their applications.
- Understand the similarities between prototype and model types of hydraulic similitude.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1	Analyze uniform and non uniform flow in open channels
CO2	Understanding the concept of different types of hydraulic jumps.
CO3	Analyze the efficiency of jet of plates in different stationary and moving conditions
CO4	Analyze hydraulic turbines and pumps including their performance and efficiency.
CO5	Evaluating of dimensional analysis to derive and interpret relationships between different physical variables

UNIT – I

OPEN CHANNEL FLOW

Introduction, Classification of flows, Types of channels; Chezy, Manning's, Bazin, 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; Momentum principle applied to open channel flow; Specific force.

UNIT – II

HYDRAULIC JUMP: Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types,applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges.

UNIT -III

BASICS OF TURBO MACHINERY: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency-Angular momentum principle.

UNIT - IV

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; Similarity laws; 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; Performance and characteristic curves; Cavitation effects; Similarity considerations.

UNIT –V

HYDRAULIC SIMILITUDE: Dimensional analysis-Rayleigh's method and Buckingham's pi theorem-study of Hydraulic models – Geometric, kinematic and dynamic similarities-dimensionless numbers – model and prototype relations

TEXT BOOKS:

1) Open Channel flow, K. Subramanya, Tata McGraw HillPublishers
2) Fluid mechanics and hydraulic machines, Rajput, A.K(2018), S chand,NewDelhi
3) Fluid Mechanics, Modi and Seth, Standard bookhouse.
4) Fluid mechanics and Hydraulic machines, R.K. Bansal, Laxmi publications,New Delhi.

REFERENCE BOOKS:

1) Fluid Mechanics by A. K. Jain; Khanna Publishers, Delhi
2) Open channel flow by K. Subramanya, TMH Publishers
3) Fluid Mechanics and Hydraulic Machines by R. K. Bansal; Laxmi Publications, New Delhi.

CO-PO/PSO MATRIX MAPPING:

CE224 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	-	-	-	-	-	-	-	1	1	1	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	1	1	1	-	-
CO3	2	3	2	1	-	-	-	-	-	-	-	1	1	2	-	1
CO4	3	2	3	2	-	-	-	-	-	-	-	1	1	2	-	1
CO5	3	2	2	1	-	-	-	-	-	-	-	1	1	2	-	1
TOTAL	3	3	3	2	-	-	-	-	-	-	-	3	1	3	-	1

CE225 (R20): PROFESSIONAL ETHICS AND HUMAN VALUES

L-3	T-0	P-0	M-100	C-0

COURSE OUTCOMES:

After completion of this course, students will be able to

CO1: Understand and appreciate the importance of integrity, work ethic, and service learning in professional engineering practice.

CO2: Develop an awareness of the moral issues and ethical dilemmas that arise in engineering, and be able to apply ethical theories to real-world situations.

CO3: Recognize the social and environmental impacts of engineering, and understand the responsibility that engineers have to society and the environment.

CO4: Be able to analyze and assess risks and benefits associated with engineering projects, and make informed decisions that prioritize safety and social responsibility.

CO5: Develop the skills to communicate effectively with colleagues, clients, and other stakeholders, and to work collaboratively and respectfully in team settings.

UNIT – I

Human Values: Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

UNIT – II

Engineering Ethics: Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT – III

Engineering as Social Experimentation: Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT - IV

Safety, Responsibility and Rights: Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and reducing risk.

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) - Discrimination

UNIT – V

Global Issues: Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Sample Code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (ISTE), India, etc.

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TEXT BOOKS:

1) R.S. Naagarazan "A Textbook on Professional ethics and Human Values", New Age International Publihers, 2006.
2) Govindarajan. M, Natarajan. S, Senthilkumar. V.S, "Engineering Ethics", Prentice Hall of India, 2004.

REFERENCE BOOKS:

1) Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Jersey, 2004 (Indian Reprint).
2) Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics Concepts and Cases", Thompson Learning, United States, 2000 (Indian Reprint now available).
3) John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4) Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

CO-PO/PSO MATRIX MAPPING:

CE225 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	3	3	-	-	2	-	-	-	2	3	1	3	1
CO2	-	2	-	2	-	-	-	3	-	-	-	1	3	2	-	2
CO3	2	3	-	3	3	-	-	3	-	-	-	2	2	1	2	3
CO4	2	2	2	2	-	-	-	-	-	-	3	2	2	2	2	2
CO5	3	2	2	3	1	-	-	2	-	1	-	2	2	1	3	2
TOTAL	3	3	3	3	2	-	-	3	-	1	3	3	3	3	3	1

CE261 (R20): ENGINEERING GEOLOGY LAB

L-0	T-0	P-3	M-100	C-1.5

Note: A minimum of ten (10 No.) shall be done and recorded

COURSE LEARNING OBJECTIVES:

The objective of this course is:

1) To study the Survey of India topo sheet for physical geology
2) To study the relevance of physiography with reference to satellite images
3) To study the physical properties of minerals.
4) To identify Igneous, Sedimentary, Metamorphic rocks in the field.

COURSE OUTCOMES:

a) Upon the successful completion of this course, the students will be able to:
b) Identify Megascopic minerals & their properties.
c) Identify Megascopic rocks & their properties.
d) Identify the site parameters such as contour, slope & aspect for topography.
e) Know the occurrence of materials using the strike & dip problems.

LIST OF 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)
    a) Silicate minerals
    b) Non silicate minerals
4) Megascopic description and identification of Rocks (3 experiments)
5) i. Igneous rocks ii. Sedimentary rocks iii Metamorphic rocks
6) Joint Data Analysis
7) Simple Structural geology Problems
8) Study of Geological Maps and their Cross-section
9) Electrical Resistivity Method (demo)
10) Seismic Hammer Sounding Method (demo)
11) Study of Structural Models
12) Study of Tunnel Models

CO-PO/PSO MATRIX MAPPING:

CE261 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	-	2	1	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	2	1	1	-	1
CO4	2	-	1	3	-	-	-	-	-	-	-	-	1	1	-	1
TOTAL	3	-	3	2	-	-	-	-	-	-	-	2	2	1	-	1

CE262 (R20): HYDRAULICS AND HYDRAULIC MACHINERY LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OBJECTIVES: /COURSE OUTCOMES:

On completion of the course the student will be able to

- To provide students with a solid foundation in fluid flow principles
- Estimate the friction and measure the frictional losses in fluid flow
- Experiment with flow measurement devices like venture meter and orifice meter.
- Predict the coefficient of discharge for flow through pipes Conduct experiments (in teams) in pipe flows and open channel flows and interpreting date from model studies to proto type cases, as well as documenting them in reports.
- The ability to analyze experimental data and develop empirical equations

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

1) Verification of Bernoulli's theorem.
2) Venturi meter: Determination of Coefficient of discharge.
3) Orifice meter: Determination of Coefficient of discharge.
4) Orifice: Determination of Coefficient of discharge by steady and unsteady flow methods.
5) Mouthpieces: 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 on 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 turbine /Kaplan turbine.
15) Performance studies on single stage centrifugal pump and Reciprocating pump.

CO-PO/PSO MATRIX MAPPING:

CE262 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	-	1	-	-	-	-	1	-	-	1	-	3	1	-
CO2	1	2	-	2	-	-	-	-	1	1	1	1	-	3	-	-
CO3	2	-	-	2	-	-	-	-	1	1	1	-	-	3	1	-
CO4	2	-	-	2	-	-	-	-	-	1	1	-	-	3	1	-
CO5	2	-	-	2	-	-	-	-	-	1	1	-	-	3	-	-
TOTAL	3	2	-	2	-	-	-	-	1	1	1	1	-1	3	1	-

CE263 (R20): MATERIAL TESTING LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OUTCOMES:

Upon completion of this course, students should be able to:

CO1: Conduct Tension, Compression, Bending & Shear tests on UTM and evaluate material properties.

CO2: Conduct Torsion, Hardness & Impact tests and determine various moduli, hardness numbers and impact energy

CO 3: Compression test on the given specimens and to plot the stress strain graphs

CO 4: Bending and Double Shear Tests using Universal Testing Machine: Bending test, Double Shear test on the given specimens and to plot the stress strain graphs.

Note: A minimum of ten (12 No.) shall be done and recorded.

LIST OF 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 fixed beam.
5) Determination of modulus of elasticity of the material of the beam by conducting bending test on cantilever beam.
6) Determination of modulus of rigidity by conducting torsion test on solid circular shaft.
7) Determination of hardness of the given material by Brinnel’s hardness test
8) Determination of hardness of the given material by Rockwell hardness test.
9) Determination of hardness of the given material by Vickers hardness test.
10) Determination of impact strength of the given material by conducting Charpy
11) Determination of impact strength of the given material by conducting by Izod test.
12) Determination of ultimate shear strength of steel by conducting direct shear test.
13) Determination of modulus of rigidity of the material of closely coiled helical spring.
14) Determination of modulus of rigidity of the material of open coiled helical spring.
15) Determination of compressive strength of wood with grain parallel to loading
16) Determination of compressive strength of wood with grain perpendicular to loading.

CO-PO/PSO MATRIX MAPPING:

CE263 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	-	-	-	1	2	1	1	-	-	-	-	3	1	-
CO2	1	1	-	-	-	-	1	1	-	1	-	1	-	3	-	-
CO3	2	1	-	-	-	1	1	-	-	-	1	-	-	3	1	-
CO4	2	1	-	-	-	1	1	-	-	1	1	-	-	3	1	-
CO5	2	2	-	-	-	2	1	1	1	-	-	1	-	3	-	-
TOTAL	**3**	**3**	**-**	**-**	**-**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**-**	**3**	**1**	**-**

CE264 (R20): ADVANCED SURVEYING LAB

L-0	T-0	P-3	M-100	C-2

COURSE OBJECTIVES: /COURSE OUTCOMES:

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

CO1: Determine the Levelling by Heigh to instrument and Rise and Fall method.

CO2: Evaluate the horizontal and vertical angle using theodolite.

CO3: Estimate Area, angles using TOTAL Station

CO4: Setting of simple circular curve using tape and chain. / TOTAL station/ theodolite

CO5: Setting out for Building.

THE ODOLITE

1) Measurement of horizontal and vertical angles.
2) Determination of distance between two inaccessible points
3) Contouring of a small area by method of Blocks/Tacheometric Survey.

TOTAL STATION

1) Study of Instrument – Determination of Distances, Directions and Elevations
2) Determination of Boundaries of a Field and computation of area.
3) Determination of Heights of objects. **Setting Out**
4) Setting of simple circular curve using tape and chain.
5) Setting of simple circular curve using tape or/and theodolite
6) Setting of a simple circular curve using TOTAL Station.
7) Setting out for Building.

Survey Camp is to be conducted for a minimum period of seven days to train in one of the following areas:

i) Preparation of a contour Plan/ Map.
ii) Earth work Computations for a high way / canal projects
iii) Marking of a Sewer line/ Water supply line.
iv) Any type of Execution works.

NOTE: 50% Weight- age of TOTAL marks of this laboratory is to be given for TOTAL survey camp work including for Report submission by each batch.

CO-PO/PSO MATRIX MAPPING:

CE264 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	-	-	-	1	2	1	1	-	-	-	-	3	1	-
CO2	1	1	-	-	-	-	1	1	-	1	-	1	-	3	-	-
CO3	2	1	-	-	-	1	1	-	-	-	1	-	-	3	1	-
CO4	2	1	-	-	-	1	1	-	-	1	1	-	-	3	1	-
CO5	2	2	-	-	-	2	1	1	1	-	-	1	-	3	-	-
TOTAL	3	3	-	-	-	3	2	1	1	-	1	1	-	3	1	-

SEMESTER V

B.Tech. CIVIL ENGINEERING

SEMESTER-V

CE 311 (R20): STRUCTURAL ANALYSIS-I

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- To understand the concept of determinate and indeterminate structures, analyses of determinate and indeterminate structures.
- To understand the principle of virtual work and the application of influence line diagrams in structural analysis problems.
- The course runs through a number of techniques which are used for the analysis of civil engineering structures.

COURSE OUTCOMES: At the end of the Course/Subject, the students will be able to:

CO1: Apply energy principles for analysis of determinate/ indeterminate structures.

CO2: Understand the concept of Influence Line Diagram and its application to analyze structural elements subjected to moving loads.

CO3: Analyze indeterminaent structures by consistent deformation, clapeyron's theorem

CO4: Analyze continuous beams, rigid joint plane frames using energy strain energy method.

CO5: Analyze the continuous beams by displacement method.

UNIT – I

DISPLACEMENTS OF DETERMINATE STRUCTURES USING ENERGY METHODS

Maxwell's reciprocal theorem; Maxwell – Betti's generalized reciprocal theorem; castigliano's theorems; Application of Castigliano's theorem for calculating deflection of beams, frames and trusses; Virtual work method for deflections.

UNIT – II

INFLUENCE LINES FOR STATICALLY DETERMINATE STRUCTURES

Moving loads and influence lines; Influence lines for beam reactions; Influence lines for shearing force; Influence lines for bending moment; Calculation of maximum shear force and bending moment at a section for rolling loads; Calculation of absolute maximum bending moment; Influence lines for simple trusses.

UNIT – III

PROPPED CANTILEVERS

Analysis of propped cantilever by method of consistent deformations.

FIXED BEAMS

Fixed moments for a fixed beam of uniform section for different types of loading; Effect of sinking of support; Effect of rotation of a support; Bending moment diagram for fixed beams.

CLAPEYRON'S THEOREM OF THREE MOMENTS

Analysis of continuous beam by Clapeyron's theorem of three moments.

UNIT – IV

STRAIN ENERGY METHOD

Strain energy method for analysis of continuous beams and rigid joined plane frames up to second degree redundancy.

REDUNDANT PIN JOINTED FRAMES

Analysis of pin jointed frames (only single degree of redundancy); Forces in indeterminate pin jointed frames due to temperature variation and lack of fit; Composite structure.

UNIT-V

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 storey with vertical legs only) without and with sides way.

MOMENT DISTRIBUTION METHOD

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

TEXT BOOK:

1) Analysis of Structures vols. 1 & 2 by Vazirani & Ratwani; Khanna Publishers; Delhi.

REFERENCE BOOKS:

1) Structural Analysis by Devdas Menon, Narosa Publishinh House.
2) Indeterminate structural analysis by C. K. Wang, McGraw-Hill Publications
3) Mechanics of structures – II by Junnarkar & Shah, Charotar Publishing House
4) Structural analysis by R. C. Hibbeler, Pearson Education.
5) Basic Structural Analysis by C. S. Reddy, Tata McGraw-Hill.

CO-PO/PSO MATRIX MAPPING:

CE311 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	-	-	1	2	-	-
CO2	2	3	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO3	2	3	2	1	-	-	-	-	-	-	-	-	1	3	-	-
CO4	2	3	2	1	-	-	-	-	-	-	-	-	1	3	-	-
CO5	2	3	2	1	-	-	-	-	-	-	-	-	1	3	-	-
TOTAL	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**-**	**-**

CE 312 (R20): DESIGN OF CONCRETE STRUCTURES

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVE:

The course introduces the theory and application of analysis and design of reinforced concrete structures. The course focuses on understanding the behavior of reinforced concrete components and systems subjected to axial load, shear, bending and torsion.

COURSE OUTCOMES:

CO1: Recognize the design philosophy of reinforced concrete structures under working stress method and limit state method.

CO2: Design of singly and doubly reinforced beams of rectangular and flanged beams for flexure, shear and torsion.

CO3: Design of one way slab and Two way slab

CO4: Design of long and short columns under axial, uniaxial and biaxial laod.

CO5: Design of Isolated and rectangular footings under various loads.

UNIT – I

WORKING STRESS METHOD: Elastic theory: design constants, modular ratio, neutral axis depth and moment of resistance - balanced, under-reinforced and over-reinforced sections. Design of singly and doubly reinforced Rectangular beams, IS Code Provisions.

LIMIT STATE DESIGN: Basic statistical principles –Characteristic strength – Characteristic loads - Partial load and safety factors – stress-strain curves for HYSD bars and MS bars. Assumptions – stress block parameters – Moment of Resistance.

UNIT –II

DESIGN FOR FLEXURE: Design of singly reinforced beams- effective depth- Moment of Resistance- Doubly reinforced and flanged (T) beams- Minimum depth - Minimum and Maximum Flexural Tension Reinforcement - Design of Flanged Sections (T)- Effective width of flange - Analysis and Design Problems.

DESIGN FOR SHEAR AND TORSION: Analysis and design of sections for shear and torsion – bond, anchorage and development length, I.S. code provisions. Design of simply supported and cantilever beams.

UNIT – III

SLABS: Classification of slabs, design of one - way slabs, one way continuous slab using IS Coefficients (Conventional) –Design of two - way slabs - simply supported slabs and slabs with various edge conditions using IS Coefficients.

LIMIT STATE OF SERVICEABILITY:

Deflection, cracking and IS code provisions for beams and slabs.

UNIT – IV

DESIGN OF COMPRESSION MEMBERS:

Effective length, Braced and un-braced columns – IS Code provisions, Design of short and long columns under axial loads, uniaxial bending and biaxial bending (Demonstration using SP 16).

UNIT –V

FOOTINGS: Types of footings – Design of isolated footings – Square and Rectangular footings subjected to axial loads, uni-axial bending moment.

TEXT BOOKS:

1) Limit State Design, A. K.Jain, Nem Chand Brothers
2) Reinforced Concrete Structures, N. Krishna Raju & R. N. Pranesh, New Age Publications.
3) Structural Design and Drawing byN.Krishna Raju, Universities Press

REFERENCE BOOKS:

1) R C C Design, B.C Punmia, A. K. Jain and A. K Jain. Lakshmi Publications
2) Reinforced Concrete Structures, S. Unnikrishna Pillai & Devdas Menon, Tata c.Graw Hill, New
3) Delhi.
4) Design of Reinforced concrete Structures, N.Subrahmanian, Oxford University Press.
5) Limit state design of reinforced concrete structures by P C Varghese, PHI Learning pvt. Ltd.

CO-PO/PSO MATRIX MAPPING:

CE312 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	-	-	-	-		-	-	-	-	1	1	2	-	-
CO2	1	2	3	2	-	-		-	-	-	-	1	1	3	-	-
CO3	1	2	3	2	-	-	1	-	-	-	-	1	1	3	-	-
CO4	1	2	3	2	-	-	1	-	-	-	-	1	1	3	-	-
CO5	1	2	3	2	-	-	1	-	-	-	-	1	1	3	-	-
TOTAL	3	3	3	3	-	-	1	-	-	-	-	3	1	3	-	-

CE 313 (R20): GEO-TECHNICAL ENGINEERING – I

L-3	T-0	P-0	M-100	C-3

COURSE LEARNING OBJECTIVES:

The objective of this course is:

- To enable the student to determine the index properties of the soil and classify it.
- To impart the concept of seepage of water through soils and determine the discharge of water through soils.
- To impart the principles of compaction and consolidation of soils and determine the magnitude and the rate of consolidation settlement.
- To enable the student to understand the concept of shear strength of soils, determine the shear parameters of sands and clays and the areas of their application.

COURSE OUTCOMES:

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

CO1 Elaborate concepts of origin of soil, identification and classification, engineering properties of the soils.

CO2 Illustrate the concept of permeability.

CO3 Analyze the stresses and see page through soils.

CO4 Understand concept of compaction of soils.

CO5 Analyze the compressibility and consolidation and of soils.

UNIT – I

INTRODUCTION

Soil formation and soil types; Regional soil deposits of India.

BASIC DEFINITIONS AND RELATIONS

Phase diagrams; Simple definitions; some important relationships; Index Properties; Grain size distribution; Atterberg Limits; Significance of other Soil Aggregate properties.

UNIT – II

SOIL CLASSIFICATION

System introduction; Particle size classification as per IS-code; Unified soil classification system; Indian standard soil classification

PERMEABILITY

Capillary rise; Darcy's law and its Validity; Determination of coefficient of permeability - constant and variable head methods, indirect methods, Factors affecting permeability; Permeability of stratified soil deposits.

UNIT – III

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.

VERTICAL STRESSES BELOW APPLIED LOADS

Introduction; Boussinesq's equation; vertical stress distribution diagrams; vertical stress beneath loaded areas; Newmark's influence chart; Approximate stress distribution methods for loaded areas; Westergaard's equation

UNIT – IV

SEEPAGE THROUGH SOILS

Principle of effective stress; physical meaning of effective stress; Types of head, seepage forces and quicksand condition;

COMPRESSIBILITY OF SOIL AND CONSOLIDATION

Introduction; Compressibility; Time-rate of consolidation; Consolidation test; Computation of settlement; extrapolation of field consolidation curve; Settlement analysis.

UNIT-V

SHEAR STRENGTH OF SOILS

Introduction; Stress at a point- Mohr Circle of stress; Mohr–coulomb Failure Criterion; Measurement of Shear Strength; Shear strength of Clayey soils; Shear Strength of Sands; Drainage conditions and Strength parameters.

TEXT BOOK:

1) Basic and Applied Soil Mechanics – GopalRanjan and A.S.R.Rao, New Age International Publishers

REFERENCE BOOKS:

1) Foundation Analysis & Design by Bowles, J.E., McGraw- Hill Book Co.
2) A Text book of Soil Mechanics and Foundation Engineering – B.C.Punmia Laxmi Publications
3) A Text book of Soil Mechanics and Foundation Engineering – K.R.Arora, Standard Publishers & Distributors, New Delhi
4) A Text book of Soil Mechanics and Foundation Engineering – P.Purushotthama Raj, Pearson Education.

CO-PO/PSO MATRIX MAPPING:

CE313 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2	1	1	-	-	-	-		2	1	3	-	-
CO2	2	2	2	1	1	1	-	-	-	-	1	2	-	3	-	-
CO3	1	2	-	1	1	1	-	-	-	-	1		1	3	-	-
CO4	2	1	2	2	1	2	-	-	-	-		1	1	3	-	-
CO5	2	-	1	1	2	1	-	-	-	-	1	1	-	3	-	-
TOTAL	3	2	2	2	2	2	-	-	-	-	1	2	1	3	-	-

CE 314/1 (R20): WATER RESOURCES ENGINEERING

L-3	T-0	P-0	M-100	C-3

COURSE LEARNING OBJECTIVES:

The course is designed to -

- Understand the hydrologic cycle and its relevance to Civil engineering.
- Make the students understand physical processes in hydrology and, components of the hydrologic cycle.
- Appreciate concepts and theory of physical processes and interactions.
- Learn measurement and estimation of the components hydrologic cycle.
- Provide an overview and understanding of Unit Hydrograph theory and its analysis.
- Understand flood frequency analysis, design flood, flood routing.
- Appreciate the concepts of groundwater movement and well hydraulics.

COURSE OUTCOMES:

At the end of the course the students are expected to -

1) Be able to quantify major hydrologic components and apply key concepts to several practical areas of engineering hydrology and related design aspects
2) Develop Intensity-Duration-Frequency and Depth-Area Duration curves to design hydraulic structures.
3) Ability to develop design storms and carry out frequency analysis
4) Be able to determine storage capacity and life of reservoirs and develop unit hydrograph and synthetic hydrograph.
5) Be able to estimate flood magnitude and carry out flood routing.
6) Be able to determine aquifer parameters and yield of wells.
7) Ability to develop the hydrological models.

UNIT – I

HYDROLOGY

Hydrologic cycle; Precipitation types; Rain gauges; Computation of average rain fall over abasin; Abstraction from rainfall; evaporation, factors affecting evaporation, measurement of evaporation; Infiltration, factors affecting infiltration, measurement of infiltration, infiltration indices; Run off; Factors affecting run off; Computation of run-off; Design flood, Estimation of maximum rate of run-off.

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

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.

CANAL OUTLETS AND 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.

UNIT – III

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.

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.

UNIT – IV

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).

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.

UNIT – V

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.

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.

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; Fore bay; Intake structures; Penstocks; Surge tank; Tail race; Turbines; Selection of suitable type of turbine.

TEXT BOOKS:

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

REFERENCE BOOKS:

1) Irrigation, Water Resources and Water Power Engineering by P.N. Modi; Standard Book House, New Delhi.
2) Irrigation, water power and water resources Engineering by K R Arora, Standar Publishers, New Delhi.
3) Water Power Engineering by M.M. Dandekar and K. K. Sharma; Vikas Publishing House Pvt. Ltd., New Delhi.

CO-PO/PSO MATRIX MAPPING:

CE314/1 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	1	1	-	1
CO4	2	2	2	1	-	-	-	-	-	-	-	-	1	1	-	1
CO5	3	3	2	2	-	-	-	-	-	-	-	-	2	1	-	1
TOTAL	3	3	3	2	-	-	-	-	-	-	-	-	1	1	-	1

CE314/2 (R20): ADVANCED CONCRETE TECHNOLOGY

L-3	T-0	P-0	M-100	C-3

COURSE LEARNING OBJECTIVES:

- To understand the behavior of RMC concrete and SCC.
- To understand behaviour of FRC & ferro cement.
- To understand the material properties, application of LWC and HPC.
- Knowledge about the NDT methods for concrete.
- To understand the Properties, Strength and Durability High density concrete.

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Understand the concepts of production of concrete, RMC & SCC.
CO2	Familiarize the usage of FRC & ferro cement
CO3	Familiarize the usage of the material properties, application of LWC and HPC.
CO4	Familiarize the usage of NDT testing.
CO5	Understand the Properties, Strength and Durability High density concrete.

UNIT - I

RMC CONCRETE AND SELF-COMPACTING CONCRETE

Manufacture, transporting, placing, precautions, Methods of concreting, under water concreting, shotcrete, High volume fly ash concrete, concrete with construction & demolition waste - concept, properties, typical mix Self-compacting concrete concept-materials, tests, properties and typical mix. Pumping, Applications of Self-compacting concrete.

UNIT - II

FIBER REINFORCED CONCRETE AND FERRO CEMENT

Fibers types and properties, Behaviour of FRC in compression, tension including pre-cracking stage and post-cracking stages, behaviour in flexure and shear Ferro cement - materials, techniques of manufacture, properties and application. Nylon fiber, Bamboo fiber.

UNIT – III

LIGHT WEIGHT CONCRETE AND HIGH PERFORMANCE CONCRETE: Materials properties, Typical light weight concrete mix. High performance concrete sustainable materials, properties, typical mix. Applications, Types.

UNIT – IV

TEST ON HARDENED CONCRETE AND NDT TESTS

Effect of end condition of specimen, capping, H/D ratio, Compression, tension and flexure tests. Tests on composition of hardened concrete-cement content, original w/c ratio. NDT tests concepts-Rebound hammer, pulse velocity methods. Rate of loading, Moisture condition.

UNIT – V

HIGH DENSITY CONCRETE

Introduction, Classification, Properties, Strength and Durability. High density concrete-Radiation, Shielding ability of concrete, Materials for high density concrete Placement methods.

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TEXT BOOKS:

1) Neville A.M., "Properties of Concrete, 5th Edition, Trans-Atlantic Publications, Inc.; 2012
2) Concrete Technology, Gambhir M.L, Tata McGraw Hill Fifth edition, 2013.
3) Shetty M. S., Concrete Technology, S. Chand & Co., 8th Edition, 2019.
4) Job Thomas., "Concrete Technology", Cenage learning, 2015.
5) R. Santhakumar, Concrete Technology, Oxford Universities Press, 2018.

REFERENCE BOOKS:

1) Neville A. M. and Brooks J. J., Concrete Technology, Pearson Education, 2010
2) Lea, Chemistry of Cement and Concrete, Butterworth-Heinemann Ltd, 5e, 2017
3) Bungey, Millard, Grantham – Testing of Concrete in Structures- Taylor and Francis, 2006.

CO-PO/PSO MATRIX MAPPING:

CE314/2 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	-	1	1	1	1	1	1	1	-	2	1	2	2	2
CO2	1	1	-	1	1	1	1	1	1	2	-	2	1	2	2	2
CO3	1	1	-	2	1	1	1	1	1	2	-	2	1	2	3	2
CO4	1	1	-	1	3	1	1	1	1	2	-	2	1	2	3	2
CO5	1	1	-	1	1	1	1	1	1	2	-	2	1	2	2	2
TOTAL	1	1	-	2	2	2	1	1	1	2	-	2	1	2	3	2

CE 314/3 (R20): ADVANCED HYDRAULICS

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- To impart the knowledge on momentum principle
- Understand the concept of uniform flow.
- To get the knowledge on Non uniform flow of varied flow.
- To introduce the concepts of the working and design aspects of hydraulic pumps.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: Apply the concept of open channel flow.

CO2: Be able to analyze the problems of uniform flow in open channels.

CO3: Be able to analyze the problems of Non-uniform flow in open channels.

CO4: Solve problems based on flow through culverts, bridge piers and obstructions.

CO5: To get the knowledge on the performance and selection of pumps.

UNIT - I

OPEN CHANNEL FLOW

Kinds of open channel flow, channel geometry, types and regimes of flow, Velocity distribution in open channel, wide open channel, specific energy, critical flow and its computation, Energy in non-prismatic channel, momentum in open channel flow.

UNIT - II

UNIFORM FLOW

Qualification of uniform flow, velocity measurement, Manning's and Chezy's formula, determination of roughness coefficients, Determination of normal depth and velocity, most economical sections, non-erodible channels, Flow in a channel section with composite roughness, flow in close conduit with open channel flow.

UNIT - III

VARIED FLOW

Dynamic equations of gradually varied flow, assumptions and characteristics of flow profiles, classification of flow profile, draw down and back water curves, profile determination, graphical integration, direct step and standard step method, numerical methods, flow through transitions, dynamic equation of spatially varied flow, Analysis of spatially varied flow profile, computation of spatially varied flow using numerical integration.

UNIT - IV

FLOW THROUGH NON-PRISMATIC CHANNEL SECTION

Sudden transition, sub-critical flow through sudden transition, flow through culverts, flow through bridge piers, obstructions, channel junction.

UNIT - V

PUMPS

Centrifugal pump, minimum speed to start the pump, Multistage pumps, jet and submersible pumps, positive displacement pumps, reciprocating pump, negative slip, flow separation conditions.

TEXT BOOKS:

1) V.T. Chow: "Open-channel hydraulics.",2009, McGraw Hill Publications(1959,1973).
2) Fluid Mechanics, Modi and Seth, Standard book house.
3) Fluid mechanics and Hydraulic machines, R.K. Bansal, Laxmi publications, New Delhi.

REFERENCE BOOKS:

1) Rajesh Srivastava: "Flow through open channels".Oxford University Press (2008).
2) K. Subramanya: "Flow in open channels". 3rd Edition, 2008, Tata McGraw Hill(1997)
3) H. Chaudhury: "Open channel flow". Second Edition. Springer (2008).

CO-PO/PSO MATRIX MAPPING:

CE314/3 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	2	-	-	1	-	-	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	1	-	-	-
CO3	2	2	3	-	-	-	-	-	-	1	-	-	1	2	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-
CO5	2	2	3	-	-	-	-	-	-	-	-	-	1	2	-	-
TOTAL	3	2	3	-	-	-	-	-	-	2	-	-	1	2	-	-

CE 314/4 (R20): CLIMATOLOGY

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

To develop understanding of atmospheric science including quantifying climate sensitivity to changes in greenhouse gases and interrelation between the various components of the climate system.

COURSE OUTCOMES:

CO1: The students will be able to know the basics of atmospheric science and climate change.

CO2: They will develop a broader awareness of current methods and areas of research in climatology.

CO3: They will also assess current and future climatic risks.

UNIT - I

CLIMATE &THERMAL COMFORT

Global climatic factors, elements of climate, classification & characteristics of tropical climates, site climate and Urban climate - Thermal balance of the human body, Thermal comfort indices – Effective temperature, CET, calculation of comfort zone & determination of overheated & under heated periods.

Unit - II

SOLAR GEOMETRY &DESIGN OF SUN SHADING DEVICES

Apparent movement of the sun, sun path diagrams (solar chart) - Solar angles, Shadow angles, solar shading masks, etc. - Exercises on plotting isopleths, transfer of isopleths to solar chart, fitting a shading mask over the overheated period & design of sun shading devices for different orientations.

UNIT - III

PRINCIPLES OF THERMAL DESIGN IN BUILDINGS

Thermal quantities – heat flow rate, conductivity (k–value) & resistivity, conductance through a multi-layered body, surface conductance, transmittance – calculation of U- value – convection, radiation, concept of sol-air temperature & solar gain factor - exercises in heat loss & heat gain under steady state conditions -.Periodic heat flow in building – time lag & decrement factor & its application in selection of appropriate materials for walls & roof. Effect of Insulation & cavity on time- lag.

UNIT - IV

VENTILATION & DAY LIGHTING

Functions of ventilation – stack effect due to the thermal forces, wind velocity – wind rose diagram, wind pressure - Air movement through building & around buildings – factors affecting indoor air flow, wind shadow etc. - The nature of light, its transmission, reflection – colored light, the munsell system – photometric quantities – illumination, day lighting prediction – the daylight design graph.

UNIT - V

DESIGN FOR CLIMATIC TYPES

Building design & lay out planning consideration for warm humid, hot dry, composite & tropical upland climates, climatic data sets – analysis – climate graph – the Mahoney tables & its recommended specification - Exercises on design of small buildings for various climates.

TEXT BOOK:

1) O.H. Koenigsberger, Manual of Tropical housing and building – Climatic Design, Orient Longman, Chennai, 1975.

REFERENCE BOOKS:

1) M .Evans – Housing, Climate & Comfort, Architectural Press, London,1980.
2) E.Schild & M.Finbow – Environmental Physics in construction & its application in Architectural Design, granadar, london, 1981.
3) B.Givoni - Man, Climate & Architecture, Applied Science, Essex 1982.
4) Donald Watson & Kenneth labs – Climatic Design – Mcgraw hill NewYork 1983.
5) A.Konya- Design Primer for Hot Climates, Architectural Press, London, 1980.

CO-PO/PSO MATRIX MAPPING:

CE314/4 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	3	-	-	3	-	3	3	3	-	-
CO2	3	3	3	3	3	3	-	3	-	-	-	3	3	3	-	-
CO3	3	3	3	3	3	3	3	3	3	-	-	3	3	3	-	-
TOTAL	3	3	3	3	3	3	2	2	3	3	-	3	3	3	-	-

CE 315/1 (R20): ENVIRONMENTAL ENGINEERING

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1 Describe various sources and characteristics of potable water, treatment and supply of protected water for the public demand in the city.

CO2 Students will gain knowledge regarding water sources, transportation and maintenance of reservoirs and raw water storage.

CO3 Students will gain knowledge about Design treatment plants, Analyse the quality of water and appropriate treatment methods.

CO4 Students can learn about water filtration and disinfection methods in water treatment and public health protection activities.

CO5 Students will learn about water distribution system, pipeline network, regular supply to the public and private buildings, and maintenance of service reservoirs.

UNIT-I

INTRODUCTION TO WATER SUPPLY ENGINEERING

Need for protected water supply system, Objectives of Water supply systems, Water borne diseases, Role of Environmental Engineers, Evolution of Water supply system.

QUANTITY AND DEMAND OF WATER

Estimation of water demand for a city or town, Per capita consumption, Factors affecting Per capita consumption, Fire demand, Fluctuations in demand, Prediction of Population.

UNIT-II

SOURCES AND INTAKE WORKS

Classification of sources of water supply, Choice of Source, Suitability with regard to Quality and Quantity, Types of Intakes, Capacity of Storage Reservoirs, Mass Curve Analysis.

TRANSPORTATION OF FRESH WATER AND WASTE WATER

Types of Conduits, Capacity and Design, Materials for Pipes, Laying and Jointing of Pipes, Leakage Tests, Classification of Pumps, Choice of Pumps.

UNIT-III

QUALITY OF AND ANALYSIS WATER

Impurities in Water, Analysis of Physical, Chemical and Biological Parameters of Fresh Water and Waste water, Standards for Potable Water-WHO and BIS Comparison. Water Quality Standards for Industries, Construction and Agriculture.

Methods of Purification of Water, Sequence of Treatment Units, Theory of Sedimentation, Sedimentation with Coagulation, Stock's Law, Design of Sedimentation and Coagulation tanks, Principles of Coagulation.

UNIT-IV

FILTRATION OF WATER

Theory of Filtration, Filter materials, Types if Filters, Design, Construction and Operation of Filters, Troubles in Rapid Sand Filters.

DISINFECTION OF WATER

Theory of Disinfection, Different Methods of Disinfection, Softening of Water, Removal of Colour, Odor and taste.

MISCELLANEOUS TREATMENT METHODS

Water softening: Methods of removing temporary and permanent hardness, Deflouridation, Aeration, Reverse Osmosis, Aeration, Ozonization, Ion-exchange and UV filtration.

UNIT-V

DISTRIBUTION SYSTEM

General requirements, Service Reservoirs, Balancing Reservoirs, Layouts of Distribution networks, Pressure in distribution layouts, Analysis of Distribution networks by Hardy-Cross method. Types of Valves.

WATER SUPPLY FOR BUILDINGS

Domestic connections, Water meters, Pipe materials for Household Network, House hold reservoirs.

PIPE APPURTENANCES

Appurtenances in the distribution system, Ideal water supply system, Service connections, Fire hydrants, Loss of Head through pipes and pipe fittings, Case studies.

TEXT BOOKS:

1) Elements of public health engineering by K. N. Duggal; S. Chand & Company Ltd., New Delhi.
2) Environmental Engineering Vol. I - Water supply engineering by S. K. Garg; Khanna Publishers, Delhi.

REFERENCE BOOKS:

1) Water Supply and Sanitary Engineering Vol. 1 by Gurucharan Singh; Standard Publishers Distributors, Delhi.
2) Water Supply and Sanitary Engineering by G.S. Birde; Dhanpat rai and sons, Delhi.
3) Manual on Water Supply & Treatment; CPH and EEO, Ministry of Urban Development; Govt. of India, New Delhi.

CO-PO/PSO MATRIX MAPPING:

CE315/1 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	1	1	-	1
CO4	2	2	2	1	-	-	-	-	-	-	-	-	1	1	-	1
CO5	3	3	2	2	-	-	-	-	-	-	-	-	2	1	-	1
TOTAL	3	3	2	2	-	-	-	-	-	-	-	-	2	1	-	1

CE 315/2 (R20): REMOTE SENSING & GIS

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- Apply the concepts of Photogrammetric and its applications such as determination of heights of objects on terrain.
- Understand the basic concept of Remote Sensing and know about different types of satellite and sensors.
- Illustrate Energy interactions with atmosphere and with earth surface features, Interpretation of satellite and top sheet maps.
- Understand different components of GIS and Learning about map projection and coordinate system.
- Develop knowledge on conversion of data from analogue to digital and working with GIS software.

COURSE OUTCOMES:

After completing this course the student will have acquired the ability on the following.

CO 1: Understand the concepts of Photogrammetric and compute the heights of objects

CO 2: Understand the principles of aerial and satellite remote sensing, Able to comprehend the energy .interactions with earth surface features, spectral properties of water bodies.

CO 3: Understand the basic concept of GIS and its applications, know different types of data representation in GIS

CO 4: Understand and Develop models for GIS spatial Analysis and will be able to know what the questions that GIS can answer are.

CO 5: Apply knowledge of GIS software and able to work with GIS software in various application Fields.

CO 6: Illustrate spatial and non spatial data features in GIS and understand the map projections and coordinates systems.

UNIT-I

BASIC CONCEPTS

Definitions; Introduction to RS; Necessity, scope and Importance; Applications

ELECTROMAGNETIC RADIATION INTRODUCTION

Solar Radiation; Electromagnetic Spectrum; Interaction of EMR with the atmosphere; Interaction with earth surface materials; Atmospheric Windows; Scattering and Transmission;

SENSORS

Spectral Constraints; Spectral hands for Sensors; Multispectral Instruments; Photon, Infrared and Thermal Detectors; Photo multipliers; Charge Coupled Devices; MulItispectral Line Scanners; Photographic Systems; Sensors for Ultra-violet Region; Visible Region; Infra-red Region; Microwave region. Classification of Sensors - Multispectral Scanner (MSS); Thematic Mapped™; Electro-optical Sensors; Linear Array; Push-broom Sensors; Thermal Scanners; Passive Microwave Spectrometers; RADAR; SLAR; and SAR. Application of Laser: Gamma- radiation; Microwave in RS.

DATA ACQUISITION PLATFORMS

Remote Sensing Platforms; Multi concept in acquiring RS Data; Characteristics of Space Platforms; and Airborne platforms. Data Formats for Digital Satellite Imagery Band Sequential Format; Band Interleaved by Line Format; Run-length, Encoding Format.

UNIT- II

DIGITAL IMAGE PROCESSING

Introduction to Image Analysis; Ground truth; Conversion of Data into Information. Initial Statistical Extraction; Universal and Multivariate Statistics; Histogram and its Significance in RS. Digital Data Processing; Introduction: Image Enhancement Techniques; Human visual system; Linear, Histogram Equalization - Gaussian and other Contrast Enhancements: Pseudo colour Enhancement; Edge Enhancement; Image Transformation - Arithmetic Operations; Vegetation Indices; Filtering Techniques- Introduction: Low Pass Filters; High Pass Filters; Edge Detection; Frequency Domain Kilter; Point and Neighbor-hood Operation; Image Processing Display Systems; Software for Image Processing; Definition of a Gray Level Image.

UNIT-III

ANALYSIS AND INTERPRETATION TECHNIQUES

Introduction; Visual Analysis and Interpretation; Digital Analysis and Image Processing; Image Classification; Morphological Approaches for Boolean Images and Grey Level Images: Introduction; Concepts of Erosion, Dilation, Opening. Closing, Edge Detection; Classification, Geometrical, Unsupervised, Supervised Classifications.

APPLICATION OF REMOTE SENSING IN THE APPRAISAL AND MANAGEMENT OF NATURAL RESOURCES

Digital Analysis of Satellite Data for Integration, Assessment and Management of Natural Resources such as -Classification of Landforms, Soil, Land use, Forest and Vegetation. Range of Biomass Estimation. Water Resources Evaluation, River morphology. Reservoir Sedimentation, Rainfall - Runoff. Glacier Inventory, Draught Assessment, Crop Average . Forest Coverage, Irrigation System Performance Evaluation, Dam site Investigation, Flood Mapping, Management and Damage Assessment, Mapping of Potential Groundwater Zones, Coastal Management and Ocean Parameters. Town and Urban Planning, Planning Transportation Routes, Mapping of Waste Lands - Type, Extent, Distribution, Development. Role of RS in the Detection of Temporal Changes Inlroduction; Change Detection - Nature of Change Detection, Change Detection Algorithms, Image Differencing, Image Rationing Classification Comparisons, Pre-processing to improve Change Detection, Concepts of Parallel Processing and Advanced Techniques in Image Processing with Parallel Computing. Changes in - Morphology of Landforms, Drainage Systems. Water bodies, Saline areas. Land use. Forest Cover.

GEOGRAPHIC INFORMATION SYSTEM

UNIT-IV

FUNDAMENTAL CONCEPTS OF GIS

Introduction, Various Definitions of GIS. Ordinary' Mapping to Geographic Information Systems; GIS Architecture (GIS Subsystems); Components of a G1S; The Theoretical Framework of a GIS; Thematic Layering; Levels of Measurement in GIS; Categories of GIS; Topology.

GIS DATA MODELS

Introduction; GIS Data Types; Spatial Data Models; Vector Data Model; Raster Data Model; Image Data; Vector GIS and Raster GIS —Advantages and Disadvantages; Attribute Data Models; Digital Elevation Model; DEM and Geographical Information Systems; Applications of DEM; Data Structure for Continuous Surface Model.

DATA ACQUISITION

Data Acquisition in GIS; Analog Maps; Aerial Photographs; Satellite Imagery; Ground Survey; Global Positioning System; Reports and Publications; Digitizers (for Vector Data Input); Scanners (for Raster Data Input); Digital Mapping by Aerial Photography; Remote Sensing with Satellite Imagery Rasterisation; Vectorisation; Advanced Technologies for Primary Data Acquisition; Digital Mapping by Aerial Photogrammetry; Digital Data Acquisition; Data Processing; Digitizing Issues; Functions of GIS; Spatial Data Relationships; Topology; Comparison of Analog Map Vs Digital Map.

APPLICATION OF GIS

Introduction; Some Applications of GIS; GIS Application Areas and User Segments; Custom CIS Software Application; Important GIS User Interface Issues; Geographic Visualization; Geographic Query Languages; Guidelines for the Preparation of a GIS: Application of GIS for Land Use and Housing Management; Application of GIS in the Assessment of Physical Transformation of an Urban Area; Land use/Land cover in water resources. Surface water mapping and inventory. Rainfall - Runoff relations and runoff potential indices of watersheds, Flood and Drought impact assessment and monitoring. Watershed management for sustainable development and Watershed characteristics.

UNIT – V

SATELLITE POSITIONING SYSTEM

THE SCIENCE OF NAVIGATION: Navigation Definition; Navigation-System Overview; Coordinate frames, Sensors, Mechanization equations. Navigation-error sources, Error analysis and correction; Types of Inertia! Systems; Positioning Systems; Complementary Filters.

SYSTEMS CONCEPT

Continuous-Time Systems; Discrete Time Systems; State-Space Analysis; Systems with Random Inputs.

DISCRETE LINEAR AND NONLINEAR KALMAN FILTERING TECHNIQUES: Weighted Least Squares (WLS); Kalman Filter; Performance Analysis; Implementation Issues; Numeric Issues; Suboplimal Filtering.

THE GLOBAL POSITIONING SYSTEM: GPS System Overview; The Mathematics of the GPS; Solution of the Pseudo range Equations; GPS Error Sources; Geometric Dilution of Precision; Two-Frequency Receivers; Carrier-Phase Observables; Differential GPS; DGPS Implementation Protocol.

TEXT BOOKS:

1) Remote Sensing and Geographic Information System, M. Ami Reddy, JN'I'U. Hyderabad. 2001, B.S. Publications. Bank Street, Hyderabad.
2) Remote Sensing and its applications by LRA Karayana, University Press 1999.

REFERENCE BOOKS:

1) Principles of Remote Sensing, A.N.Patel and Surendra Singh, Scientific Publishers (India), Jodhpur.
2) Remote Sensing and Image Interpretation, T.M.Lillesand and R.W.Kiefer, John Willey and Sons, 1987, Sold at Universal Bookshop, New Delhi-29
3) Manual of Remote Sensing Vol I & II, Robert B. Reeves et al, American Society of Photogrammetry, Falls Church, 2'"1 Edn 1983.
4) Remote Sensing Principles and Interpretation, F.F. Sabins Jr., W.H. Freeman & Co., San Francisco, 1978
5) Remote Sensing Optics & Optical Systems, Philip N, Stater. Addison Wesley Publishing Co. Ma, USA.
6) Applied Remote Sensing, C.P. Lo. Longman Inc., New York.
7) Remote Sensing; Digital Image Analysis, Richards, Sold at Universal Bookshop, New Delhi-29
8) 22, Introductory digital Image Processing: A Remote Sensing Perspective, John RJensen. Printice Hall, 1986
9) Introduction to Satellite Remote Sensing, FI.C.Misra, Sold at: The Managing Director GIS India, Shantinivas, 6-3-1149/2/AI, B.S.Makhta, Begumpet. Hyderabad-16.

CO-PO/PSO MATRIX MAPPING:

CE315/2 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	2	2	1	-	-	-	-	2	-	2	-	2	-	-	-
CO3	2	3	2	2	-	-	-	-	2	-	3	-	1	1	-	1
CO4	3	3	3	3	3	-	3	-	-	-	-	-	1	1	-	1
CO5	2	3	2	2	2	3	-	-	3	-	-	-	2	1	-	1
TOTAL	3	3	3	3	2	3	3	-	2	-	3	-	3	1	-	1

CE 315/3 (R20): INFRASTRUCTURE PLANNING & MANAGEMENT

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

To study the necessity of infrastructure & its management, finance management Fundamentals & Evaluation and managerial economics.

COURSE OUTCOMES:

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

CO1-Achieve Knowledge of Planning and development of problem-solving skills in management.

CO2-Understand the principles of financial fundamentals.

CO3-Develop analytical skills.

CO4-Summarize the solution of economic evaluation techniques.

CO5-Understand the concepts of financial and Economics management.

UNIT - I

AN OVERVIEW OF BASIC CONCEPTS RELATED TO INFRASTRUCTURE

Introduction to Infrastructure, an overview of the Power Sector in India., an Overview of the Water Supply and Sanitation Sector in India., an overview of the Road, Rail, Air and Port Transportation Sectors in India. An overview of the Telecommunications Sector in India., an overview of the Urban Infrastructure in India, an overview of the Rural Infrastructure in India, an Introduction to Special Economic Zones, Organizations and layers in the field of Infrastructure, The Stages of an Infrastructure Project Lifecycle., an overview of Infrastructure Project Finance.

UNIT - II

PRIVATE INVOLVEMENT IN INFRASTRUCTURE

A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization of Water Supply: A Case Study, Challenges in Privatization of Power: Case Study, Privatization of Infrastructure in India: Case Study, Privatization of Road Transportation Infrastructure in India.

UNIT - III

CHALLENGES TO SUCCESSFUL INFRASTRUCTURE PLANNING AND IMPLEMENTATION

Mapping and Facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks: The Case study for Political Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure.

UNIT - IV

STRATEGIES FOR SUCCESSFUL INFRASTRUCTURE PROJECT IMPLEMENTATION

Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Introduction to Fair Process and Negotiation, Negotiating with multiple Stakeholders on Infrastructure Projects.

UNIT - V

SUSTAINABLE DEVELOPMENT OF INFRASTRUCTURE

Information Technology and Systems for Successful Infrastructure Management, - Innovative Design and Maintenance of Infrastructure Facilities, Infrastructure Modeling and Life Cycle Analysis Techniques, Capacity Building and Improving the Governments Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.

REFERENCE BOOKS: / TEXT BOOKS:

1) Grigg, Neil, Infrastructure engineering and management, Wiley, (1988).
2) Haas, Hudson, Zaniewski, Modern Pavement Management, Krieger, Malabar, (1994).
3) Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997). 15
4) Munnell, Alicia, Editor, Is There a Shortfall in Public Capital Investment? Proceedings of a Conference Held in June (1990).
5) World Development Report 1994: Infrastructure for Development (1994).
6) Zimmerman, K. and F. Botelho, "Pavement Management Trends in the United States" 1st European Pavement Management Systems Conference, Budapest, September (2000).

CO-PO/PSO MATRIX MAPPING:

CE315/3 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	-	-	-	-	3	3	1	3	-	-
CO2	3	3	3	3	3	3	-	-	-	-	3	3	-	3	-	-
CO3	3	3	3	3	3	3	-	-	-	-	3	3	1	3	-	-
CO4	3	3	3	3	3	3	-	-	-	-	3	3		3	-	-
CO5	3	3	3	3	3	3	-	-	-	-	3	3	-	3	-	-
TOTAL	3	3	3	3	3	3	-	-	-	-	3	3	1	3	-	-

CE 315/4 (R20): BUILDING SERVICES

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

The main objectives for this course -

- Defining and identifying of Eng. services systems in buildings.
- The role of Eng. services systems in providing comfort and facilitating life of users of the building.
- Taking into account that Eng. services systems are vital physical elements in any building, the following facts should be highlighted: -
- Correlation and integration among them.
- Correlation and integration between them and the architectural and constructional structural systems.
- Spaces needed by these systems which should identified within (and as a part of) the building and it's architectural and structural constitution.
- The most suitable and efficient types of these systems according to building types functions, level of complication, height, size, etc.

COURSE OUTCOMES:

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

1) Types of Eng. Services systems in buildings.
2) Comfort condition of the users and how these systems participating in achieving it.
3) Relationships, interactions, spaces, and routs requirements of these systems within the building.
4) Providing of what have been mentioned in item 3 above by the architect (the designer) from the preliminary stages of the architectural concept to the final advanced stages of design.
5) Basics of dealing and communicating with services engineers, those who design the building services systems, across the whole stages of design, in order to understand and fulfil their requirements.

UNIT- I

INTRODUCTION TO BUILDING SERVICES:

Definitions - Objective and uses of services - Applications of services for different types building considering - Classification of services- Types of services and selection of services- Natural and artificial lighting principles and factors- Arrangement of luminaries, Distribution of illumination, Utilization factors- Necessity of Ventilation Types – Natural and Mechanical Factors to be considered in the design of Ventilation.

UNIT- II

ELECTRICAL SERVICES AND LAYOUT:

Electrical services in the building -Technical terms and symbols for electrical installations and Accessories of wiring- Systems of wiring like wooden casing, cleat wiring, CTS wiring conduit wiring - Types of insulation- electrical layout for residence, small work shop, show room, school building, etc.

UNIT- III

MECHANICAL SERVICES IN BUILDINGS:

Introduction of mechanical services - Lift - Definition, Types of Lifts, Design Considerations, Location, Sizes, Component parts - Lift Well, Travel, Pit, Hoist Way, Machine, Buffer, Door Locks, Suspended Rope, Lift Car. Elevators & Escalators -Different types of elevators and Escalators -Freight Elevators-Passenger elevators –Hospital elevators -Uses of different types of elevators and Escalators.

Air Conditioning- Definition, Purpose, Principles, Temperature Control, Air Velocity Control, Humidity Control, Air Distribution system, Cleaners, Filters, Spray washers, Electric preceptors, Types of Air Conditioners (Central type, Split Unit).

UNIT- IV

FIRE PROTECTION, ACOUSTIC AND SOUND INSULATIONS: Introduction- Causes of fire and Effects of fire-General Requirements of Fire Resisting building as per IS and NBC 2005-Characteristics of Fire resisting materials- Maximum Travel Distance- ire Fighting Installations for Horizontal Exit, Roof Exit / Fire Lifts, External Stairs- Requirement of good Acoustic -Various sound absolvent- Factors to be followed for noise control in residential building.

UNIT -V

MISCELLANEOUS SERVICES AND GREEN BUILDINGS PROVISIONS:

Rain water Harvesting for buildings-Concept of GREEN buildings - Components of GREEN building -Introduction and Significance to Grey water- Components of Grey water system - Management of Grey water system.

TEXT BOOKS:

1) A text book on Building Services by R. Udaykumar, Eswar Press, Chennai.
2) Building Services by S. M. Patil, Seema Publication, Mumbai Revised edition.
3) Heating, Ventilating and Air Conditioning: Analysis and Design, 6th Edition", Faye C. McQuiston, Jerald D. Parker and Jeffrey D. Spitler, John Wiley & Sons.

REFERENCE BOOKS:

1) SP 7: 2005 National Building Code of India, Bureau of Indian Standards, BIS, New Delhi
2) Building Construction by B. C. Punmia, Laxmi Publications (P) Ltd., New Delhi
3) 3IS 3534: 1976 "Outline dimensions of electric lifts"
4) IS1860: 1980 "Code of Practice for Installation, Operation and Maintenance of Electric Passenger and Goods Lifts".

CO-PO/PSO MATRIX MAPPING:

CE315/4 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	-	-	-	-	3	3	3	3	3	3
CO2	3	3	3	3	3	3	-	-	-	-	3	3	3	3	3	3
CO3	3	3	3	3	3	3					3	3	3	3	3	3
CO4	3	3	3	3	3	3	-	-	-	-	3	3	3	3	3	3
CO5	3	3	3	3	3	3	-	-	-	-	3	3	3	3	3	3
TOTAL	3	3	3	3	3	3	-	-	-	-	3	3	1	3	3	3

CE 316 (R20): FUNDAMENTALS OF RESEARCH METHODOLOGY

L-3	T-0	P-0	M-100	C-0

COURSE OBJECTIVES:

- To get the idea of the Research Process.
- Knowledge from the Literature survey.
- Providing systematic analysis & enhance the research quality.
- Develop the Report Writing Skills & ethics.
- Knowledge about the IPR & Patents.

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1 Understand the different types of research and research process

CO2 Analyse the phases involved in conducting research

CO3 Apply this knowledge to formulate research questions

CO4 Develop research plans in their respective fields.

CO5 Understand about the patents and journal publications.

UNIT - I

INTRODUCTION TO RESEARCH METHODOLOGY

Objectives of Research, Motivation in Research, Types of Research, Research process and Phases of Research.

UNIT - II

RESEARCH DESIGN

Need, Problem Definition, variables, research design concepts, Literature survey and review, Research design process, Errors in research.

UNIT - III

RESEARCH MODELING

Types of Models, Model building and stages, Data consideration and Testing, Heuristic and Simulation modeling. Simulation: Need for simulation, Types of simulation.

UNIT - IV

REPORT WRITING

Pre-writing considerations, Thesis writing, formats of report writing, Formats of publications in Research Journals. Technique of Interpretation, Precaution in Interpretation, Significance of Report writing, Different steps in writing Report, Layout of the Research Report, Types of Reports, Report Format, Typing Instructions, Oral Presentations.

UNIT - V

RESEARCH ETHICS AND MORALS

Issues related to plagiarism, collaborative models and ethics, acknowledgements. Intellectual Property Rights: copy rights, copy left; Patents, Industrial designs, Trade marks.

TEXT BOOKS:

1) C.R. Kothari: Research Methodology, Methods & Techniques, 2nd Edition, New Age International Publications.
2) Krishnaswamy, K N SivaKumar, AppaIyer and Mathiranjan M (2006), Management Research Methodology; Integration of Principles, Methods and Techniques (Person Education, New Delhi).
3) R Pannerselvam, Research Methodology. PHI.

REFERENCE BOOKS:

1) Graziano, A.M., Raulin, M.L: Research Methods – A Process of Inquiry, Pearson Publications.
2) Bhandarkar & Wilkinson: Methodology and Techniques of Social Research, Himalaya publications, 2009.
3) Bell. J.2005: Doing your Research Project, 4th Edition, Open University Press, Berkshire.
4) How to write a Thesis: Murray.R. Tata McGraw-Hill.
5) Writing for Academic Journals, Murray. R. 2009, McGraw-Hill International.
6) A Handbook of Academic Writing, Murray, R. and Moore, S. 2006, Tata McGraw-Hill.
7) Wrinting for Publication, Henson, K.T. 2005.
8) Ranjit Kumar, Research Methodology; a step-by-step Guide for Beginners, SAGE Publications Ltd.

CO-PO/PSO MATRIX MAPPING:

CE316 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	3	2	1	1	2	1	1	-	1	1	-	-	3
CO2	-	3	2	1	1	1	-	2	1	1	-	1	1	-	-	3
CO3	2	3	2	2	2	1	1	2	1	1	-	1	1	-	-	3
CO4	1	-	-	-	-	-	-	3	1	-	-	1	1	-	-	3
CO5	-	-	1	1	1	1	1	2	-	1	-	1	1	-	-	3
TOTAL	2	3	2	3	3	1	1	3	1	1	-	1	1	-	-	3

CE 351 (R20): ENVIRONMENTAL ENGINEERING LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OBJECTIVES:

- Perform the experiments to determine water and waste water quality.
- Understand the water &waste water sampling, their quality standards.
- Estimate quality of water, waste water, Industrial water.

COURSE OUTCOMES:

CO1: Analyse the physical parameters of water for drinking
CO2: Analyse the major elements of water for drinking
CO3: Analyse the minor elements of water for drinking
CO4: Analyse the waste water for different purposes of recycle
CO5: Analyse the biological parameters of water for drinking

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

LIST OF 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 Settle able 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.
15) Determination of Chemical Oxygen Demand (COD) of waste water.

CO-PO/PSO MATRIX MAPPING:

CE351 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	1	3	2	1	1	2	1	1	-	1	1	-	-	3
CO2	-	3	2	1	1	1	-	2	1	1	-	1	1	-	-	3
CO3	2	3	2	2	2	1	1	2	1	1	-	1	1	-	-	3
CO4	1	-	-	-	-	-	-	3	1	-	-	1	1	-	-	3
CO5	-	-	1	1	1	1	1	2	-	1	-	1	1	-	-	3
TOTAL	2	3	3	3	3	1	1	3	1	1	-	1	1	-	-	3

CE 352 (R20): CONCRETE TECHNOLOGY LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OBJECTIVES:

This lab enables students to carry various experiments regarding compressive strength, tensile strength of concrete, workability test, setting time, design mix, specific gravity of cement, and soundness of cement. All these experiments intended to determine the quality of concrete.

COURSE OUTCOMES:

On completion of the course the student will be able to

CO1: The importance of testing of cement and its properties.

CO2: Assess the different properties of aggregates.

CO3: Summarise the concept of workability and testing of concrete.

CO4: Examine the properties of fresh and hardened of concrete.

CO5: Understand the Non- destructive testing procedures of concrete.

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

LIST OF EXPERIMENTS:

1. Determination of
   a) Normal consistency of Cement
   b) Fineness of Cement using 90 microns IS sieve.
2. Determination of
   a) Initial Setting Time and
   b) 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) Split Tensile strength of concrete.
8. Determination of Modulus of Elasticity of concrete by conducting compression test on Concrete Cylinder.

9. Bulk density & Specific Gravity of
   a) Fine Aggregate
   b) Coarse Aggregate.
10. Determination of Bulking of Fine Aggregate.
11. Determine the homogeneity of concrete by Ultrasonic Pulse Velocity test.
12. Schmidt Rebound Hammer Test.
13. Permeability Test.

CO-PO/PSO MATRIX MAPPING:

CE352 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	-	-	-	1	1	-	1	1	-	1	1	3	-	-
CO2	1	2	-	-	-	1	1	-	1	1	-	1	1	3	-	-
CO3	1	2	3	-	-	1	1	-	1	1	-	1	1	3	-	-
CO4	1	2	3	-	-	1	1	-	1	1	-	1	1	3	-	-
CO5	1	2	3	-	-	1	1	-	1	1	-	1	1	3	-	-
TOTAL	1	3	3	-	-	1	1	-	1	1	-	1	1	3	-	-

CE 353 (R20): ADVANCED COMMUNICATION SKILLS LAB

L-0	T-0	P-3	M-100	C-2

COURSE OUTCOMES:

After completion of this course, students will be able to

CO1-Understand the different types of communication and identify their characteristics.

CO2-Analyze and overcome barriers to effective communication.

CO3-Demonstrate strategies for effective communication in various situations.

CO4-Identify and interpret nonverbal communicationcues, including body language, kinesics, facial expressions, proxemics, oculesics, haptics, and chronemics.

CO5-Develop employability skills, such as interview skills, group discussion, and resume writing, and apply them in real-world scenarios.

MODULE-L

COMMUNICATION SKILLS:

I. Verbal

a) Types of Communication
b) Barriers to Communication
c) Strategies for effective communication

II. Nonverbal Skills -

a) Body Language – Voluntary and Involuntary
b) Kinesics
c) Facial Expressions
d) Proxemics
e) Oculesics
f) Haptics and Chronemics

MODULE-2: ADVANCED VOCABULARY:

a) Word list (GRE & TOEFL related)
b) One Word Substitutes
c) Idioms

MODULE-3: EMPLOYABILITY SKILLS (REF: 6):

a) Interview Skills
b) Group Discussion
c) Resume Writing

MODULE-4: TELEPHONIC SKILLS:

a) Formal &Informal interaction
b) Receiving Messages & Complaints
c) Tone modulation

MODULE-5: DESCRIPTIONS:

a) Process Description
b) Pictures
c) Narration

MODULE-6: BEHAVIOURAL SKILLS:

a) Emotional Intelligence
b) Positive Attitude
c) Team Work

Organization Skills

CO-PO/PSO MATRIX MAPPING:

CE353 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	-	-	-	-	2	-	-	2	2	3	3	2	3
CO2	2	2	-	-	-	1	1	-	-	-	-	2	2	3	2	2
CO3	2	1	2	2	2	1	1	2	2	2	2	-	3	2	2	1
CO4	3	2	1	2	-	-	1	2	2	2	2	-	3	3	3	2
CO5	3	2	2	1	2	2	-	-	-	-	-	-	3	2	3	2
TOTAL	3	3	3	3	2	2	1	2	2	2	2	2	3	3	3	3

SEMESTER VI

B.Tech. CIVIL ENGINEERING

SEMESTER-V

CE 321 (R20): STRUCTURAL ANALYSIS – II

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- To impart the principles of elastic structural analysis and behavior of indeterminate structures.
- To impart knowledge about various methods involved in the analysis of indeterminate structures.
- To apply these methods for analyzing the indeterminate structures to evaluate the response of structures
- To enable the student get a feeling of how real-life structures behavior
- To make the student familiar with latest computational techniques and software used for
- structural analysis.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: Analyze multistory frames by approximate methods.

CO2: Analyze parabolic and circular arches for static and moving loads.

CO3: Perform plastic analysis of various structures.

CO4: Analyze continuous beams by flexibility method.

CO5: Analyze continuous beams by Stiffness method.

UNIT – I

MULTI STOREY FRAMES (APPROXIMATE METHODS)

Substitute frame method for gravity loads; Portal method and cantilever method for lateral loads.

KANI'S METHOD

Principles of the method; Application to continuous beams and portal frames (single bay, single storey with vertical legs only) without and with side-sway.

UNIT – II

ARCHES

Eddy's Theorem; Analysis of three hinged and two hinged Parabolic and Circular arches for Static and moving loads.

CABLES

Analysis of cables under uniformly distributed and concentrated loads; Shape of the cable under self weight; Effect of temperature changes in suspension cables; Anchor cables.

UNIT – III

PLASTIC BEHAVIOUR OF STRUCTURES

Idealized stress - strain curve for mild steel; Ultimate load carrying capacity of members carrying axial forces; Moment - Curvature relationship for flexural members; Evaluation of fully plastic moment; Shape factor; Collapse load factor; Upper and lower bound theorems; Collapse load analysis of indeterminate beams and single bay, single storied portal frames.

UNIT – IV

FLEXIBILITY AND STIFFNESS MATRICES

Flexibility and stiffness; Flexibility matrix; Stiffness matrix; Relationship between flexibility matrix and stiffness matrix.

FLEXIBILITY METHOD (MATRIX APPROACH)

Analysis of continuous beams and rigid jointed plane frames (Single bay, single storey with vertical legs only) by flexibility method with matrix approach.

UNIT – V

STIFFNESS METHOD (MATRIX APPROACH)

Analysis of continuous beams, rigid jointed plane frames (Single bay, single storey with vertical legs only) and pin jointed plane frames by stiffness method with matrix approach.

NOTE: *Two questions of 12 marks each will be given from each unit out of which one is to be answered.*

TEXT BOOK:

1) Analysis of Structures vols. 1 & 2 by Vazirani & Ratwani; Khanna Publishers; Delhi.

REFERENCE BOOKS:

1) Structural Analysis by Devdas Menon, Narosa Publishinh House.
2) Indeterminate structural analysis by C. K. Wang, McGraw-Hill Publications
3) Mechanics of structures – II by Junnarkar & Shah, Charotar Publishing House
4) Structural analysis by R. C. Hibbeler, Pearson Education.
5) Basic Structural Analysis by C. S. Reddy, Tata McGraw-Hill.

CO-PO/PSO MATRIX MAPPING:

CE321 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	-	-	-	-	-	-	-	-	-	1	2	-	-
CO2	2	3	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-	1	3	-	-
CO4	2	3	2	1	-	-	-	-	-	-	-	-	1	3	-	-
CO5	2	3	2	1	-	-	-	-	-	-	-	-	1	3	-	-
TOTAL	3	3	3	1	-	-	-	-	-	-	-	-	1	3	-	-

CE 322 (R20): DESIGN OF STEEL STRUCTURES

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

At the end of the Course/Subject, the students will be able to:

To make the student familiar with different types of steel sections, their properties and methods of structural steel design. Calculate different loads on the structure, analyze the effect of loads on the structure, analyze the effect of loads on the elements and design them safely under collapse and serviceability conditions.

COURSE OUTCOMES:

CO1: Understanding the basic design principles, loads and design of connections using structural steel.

CO2: Analyze and design members for flexure, compression & tension as per IS code of practice.

CO3: Evaluating the effects of various loads on foundations for steel structures and design various type of slab bases.

CO4: Evaluate forces on various members of roof truss and design them.

CO5: Understanding the behavior of built-up sections for plate and gantry girder. Design them for combination of loads.

UNIT – I

Types of structural steel – Mechanical properties of steel – Concepts of plasticity – yield strength -Loads and Stresses – Local buckling behavior of steel. Concepts of limit State Design – Different Limit States– Load combinations for different Limit states - Design Strengths- deflection limits – serviceability – stability check.

CONNECTIONS: Design of Connections– Different types of connections – Bolted connections –Design strength– efficiency of joint.

WELDED CONNECTIONS: Advantages and disadvantages - Strength of welds-Butt and fillet welds: Permissible stresses – IS Code requirements. Design of fillet weld subjected to in-plane moment acting in the plane and at right angles to the plane of the joints.

UNIT – II:

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 – III

COMPRESSION MEMBERS

Introduction; 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.

TENSION MEMBERS

Introduction, Net area; Shear-lag; Design of tension members

UNIT – IV

ROOF TRUSS ELEMENT

Different types of trusses – Design loads – Load combinations as per IS Codes–Design of simple roof trusses involving design of purlins, rafters and joints – tubular trusses.

DESIGN OF COLUMN FOUNDATIONS

Design of slab base and gusseted base, Column bases subjected moment.

UNIT – V

DESIGN OF PLATE GIRDER: Design consideration – I S Code recommendations Design of plate girder - Welded – Curtailment of flange plates, stiffeners – splicing and connections.

DESIGN OF GANTRY GIRDER

Impact factors - longitudinal forces, Design of Gantry girders.

NOTE: *Two questions of 14 marks each will be given from each unit out of which one is to be answered.*

TEXT BOOKS:

1) Design of steel structures by K. S. Sai Ram, Pearson Education, 2010.
2) Limit State Design of Steel Strutures by S.K.Duggal, Tata McGraw Hill Education Pvt.Ltd.

REFERENCE BOOKS:

1) Steel Structures - Design and Practice by N. Subramanian, Oxford University Press.
2) Limit state design of steel structures by M.R.Shiyekar, PHI Learning.
3) General Construction In Steel – Code of Practice: IS 800-2007.

CO-PO/PSO MATRIX MAPPING:

CE322 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	-	-	-	-	-	-	-	-	1	3	-	-
CO2	2	3	3	1	-	-	-	-	-	-	-	-	1	3	-	-
CO3	2	3	3	1	-	-	-	-	-	-	-	-	1	3	-	-
CO4	2	3	3	1	-	-	-	-	-	-	-	-	1	3	-	-
CO5	3	2	3	1	-	-	-	-	-	-	-	-	1	3	-	-
TOTAL	3	3	3	1	-	-	-	-	-	-	-	-	1	3	-	-

CE 323 (R20): GEO - TECHNICAL ENGINEERING - II

L-3	T-0	P-0	M-100	C-3

COURSE LEARNING OBJECTIVES:

The objective of this course is

- To impart to the student knowledge of types Sub–Soil Investigation And Sampling
- To impart to the student knowledge of types of shallow foundations and theories required for the determination of their bearing capacity.
- To enable the student to compute immediate and consolidation settlements of deep foundation
- To enable the student to compute Lateral Earth Pressure & Retaining Walls
- To impart the principles of important field tests such as SPT and Plate bearing test.
- To enable the student to imbibe the concepts of pile foundations and determine their load carrying capacity

COURSE OUTCOMES:

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

CO1 Student can understand sub soil investigation and design the bore holes

CO2 Calculate the lateral earth pressure of the soil and the stability of slopes

CO3 Understand the shallow foundation and calculate the bearing capacity of the soil

CO4 Analysis the settlement in soil

CO5 Understand the deep foundation and calculate the pile efficiency and expansive soils

UNIT – I

SUB–SOIL INVESTIGATION AND SAMPLING

Introduction; Methods of exploration; Methods of Boring; Soil Samples; Soil samplers and Sampling; Number and disposition of trial pits and borings; Depth of exploration; Ground water observations; Field tests vis-à-vis Laboratory tests; Plate load test; Penetrometer tests - SPT,CPT(static and dynamic), Pressure meter tests(PMT);Geophysical methods; Borehole logs; Site investigation report;

UNIT – II

STABILITY OF SLOPES

Introduction; Infinite slopes and translational slides; Definitions of factor of safety; Finiteslopes- forms of slip surface; TOTAL stress and Effective stress methods of analysis; u=0 Analysis (TOTAL Stress Analysis); c- Analysis- Method of slices; Location of most Critical Circle; Stability of Earth Dam Slopes; Friction Circle Method; Taylor's Stability Number;

LATERAL EARTH PRESSURE & 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; Design considerations for retaining walls.

UNIT –III

SHALLOW FOUNDATIONS

Concept of foundations; Types of foundations and their applicability; General requirements of foundations; Location and Depth of foundation.

BEARING CAPACITY OF SHALLOW FOUNDATION

Terminology relating to bearing capacity; Bearing Capacity of Shallow Foundations– Terzaghi's Bearing Capacity theory; Skempton's Bearing Capacity Analysis for Clay soils; IS-Code Recommendations for Bearing Capacity; Influence of water table on bearing capacity;

UNIT – IV

SETTLEMENT ANALYSIS

Settlement of Shallow foundation – types; Methods to reduce differential settlements; Allowable Bearing Pressure; Immediate settlemtent –Terzaghi's Method; Allowable Bearing pressure of Granular Soils based on Standard Penetration Test Value – Terzaghi and IS methods.

PILE FOUNDATIONS

Introduction; Uses of Piles; Types of Piles;Cast- in-situ Pile construction; Selection of Pile type; Pile driving; Pile load carrying capacity in compression – Static Pile Load formula, load tests, Dynamic Pile formulae; Correlations with Penetration test data; Group action of Piles – load carrying capacity and settlement; Negative skin friction;

UNIT -V

WELL FOUNDATIONS

Types of wells; Components of well foundation; Shapes of wells; Forces acting on well foundation; Construction and Sinking of wells; Depth of well foundation; stability check up of well-Terzaghi method.

FOUNDATIONS IN EXPANSIVE SOILS

Clay minerals,Clay water relations, Identification of expansive soil; Field conditions that favour swelling; consequences of swelling; Different alternative foundation practices in swelling soils; Construction practice of UR piles in swelling soils.

TEXT BOOK:

1) Basic and Applied Soil Mechanics – Gopal Ranjan and A.S.R. Rao, New Age International Publishers.

REFERENCE BOOKS:

1) Foundation Engineering by B. J. Kasmalkar; Pune Vidyarthi Griha Prakashan, Pune.
2) Foundation Analysis & Design by Bowles, J.E., McGraw- Hill Book Company.
3) Foundations of Expansive Soils, F.H. Chen. Elsevier Publications.
4) Geotechnical Engineering by SK Gulati & Manoj Datta, Tata McGraw- Hill Publishing Company Limited.
5) Principles of Foundation Engineering (1999), B.M. Das., PWS Publishing Company, 4th edition, Singapore
6) Geotechnical Engineering, - Codutu, Pearson Education

CO-PO/PSO MATRIX MAPPING:

CE323 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	3	1	2	1	2	1	-	-	3	1	1	3	-	-
CO2	1	3	3	2	2	-	1	-	-	-	-	2	-	3	-	-
CO3	2	3	2	2	2	1	1	-	-	-	-	2	1	3	-	-
CO4	2	3	2	2	2	1	1	-	-	-	-	2	1	3	-	-
CO5	2	3	2	2	1	2	1	-	-	-	-	2	-	3	-	-
TOTAL	3	3	3	3	3	1	2	1	-	-	1	3	1	3	-	-

CE 324/1 (R20): TRANSPORTATION ENGINEERING

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

This course is designed to review the fundamentals of design and practices of transportation engineering (Highway and Railway) within the Civil Engineering curriculum. Students will explore transportation engineering processes in the theoretical and applied realm in the fields of traffic engineering, geometric design, highway materials, design of highway pavements, highway construction, components of railway and geometric design of railway. The transportation engineering curriculum is designed to prepare interested students for future careers in design and operation related works of transportation facility.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: Plan the highway network for a given area based on engineering surveys.

CO2: Design the highway geometrics.

CO3: Design flexible and rigid pavements, Construct & maintain the highways.

CO4: Attain knowledge on components of Railway Engineering.

CO5: Design geometrics of Railway Track

HIGHWAY ENGINEERING

UNIT – I

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

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

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.

RAILWAY ENGINEERING

UNIT – IV

INTRODUCTION

Role of railways in transportation, Comparison of railway and highway transportation: Development of railway systems with particular reference to India, Classification of railways.

RAILWAY TRACK

Permanent way: Gauges in Railway track, railway track cross- sections; Coning of wheels.

RAILS & RAIL JOINTS

Functions of rails; Requirements of rails; types of rails sections; standard rail sections; length of rails; Rail failures; Wear on Rails Welding of rails,

SLEEPERS

Function of sleepers; Requirements of sleepers, Classification of sleepers – Timber sleepers. Metal sleepers & Concrete sleepers, Comparison of different types of sleepers.

FISH PLATES

Fish plates, section of fish plates, and failure of fish plates.

BALLAST

Functions and requirements of ballast, Types of ballast, Renewal of ballast.

UNIT-V

GEOMETRIC DESIGN OF TRACK

Necessity; 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 CROSSINGS

Functions of components of turnout; Crossings.

STATIONS AND YARDS

Site selection for railway station; Requirements of railway station; Classifications; Station Yards; Level crossing.

TEXT BOOKS:

1) UNIT I, II & III: Highway Engineering by S. K. Khanna & C. E. G. Justo; Nemchand & Brothers, Roorke.
2) UNIT IV & V: Railway Engineering by S.C.Saxena and S.Arora Dhanpat Rai & sons.

REFERENCE BOOKS:

1) Principles of Transportation Engineering by Partha Chakroborty & Animesh Das, Prentice Hall of India, New Delhi.
2) Principles of Transportation Engineering and highway engineering by G. Venkatappa Rao, Tata Mc Graw-hill publishing company limited New Delhi.
3) Railway Engineering by M.M.Agarwal; Prabha & Co, New Delhi.

CO-PO/PSO MATRIX MAPPING:

CE324/1 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	2	-	-	1	-	2	1
CO2	3	2	3	-	-	-	-	-	-	-	-	-	-	-	3	1
CO3	2	2	3	-	-	-	-	-	-	1	-	-	-	2	3	1
CO4	3	-	-	-	-	-	-	-	-	-	-	-	1	-	2	1
CO5	2	2	3	-	-	-	-	-	-	-	-	-	1	2	3	1
TOTAL	3	2	3	-	-	-	-	-	-	2	-	-	1	3	3	1

CE 324/2 (R20): GROUND WATER DEVELOPMENT & MANAGEMENT

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES / OUTCOMES:

- To learn basic fundamentals of groundwater flow
- To learn the hydraulics of different kinds of wells
- Conjunctive use of ground water along with other fresh water sources

UNIT-I

INTRODUCTION

Ground Water Occurrence: Ground water hydrologic cycle, origin of ground water, rock properties effecting ground water, vertical distribution of ground water, zone of aeration and zone of saturation, geologic formation as Aquifers, types of aquifers, porosity, Specific yield and Specific retention.

GROUND WATER MOVEMENT

Permeability, Darcy's law, storage coefficient. Transmissivity, differential equation governing ground water flow in three dimensions derivation, Ground water flow contours their applications.

UNIT-II

ANALYSIS OF PUMPING TEST DATA

Steady flow groundwater flow towards a well in confined and unconfined aquifers – Dupit's and Theim's equations, Assumptions, Formation constants, yield of an open well interface and well tests.

Unsteady flow towards a well – Non equilibrium equations – Theis solution – Jocob and Chow's simplifications, Leaky aquifers.

UNIT-III

SURFACE AND SUBSURFACE INVESTIGATION

Surface methods of exploration – Electrical resistivity and Seismic refraction methods. Subsurface methods – Geophysical logging and resistivity logging. Aerial Photogrammetry applications along with Case Studies in Subsurface Investigation.

UNIT-IV

ARTIFICIAL RECHARGE OF GROUNDWATER

Concept of artificial recharge – recharge methods, relative merits. Applications of GIS and Remote Sensing in Artificial Recharge of Ground water along with Case studies.

UNIT-V

Saline Water Intrusion in aquifer: Occurrence of saline water intrusions, Ghyben-Herzberg relation, Shape of interface, control of seawater intrusion. Groundwater Basin Management: Concepts of conjunction use, Case studies.

TEXT BOOKS:

1) Groundwater by H.M. Raghunath, Wiley Eastern Ltd.
2) Ground water Hydrology by David Keith Todd, John Wiley & Son, New York.

REFERENCE BOOKS:

1) Groundwater by Bawvr, John Wiley & sons.
2) Groundwater Syatem Planning &Managemnet – R. Willes & W.W.G. Yeh, Printice Hall.

CO-PO/PSO MATRIX MAPPING:

CE324/2 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	2	-	-	1	-	2	1
CO2	3	2	3	-	-	-	-	-	-	-	-	-	1	-	3	1
CO3	2	2	3	-	-	-	-	-	-	1	-	-	1	2	3	1
TOTAL	3	2	3	-	-	-	-	-	-	2	-	-	1	2	3	1

CE 324/3 (R20): LOW-COST HOUSING

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- The course introduces the basic concepts and issues related to urban and rural housing.
- To enable the students to understand the fundamentals of housing needs, housing finance and housing techniques with relation to social and environmental effect.

COURSE OUTCOMES:

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

CO1-To outline the Issues concerning housing in the Indian Context and the various agencies involved in the production of housing.

CO2-To understand factors that influence housing affordability and to familiarize students with various schemes and policies of the government in the housing sector.

CO3-To inform about the standards and guidelines for housing

CO4-To inform about the various housing design typologies and the processes CO1-involves in housing project development.

CO5-To understand how the various housing agencies plays a major role in the housing development.

UNIT – I

HOUSING SCENARIO: Status of urban housing- Status of Rural Housing, Housing Finance: Introducing- Existing finance system in India- Government role as facilitator Status at Rural Housing Finance- Impedimently in housing finance and related issues.

UNIT- II

LAND USE AND PHYSICAL PLANNING FOR HOUSING:

Planning of urban land- Urban land ceiling and regulation act- Efficiency of building bye laws - Residential Densities.

HOUSING THE URBAN POOR: Living conditions in slums- Approaches and strategies for housing urban poor.

UNIT-III

DEVELOPMENT AND ADOPT ON OF LOW-COST HOUSINGTECHNOLOGY:

Adoption of innovative cost effective construction techniques- Adoption of precast elements in partial prefabrication- Adopting of TOTAL prefabrication of mass housing in India-General remarks on pre cast rooting/flooring systems- Economical wall system- Single Brick thick loading bearing wall- 19cm thick load bearing masonry walls- Half brick thick load bearing wall-Fly ash, gypsum thick for masonry- Stone Block masonry- Adoption of precast R.C. plank and join system for roof / floor in the building.

ALTERNATIVE BUILDING MATERIALS FOR LOW-COST HOUSING:

Substitute for scarce materials- Ferro cement- Gypsum boards- Timber substitutions- Industrial wastes- Agricultural wastes.

UNIT- IV

LOW-COST INFRASTRUCTURE SERVICES:

Present status- Technological options- Low-cost sanitation's- Domestic wall- Water supply energy.

RURAL HOUSING

Introduction- traditional practice of rural housing continuous- Mud Housing technology- Mud roofs- Characteristics of mud- Fire resistant treatment for thatched roof- Soil stabilization- Rural Housing programs.

UNIT-V

HOUSING IN DISASTER PRONE AREAS:

Earthquake- Damages to houses- Traditional Houses in disaster prone areas Type of Damages and Railways of non-engineered buildings- Repair and restore action of earthquake Damaged nonengineered buildings recommendations for future constructions- Requirements of structural safety of thin precast roofing units against - Earthquake forces- Status of R&D in earthquake strengthening measures- Floods- cyclone- future safety.

TEXT BOOKS:

1) Building materials for low –income houses – International council for building research studies and documentation.
2) Modern trends in housing in development countries – A.G. Madhava Rao, D.S. Ramachnadra Murthy & G. Annamalai
3) Light weight concrete- Academic Kiado- Rudhai. G – Publishing home of Hungarian Academy of Sciences 1963.

REFERENCE BOOKS:

1) Building Systems for Low Income Housing, Ashok Kumar Jain; Management Publishing House, 1992
2) Hand book of low-cost housing - by A. K. Lal – Newage international publishers.
3) Low-Cost Housing in Developing Countries, Guru Charan Mathur; For Centre for Science & Technology of the Non-Aligned and Other Developing Countries, Oxford & IBH Publishing Company, 1993.

CO-PO/PSO MATRIX MAPPING:

CE324/3 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	3	-	-	-		3	-	3	-	-
CO2	3	3	3	3	3	3	-	-	-	-		3	-	3	-	-
CO3	3	3	3	3	3	3	-	-	-	-	3	3	-	3	-	-
CO4	3	3	3	3	3	3	-	-	-	-	3	3	-	3	-	-
CO5	3	3	3	3	3	3	-	-	-	-	3	3	-	-	-	-
TOTAL	3	3	3	3	3	3	3	-	-	-	3	3	-	3	-	-

CE 324/4 (R20): BASICS OF INTERIOR DESIGN

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

The main objectives of this course are:

- Prepare graduates for designing the Residential & Commercial Projects.
- Equip future designers with technical skills, new technology to be able to produce working drawings, specifications, layouts and suggest materials and finishes for a specific project.
- Help students to demonstrate a good understanding of the various components of interior designing by exposing them to a wide variety of live design projects, presentations, lab works, research papers and critique.
- Develop designs, plan material and suggest systems for various spaces for aesthetic and effective functioning.
- Familiarize students with computational techniques and software typically used in the profession of Interior Design.

COURSE OUTCOMES:

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

CO1-Integrate knowledge, skill and attitude that will sustain an environment of learning and creativity.

CO2-Develop and integrate trends in interior design.

CO3-Understand the design, technology and techniques to design spaces effectively.

CO4-Understand building and safety codes, principles and practices for environmental and sustainable interior design.

CO5-Develop an understanding of various tools, techniques and software.

CO6-Engage a process of research and design for holistic contribution to the profession.

CO7-Develop self-confidence and awareness of general issues prevailing in the society.

UNIT - I

The profession of Interior Design; Role of an Interior Designer- past and present; Scope of services; Interior Design Process. Interior Design and Concepts: Elements and Principles of design- an overview and their applications in interior designing.

UNIT - II

IIntroduction to the fundamentals of Interior Design such as Lighting, Furniture, Space, Materials, Furnishings, Art etc.

UNIT - III

Colours in interiors – Colour Theory, Effect of light on colour, various colour schemes like analogues, complementary, triadic etc. Colour symbolism. Psychology of colour, Industrial colour codes. International standards.

UNIT – IV

Introduction to Furniture and Accessories: An overview of historical perspective of furniture and styles, accent pieces and accessories from Egyptian period to the present. Basic Furniture vocabulary. Styles of Interiors – Italian, English, French, Japanese styles etc.

UNIT – V

Interior lighting – direct and indirect lighting, location and light grid systems, types of luminaries, quality of lighting. Ambient, task and accent lighting. Exposure to eminent interior designers' works- Indian and international

TEXT BOOKS:

1) Archi World. Interior Best Collection: Residence, Commerce, Office, Restaurant Asia I-IV. Archi World Co., Korea, 2003.
2) Friedmann, Arnold and Others. Interior Design: An Int. to Architectural Interiors. Elsevier, New York, 1979.
3) Miller, E. William. Basic Drafting for Interior Designers. Van Nostrand Reinhold, New York, 1981.

CO-PO/PSO MATRIX MAPPING:

CE324/4 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	-	-	-	-		3	1	3	-	-
CO2	3	3	3	3	3	3	3	-	-	-	3	3	-	3	-	-
CO3	3	3	3	3	3	3	3	-	-	-	3	3	1	3	-	-
CO4	3	3	3	3	3	3	-	-	-	-	3	3		3	-	-
CO5	3	3	3	3	3	3	-	-	-	-	3	3	-	3	-	-
CO6	3	3	3	3	3	3	-	-	-	-	3	3	-	-	-	-
CO7	3	3	3	3	3	3	-	-	-	-		3	-	-	-	-
TOTAL	3	3	3	3	3	3	3	-	-	-	3	3	1	3	-	-

CE 325/1 (R20): ESTIMATION SPECIFICATION & COSTING

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- To understand the different items of works their measuring units and deduction to be made.
- To be able to extract the dimensions and other parameters required from the given drawings.
- To gain knowledge in calculating the quantities for different items of work.
- To understand the principle of contract system, tendering, M-book and valuation.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: Identifying the main items of work and their units of measurements.

CO2: Understanding how to extract dimensions from the given plan, identifying number of corners and junctions. Calculating the quantities for load bearing structures.

CO3: Extracting required dimensional quantities and preparing bar bending schedule for all reinforced concrete elements.

CO4: Preparing levels for existing ground and formation levels for road work and canal works.

CO5: Understanding various types of contracts, estimates, tenders, valuation and specifications for all types of works.

UNIT – I

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

ESTIMATE OF RCC WORKS

Standard hooks and cranks; Estimate of RCC slab; RCC beam; RCC T–beam slab 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

SPECIFICATIONS

Purpose and method of writing specifications; General specifications. Detailed Specifications for Brick work; R.C.C; Plastering; Mosaic Flooring; R.R.StoneMasonary.

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

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.

UNIT – V

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.

NOTE: Two questions of 12 marks each will be given from each unit out of which one is to be answered.

TEXT BOOKS:

1) Estimating & Costing in Civil Engineering by B.N. Dutta; U. B. S. Publishers & Distributors, New Delhi.
2) Valuation of Real properties by S. C. Rangwala; Charotar Publishing House, Anand.

CO-PO/PSO MATRIX MAPPING:

CE325/1 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	-	1	-	1	1	-	-	1
CO2	2	3	2	1	-	-	-	-	-	1	-	1	1	-	-	1
CO3	2	3	1	1	-	-	-	-	-	1	-	1	1	2	2	1
CO4	2	3	2	1	-	-	-	-	-	1	-	1	1	2	2	1
CO5	3	2	-	-	-	-	-	-	-	1	-	1	1	2	2	1
TOTAL	3	3	3	3	-	-3	-	-	-	1	-	3	1	3	2	1

CE 325/2 (R20): GEO-SYNTHETICS

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

The Objectives of the course are to impart to the student

- An overview of the evolution of new construction materials in geotechnical engineering and to initiate geo synthetic materials.
- Understanding the properties and the testing methods of different types of materials of go synthetics.
- The knowhow of manufacturing methods, uses and applications of geo textiles, geo grids, geo membranes and geo composites.
- The concepts of designing geo synthetics for the functions of separation, reinforcement, stabilization, filtration, drainage and moisture barriers.
- Designing criteria of reinforced earth retaining walls, gabions, pond liners, covers for reservoirs, canal liners, landfill liners, caps and closures, dams and embankments.
- Additional advantages of geo composites, geo-webs and geo-cells, and moisture barriers and natural geo textiles etc. for applications to meet various functions.

COURSE OUTCOMES:

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

CO1 Student can realize the need and demand for the use of geosynthetic materials in the field of geotechnical construction works.

CO2 Conduct required laboratory and field tests to obtain the properties of different materials of geosynthetic

CO3 Distinguish and describe various manufacturing methods of geotextiles, geogrids, geomembranes and geocomposites.

CO4 Understand concepts and could design the geosynthetic for the functions of separation, reinforcement, stabilization, filtration, drainage and moisture barriers.

CO5 Design reinforced earth retaining walls, gabions, pond liners, covers for reservoirs, canal liners, landfill liners, caps and closures.

UNIT I

TYPES, APPLICATIONS AND FUNCTIONS OF GEOSYNTHETIC: Introduction – Types of Geosynthetic – Function: Reinforcement, separation, drainage, filtration and barrier – Uses and Applications.

UNIT II

MANUFACTURE, PROPERTIES AND TESTING METHODS OF GEOSYNTHETIC:

Raw materials – manufacturing process of various types of geosynthetic.

UNIT III

DESIGN OF REINFORCED EARTH RETAINING WALLS: Types of soil reinforced structures like wrap- around walls full height panel walls discrete facing panel walls modular block walls, Construction aspects - Usage of BS 8006 FHWA design codes Internal and External stability analyses Seismic loads.

UNIT IV

DESIGN OF REINFORCED EARTH SLOPES: Basal reinforcement for construction on soft clay soils, construction of steep slopes with reinforcement layers on stable foundation soil, different slope stability analysis, erosion control on slopes using geosynthetics.

UNIT V

DESIGN OF FILTERS, DRAINS, PREFABRICATED VERTICAL DRAINS AND EROSION CONTROL MEASURES USING GEOSYNTHETICS: Different filtration requirements Criteria for selection of geotextiles for filtration, Erosion control techniques for slopes and coastal regions, Designing of PVD for stabilizing soft and marine soils.

REFERENCE BOOKS:

1) "Designing with Geosynthetics" by Robert M. Koerner Prantice Hall, Eaglewood Cliffs, NJ 07632.
2) "Construction and Geotechnical Engineering using Synthetic Fabries" by Robert M. Koerner and Josoph P. Welsh. John Willey and Sons, New York.
3) "Engineering with Geosynthetics", by G. Venkatappa Rao and GVS Suryanarayana Raju – Tata McGraw Hill Publishing Company Limited, New Delhi.
4) "Foundation Analysis and Design" by J.E. Bowles McGraw Hill Publications.
5) FHWA code
6) BS 8006 code

CO-PO/PSO MATRIX MAPPING:

CE325/2 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	1	-	1	-	1	1	-	-	-	-	3	1	-
CO2	1	2	2	2	2	-	1	-	-	-	-	-	-	3	-	-
CO3	2	3	2	2	2	-	-	-	-	-	-	-	-	3	1	-
CO4	1	3	3	2	2	1	1	-	-	-	-	-	-	3	1	-
CO5	1	3	2	2	1	2	1	-	-	-	-		-	3	-	
TOTAL	3	3	3	3	3	3	1	1	-1	-	-	-	-	3	1	-

CE 325/3 (R20): CONSTRUCTION SAFETY MANAGEMENT

L-3	T-0	P-0	M-100	C-3

COURSE LEARNING OBJECTIVES:

- To learn and understand the importance of safety n construction projects
- To learn the ways of effective safety management system and ensure safe construction work place and projects.
- To understand the advantage of following safety policies and educate the workers.

COURSE OUTCOMES:

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

CO1 To identify any underlying causes and implications for the design and operation of the safety and health management system

CO2 To understand the requirements of safety and health legislation

CO3 To understand the safe working procedures for specialized or heavy works at site

CO4 To realize the need for the organization to develop an understanding o risks and risk control

CO5 To connect the quality, the workplace environment, safety and health of employees

UNIT-I

Introduction to Safety Management – Safety in Indian Construction Sites,
Industrial Safety, Health Management, Environment Management, IS Safety Codes.

UNIT-II

Protective Clothing & Safety Equipment – requirement and equipments, Need for Safety training & Courses – Employees.

UNIT-III

Physical Injury hazards – scaffolding, formwork Structural framework, roof work, cranes & heavy lifting, transport & mobile plants, highways, tunneling, sewers &confined spaces, demolition & contaminated sites, work over water.

UNIT-IV

Health Hazards – Chemical, physical & biological hazards, Site arrangements for health safety & welfare – first-aid facilities and first-aiders, Reporting injuries and investigation of accidents, Legislation – Health & safety policy statements.

UNIT-V

Safety organization, safety management contracting & sub-contracting – Pre contract activities, survey & investigation, Design & specification for safe construction – management and costs of safety, Safety groups & schemes.

TEXT BOOKS:

1) Kwaku.A., Tena, Jose, M. Guevara, Fundamentals of Construction Management
2) and Organisation, Reston Publishing Co., Inc., 1985
3) John V. Grimaldi, Safety Management, Richard D Irwin,1994
4) Construction Project Management, Kumar Neeraj Jha, Pearson Publications, 2011.

CO-PO/PSO MATRIX MAPPING:

CE325/3 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	1	-	1	-	1	1	-	-	-	-	3	-	1
CO2	1	2	2	2	2	-	1	-	-	-	-	-	-	3	-	-
CO3	2	3	2	2	2	-	-	-	-	-	-	-	-	3	-	1
CO4	1	3	3	2	2	1	1	-	-	-	1	-	-	3	-	1
CO5	1	3	2	2	1	2	1	-	-	-	-	-	-	3	-	-
TOTAL	3	3	3	3	3	3	1	1	1	-	1	-	-	3	-	1

CE 325/4 (R20): CONSTRUCTION ECONOMIC & FINANCE

L-3	T-0	P-0	M-100	C-3

COURSE LEARNING OBJECTIVES:

- To understand the concept quantifying alternatives for decision making.
- To understand the concepts of Time value of money.
- To understand the comparison of alternatives.
- To understandtheconceptsofdepreciation,inflationandtaxesandcost–estimating
- To understand the concepts of equipment economics
- To understand the concepts of introduction to financial management

COURSE OUTCOMES:

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

CO1	Understand the concept quantifying alternatives for decision making.
CO2	Understand the concepts of Time value of money.
CO3	Understand the comparison of alternatives.
CO4	Understand the concepts of depreciation, inflation and taxes and cost–estimating
CO5	Understand the concepts of equipment economics
CO6	Understand the concepts of introduction to financial management

UNIT-I

INTRODUCTION: Basic Principles - Time value of money, Quantifying alternatives for decision making, Cash flow diagrams.

UNIT-II

TIME VALUE OF MONEY: Equivalence- Single payment in the future (P/F, F/P), Present payment compared to uniform series payments (P/A, A/P), Future payment compared to uniform series payments (F/A, A/F), Arithmetic gradient, Geometric gradient.

UNIT-III

COMPARISON OF ALTERNATIVES: Comparison of alternatives: Present, future and annual worth method of comparing alternatives, Rate of return, Incremental rate of return, Breakeven comparisons, Capitalized cost analysis, Benefit-cost analysis.

UNIT-IV

DEPRECIATION, INFLATION AND TAXES AND COST – ESTIMATING: Depreciation, Inflation, Taxes; Types of Estimates, Approximate estimates – Unit estimate, Factor estimate, Cost indexes, Parametric estimate, Life cycle cost.

UNIT V

EQUIPMENT ECONOMICS: Equipment costs, Ownership and operating costs, Buy / Rent / Leaseoptions, Replacement analysis.

TEXT BOOK:

1) Phillip F. Ostwald, 'Construction Cost Analysis and Estimating', 1st Edition, 2000, Prentice Hall, Upper Saddle River, New Jersey.

REFERENCE BOOKS:

1) Peterson, S. J., 'Construction Accounting and Financial Management',3rd Edition, 2012, Pearson Education, New Jersey.
2) Peurifoy, R. L., Schexnayder, C. J. and Shapira, A., 'Construction Planning, Equipment, and Methods', 9thEdition., 2018,Tata McGraw-Hill, New Delhi.

CO-PO/PSO MATRIX MAPPING:

CE325/4 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	1	-	1		1	1	-	-	-	-	3	-	1
CO2	1	2	2	2	2	-	1	-	-	-		-	-	3	1	-
CO3	2	3	2	2	2			-	-	-		-	-	3	1	1
CO4	1	3	3	2	2	1	1	-	-	-	1	-	-	3	-	1
CO5	1	3	2	2	1	2	1	-	-	-		-	-	3	-	-
TOTAL	3	3	3	3	3	3	1	1	1	-	1	-	-	3	1	1

CE 326 (R20): MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

L-3	T-0	P-0	M-100	C-0

COURSE OBJECTIVES:

- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting.
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis.
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles.
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation.
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1 A student will be able to understand basic economics as well as management concepts, knowledge of estimating the Demand and demand elasticity for a product.

CO2 The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs & break- even analysis.

CO3 The student is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.

CO4 The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis.

CO5 The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

UNIT -I

INTRODUCTION TO MANAGERIAL ECONOMICS AND DEMAND ANALYSIS:

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

UNIT -II

THEORIES OF PRODUCTION AND COST ANALYSES:

Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and TOTAL costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

UNIT -III

INTRODUCTION TO MARKETS, THEORIES OF THE FIRM & PRICING POLICIES:

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles: Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms.

UNIT -IV

INTRODUCTION TO ACCOUNTING & FINANCING ANALYSIS:

Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems).

UNIT -V

CAPITAL AND CAPITAL BUDGETING

Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods (pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index).

TEXT BOOK:

1) A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

REFERENCE BOOKS:

1) Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd,
2) JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition

3) N.P Srinivasn and M. Sakthivel Murugan, Accounting for Management, S. Chand & Company Ltd.,
4) Maheswari S.N, AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd
5) I.M Pandey, Financial Management, Vikas Publishing House Pvt Ltd
6) Maheswari, Managerial Economics, S. Chand & Company Ltd.

CO-PO/PSO MATRIX MAPPING:

CE326 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	1	1	1	1	1	2	1	1	3	2	3	1	-	2
CO2	1	2	1	1	1	1	1	2	1	3	3	1	3	1	-	2
CO3	1	2	2	2	3	1	1	2	3	2	3	1	3	1	-	2
CO4	1	2	2	3	3	1	1	2	3	2	3	1	3	1	-	2
CO5	1	3	1	3	3	2	1	2	3	2	3	1	3	1	-	2
TOTAL	1	3	3	3	3	3	1	3	3	3	3	3	1	1	-	2

CE 361 (R20): GEOTECHNICAL ENGINEERING LAB

L-0	T-0	P-3	M-100	C-1.5

LEARNING OBJECTIVES:

The objective of this course is:

- To determine the index properties for soil classification – Grainsize distribution & Atterberg's limits.
- To determine the engineering properties–Permeability, Compaction, consolidation, shear strength Parameters & CBR value.
- To find the degree of swelling by DFS test.
- To impart knowledge of determination of index properties required for classification of soils.
- To teach how to determine compaction characteristics and consolidation behavior from relevant lab tests; to determine permeability of soils.
- To teach how to determine shear parameters of soil through different laboratory tests.

COURSE OUTCOMES:

Upon successful completion of this course, student will be able to-

1) Determine ex properties of soil and classify them.
2) Determine permeability of soils.
3) Determine Compaction, Consolidation and shear strength characteristics.

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

LIST OF EXPERIMENTS:

1) Determination of water content by oven drying method.
2) Determination of specific gravity by
    a) Density bottle method
    b) Pycno meter method.
3) Gradation analysis
    c) Mechanical Sieve analysis
    d) Hydrometer analysis.
4) Determination of Atterberg limits
5) Determination of free swell index
6) Determination of field unit weight by
    e) Core cutter method.
    f) Sand replacement method.

7) Determination of permeability by
    g) Constant head permeameter.
    h) Variable head perameameter.
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) Consolidation test

CO-PO/PSO MATRIX MAPPING:

CE361 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	3	1	2	1	2	1	1	-	-	-	1	3	-	3
CO2	1	3	3	2	2		1	-	-	-	--	-	-	3	-	3
CO3	2	3	2	2	2	1	1	-	-	-	1	-	1	3	-	3
CO4	2	3	2	2	2	1	1	-	-	-	1	-	-	3	-	3
CO5	2	3	2	2	1	2	1	-	-	-	-	-	-	3	-	3
TOTAL	3	3	3	3	3	3	3	1	1	-	1	-	1	3	-	3

CE362 (R20): TRANSPORTATION ENGINEERING LAB

L-0	T-0	P-3	M-100	C-1.5

COURSE OBJECTIVES:

To introduce

- Aggregates and its engineering behavior
- Bitumen and its engineering behavior

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: Test aggregates and judge the suitability of aggregates for the road construction

CO2: Test the given bitumen samples and judge their suitability for the road construction.

CO3: Demonstrate the optimum bitumen content for the mix design

CO4: Demonstrate the CBR % for the soil sample.

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

TESTS ON AGGREGATES:

1) Aggregate Crushing value test.
2) Aggregate impact value test.
3) Los Angele's 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.

TESTS ON BITUMINOUS MATERIALS:

1) Penetration test.
2) Softening point test.
3) Flash and fire point test.
4) Ductility test.
5) Viscosity test.
6) Bitumen Extractions Test.
7) Specific gravity of Bitumen.

TEST ON BITUMINOUS MIXES

1) Marshall stability test.

TEST ON SOIL SUBGRADE

1) California bearing ratio test.

CO-PO/PSO MATRIX MAPPING:

CE362 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	3	-	3	-	1	1	-	3	1	-	-	1	-	3	-
CO2	2	3	-	3	-	1	1	-	3	1	-	-	-	-	3	-
CO3	2	3	2	3	-	1	1	-	3	1	-	-	-	-	3	-
CO4	2	3	2	3	-	1	1	-	3	1	-	-	1	-	3	-
TOTAL	3	3	2	3	-	3	1	-	3	1	-	-	1	-	3	-

CE363 (R20): DETAILING & DRAWING OF STRUCTURES

L-0	T-0	P-3	M-100	C-1.5

COURSE OBJECTIVES:

- To make the student learn the fundamental concept of issuing drawings.
- To understand and familiarize the student on how to issue good for construction drawings as per the guidelines given in IS codes.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: To demonstrate a comprehensive understanding of fundamentals in detailing of structures.

CO2: To understand the principle of detailing flexural members with different support conditions.

CO3: To understand the principle of detailing columns and footings for RCC structures.

CO4: To give good detailing and drawing for the multistory structure.

CO5: To give detailing for a steel truss.

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

LIST OF DRAWINGS:

1) Detailing of Simply Supported Beam & Cantilever Beam.
2) Detailing of continuous beam with one end overhang.
3) Detailing of two way and one way slab.
4) Detailing of isolated footing.
5) Detailing of pile cap
6) Detailing of Flat slab interior panel.
7) Detailing of cantilever Retaining wall.
8) Typical detailing of R.C.C footing with steel column.
9) Detailing of beam to column framed connection (using bolts).
10) Detailing of beam to column moment resistant connection (using bolts).
11) Detailing of welded plate girder.
12) Detailing of gantry girder.
13) Detailing of welded column base.

CO-PO/PSO MATRIX MAPPING:

CE363 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	2	-	1	-	-	-	1	-	1	1	3	-	1
CO2	1	2	3	2	-	1	-	-	-	1	-	1	1	3	-	1
CO3	2	2	3	2	-	1	-	-	-	1	-	1	1	3	-	1
CO4	2	2	3	2	-	1	-	-	-	1	-	1	1	3	-	1
CO5	2	2	3	2	-	1	-	-	-	1	-	1	1	3	-	1
TOTAL	2	2	3	2	-	1	-	-	-	1	-	1	1	3	-	1

CE364 (R20): STAAD PRO

L-0	T-0	P-3	M-100	C-2

Students are required to analyze and design the following structures using software package like STAAD Pro/STRUDS/GTSTRUDL/STRAP etc.

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Model the geometry of real-world structure Represent the physical model of structural element/structure
CO2	Perform analysis
CO3	Interpret from the Post processing results
CO4	Design the structural elements and a system as per IS Codes

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

CYCLE-1

(At least SIX of the following)

1) Analysis and design of continuous beam with simple supports on either ends.
2) Analysis and design of continuous beam with a fixed end support.
3) Analysis of single storey unsymmetrical portal frame
4) Analysis and design of plane frame subjected to gravity loading.
5) Analysis and design of plane frame subjected to gravity loads and lateral load (wind load)
6) Analysis and design of plane roof truss (DL+LL).
7) Analysis and design of plane roof truss (DL+WL).

CYCLE-2

(At least FIVE of the following*)*

1) Design of one-way slab
2) Design of two way slab
3) Design of Cantilever Retaining wall
4) Design of Counterfort Retaining wall
5) Design of Isolated footing.
6) Design of Pile foundation.

CYCLE-3

(At least one of the following)

1) Analysis and design of two-storied R.C.C.Framed building.
2) Analysis and design of Industrial steel building.

CO-PO/PSO MATRIX MAPPING:

CE364 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	2	-	1	-	-	-	1	-	1	1	3	-	1
CO2	1	2	3	2	-	1	-	-	-	1	-	1	1	3	-	1
CO3	2	2	3	2	-	1	-	-	-	1	-	1	1	3	-	1
CO4	2	2	3	2	-	1	-	-	-	1	-	1	1	3	-	1
CO5	2	2	3	2	-	1	-	-	-	1	-	1	1	3	-	1
TOTAL	2	2	3	2	-	1	-	-	-	1	-	1	1	3	-	1

SEMESTER VII

B.Tech. CIVIL ENGINEERING

SEMESTER-VII

CE411/1 (R20): LIQUID AND SOLID WASTE MANAGEMENT

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1 Describe various sources and characteristics of wastewater, sewage treatment and maintain Cleanliness of the city.

CO2 Adopt various treatment methods available for wastewater treatment and chemical activities in the sewage.

CO3 Students will gain knowledge about Design Septic Tanks, Analyse the functions of various waste water treatment units and house plumbing for building drainage.

CO4 Design various units for waste water treatment and Analyse the different methods used for treating and disposal of sewage sludge.

CO5 Students will learn about Solid and Hazardous waste management, application of various techniques for waste minimization, re-cycle, re-use and wealth from waste.

UNIT-I

INTRODUCTION TO SANITARY ENGINEERING

Sanitation, Sewerage Systems, Sanitary Sewage and Storm Water Sewage, Factors affecting Sanitary Sewage and Storm Water Sewage, Quantity Determination

SEWERS AND SEWER APPURTENANCES

Types of Sewers, Design and Construction of Sewers, Testing and Maintenance of Sewers.

Sewer Appurtenances; Man Holes, Drop man Holes, Inverted Siphons, Street Inlets, Catch Basins; Storm Water Regulators, Sewage Pumping.

UNIT-II

QUALITY AND CHARACTERISTICS OF SEWAGE

Characteristics of Sewage, Decomposition of Sewage, Carbon, Nitrogen Sulphur Cycles of Decomposition, BOD, COD, Physical and Chemical analysis of Sewage

PRIMARY AND SECONDARY TREATMENT OF SEWAGE

Screens, Grit Chambers, Grease Traps, Skimming Tanks, Sedimentation Tanks. Trickling Filters, principles of Action, Filter Types, Recirculation, Operational Problems and Remedies. Activated Sludge Process, Principles of Action, Features of Operation, Organic Loading Parameters. Methods of Aeration. Activated Sludge vs Trickling Filter Process: Sludge Bulking, Sludge Volume Index, Secondary Settling Tanks, and Oxidation Ponds.

UNIT-III

SEPTIC TANK AND SEWAGE DISPOSAL

Septic Tank Design, Septic Effluent Disposal, Soak Pits, Leaching Cesspools. Sewage Disposal Objects and Methods, Sewage Sickness.

SLUDGE TREATMENT AND DISPOSAL

Characteristics of Sewage Sludge, Anaerobic Sludge Digestion Process, Stages of Sludge Digestion, Factors affecting Sludge Digestion, Sludge Digestion Tank, Methods of Dewatering the Sludge, Methods of Sludge Disposal.

HOUSE PLUMBING

House Drainage, Sanitary Fittings, Traps, Plumbing System of drainage: Single Stack, One Pipe and Two Pipe System. Principles governing design of Building drainage.

UNIT-IV

INTRODUCTION TO SOLID WASTE MANAGEMENT

Goals and Objectives of Solid Waste Management, Classification of Solid Waste, Factors influencing Generation of Solid waste, Legislation and Monitoring Responsibilities, Terminology

COLLECTION AND TRANSPORTATION

Methods of Waste Collection System, Analysis of Collection System, Rout maps for collection, Alternative Techniques for collection. Transfer Stations, Segregation, Compaction, Transformation and Materials Recovery, Source Reduction and Minimization

UNIT-V

PROCESSING AND TREATMENT OF SOLID WASTE

Combustion and Energy Recovery, Incinerators, Composting Methods, Anaerobic and Aerobic methods for Material Recovery and Treatment, Biogas Production and Cleaning.

DISPOSAL OF SOLID WASTE

Methods of Disposal, Landfills: Site selection, Design and Operation, Drainage and Leachate Collection Systems, Designated Waste Landfill remediation, Case studies.

HAZARDOUS WASTE MANAGEMENT

Introduction, Sources, Collection, Transportation, Treatment and Disposal methods. Bio-Medical Waste Management. E-Waste Management. Environmental Laws Related to Waste Management. Case Studies. Public Awareness.

TEXT BOOKS:

1) Elements of Public Health Engineering by K.N Duggal. S. Chand & Company Limited., New- Delhi
2) Manual on Sewage & Sewerage treatment: CEPH and EEO, Ministry of Works and Housing.
3) Integrated Solid Waste Management, George Techonologus, McGrow Hill Publication-1993.

4) Hazardous Waste Management, Charles A. Wentz, McGrow Hill publications-1995.

CO-PO/PSO MATRIX MAPPING:

CE411/1 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	2	2	3	2	--	--	1	2	3	2	3	3
CO2	3	2	2	2	2	2	3	1	--	1	1	2	3	2	2	3
CO3	3	2	2	2	2	2	3	--	1	--	1	2	3	2	2	3
CO4	3	3	2	2	3	2	3	1	--	--	1	2	3	2	2	3
CO5	3	3	2	2	3	2	3	3	1	1	1	2	3	2	3	3
TOTAL	3	3	3	3	3	3	3	3	1	1	3	3	1	3	3	3

CE411/2 (R20): AIRPORT& HARBOR ENGINEERING

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- To expose the students to planning, design, construction, maintenance and design principles of airports and harbors.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: Know the planning of airport and its components in layout.

CO2: To impart knowledge to students the airport design and understood the basic needs in the airport construction.

CO3: Understand the maintenance and rehabilitation of airfield pavements.

CO4: Attain knowledge on components in harbor layout.

CO5: planning & design of harbor and other costal structures.

AIRPORT ENGINEERING

UNIT – I

AIRPORT PLANNING & DESIGN:

INTRODUCTION

Development of air transportation system with particular reference to India; Aeroplane components; Air–craft characteristics.

AIRPORT PLANNING AND LAYOUT

Selection of site; Apron; Hanger; Typical airport layouts; Airport marking; Airport lighting; Drainage systems.

AIRPORT OBSTRUCTION

Zoning laws; Classification of obstructions; Imaginary surfaces; Approach zone; Turning zone.

UNIT – II

RUNWAY DESIGN:

Runway orientation; Basic runway length; Corrections for elevation; Temperature and gradient; Runway geometric design.

SPECIFICATIONS FOR STRUCTURAL DESIGN OF AIRPORT PAVEMENT

Design factors methods for flexible and rigid pavements; LCN system of pavement design.

UNIT - III

MAINTENANCE AND REHABILITATION OF AIRFIELD PAVEMENTS– Evaluation & Strengthening of Airfield pavements – Airport Drainage – Design of surface and subsurface drainage.

DOCKS AND HARBOR ENGINEERING

UNIT - IV

INTRODUCTION

Types of water transportation; Economics and advantages of water transportation.

PLANNING, LAYOUT:

Classification of ports – Requirement of a good port – classification of Harbours – Docks - Dry & wet docks – Transition sheds and workhouses – Layouts; Quays – construction of Quay walls – Wharves – Jetties – Tides - Tidal data and Analysis – Break waters – Dredging.

UNIT – V

CONSTRUCTION:

Size and Shape of Harbour and Turning Basin – Type- Location and Height of Breakwaters – Location and Width of Entrance to Harbour – Depth of Harbour and Navigational Channel – Number- Location and Type of Docks or Berths or Jetties.

MAINTENANCE OF DOCKS AND HARBORS:

Maintenance of Ports and Harbors – Navigational aids.

TEXT BOOKS:

1) Airport Engineering by Khanna & Arora - Nemchand Bros, New Delhi.
2) Docks and Harbor Engineering by Bindra S.P. - Dhanpathi Rai & Sons, New Delhi.
3) Design & Construction of ports and Marine structures by Quinn- A.D.F.- McGraw-Hill.

REFERENCE BOOKS:

1) 'Highway, Railway, Airport and Harbor Engineering' by Subramanian KP, Scitech Publications (India) Pvt Limited, Chennai.
2) A Text book of Transportation Engineering by S.P.Chandola, S. Chand & Company pvt. Ltd., New Delhi.

CO-PO/PSO MATRIX MAPPING:

CE411/2 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	2	-	-	1	-	3	-
CO2	3	-	2	-	-	-	-	-	-	-	-	-	1	-	3	-
CO3	2	2	3	-	-	-	-	-	1	1	-	-	1	-	3	-
CO4	3	-	-	-	-	-	-	-	-	1	-	-	1	-	3	-
CO5	2	2	3	-	-	-	-	-	1	1	-	-	1	-	3	-
TOTAL	3	2	3	-	-	-	-	-	1	1	-	-	1	-	3	-

CE411/3 (R20): ADVANCED FOUNDATION ENGINEERING

L-3	T-0	P-0	M-100	C-3

COURSE LEARNING OBJECTIVES:

- To Analysis and interpretation of soil exploration data.
- To estimate the soil parameters for design of foundations.
- To design the shallow foundations.
- To understand the concept of pile foundations.
- To understand the concept of retaining walls.
- To understand the concept of reinforced earth.

COURSE OUTCOMES:

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

CO1 Student can Understand and Analyze the bearing capacity of soils.

CO2 Settlement analysis in different types of soil

CO3 Design the shallow foundations.

CO4 Design the deep foundations.

CO5 Elaborate the concepts of earth pressure theory and stability of slopes.

CO6 Discuss of Foundations in expansive

UNIT-I

Bearing capacity of Foundations using general bearing capacity equation – Meyerhof's, Brinch Hansen's and Vesic's methods.

UNIT-II

Settlement analysis: Immediate settlement of footings resting on granular soils – Schmertmann& Hartman method – De Beer and Martens method – Immediate settlement in clays – Janbu's method – correction for consolidation settlement using Skempton and Bjerrum's method – Correction for construction period.

UNIT-III:

Mat foundations – Purpose and types of isolated and combined footings – Mats/ Rafts – Proportioning of footings – Ultimate bearing capacity of mat foundations – allowable bearing capacity of mats founded in clays and granular soils – compensated rafts.

UNIT-IV:

Pile foundations – single pile versus group of piles – load-carrying capacity of pile groups – negative skin friction (NSF) -settlement of pile groups in sands and clays – laterally loaded piles in granular soils – Reese and Matlock method – laterally loaded piles in cohesive soils – Davisson and Gill method – Broms' analysis.

UNIT-V

Foundations in expansive soils – definitions of swell potential and swelling pressure – determination of free swell index – factors affecting swell potential and swelling pressure – foundation practices – sand cushion method – CNS layer – drilled piers and belled piers – under-reamed piles – moisture control methods.

TEXT BOOKS:

1) 'Basic and applied soil mechanics' by Gopal Ranjan and ASR Rao, New Age Publishers.
2) 'Soil Mechanics and Foundation Engineering' by VNS Murthy, CBS Publishers.
3) 'Principles of Foundation Engineering' by BM Das, Thomson Brooks/Cole.

REFERENCE BOOKS:

1) 'Foundation Analysis and Design' by JE Bowles, John Wiley.
2) 'Foundation Design' by WC Teng, Prentice Hall Publishers

CO-PO/PSO MATRIX MAPPING:

CE411/3 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	3	3	1	2	1	2	-	-	-	-	-	1	-	-	3
CO2	1	3	3	2	2	-	1	-	-	-	-	-	-	-	-	3
CO3	2	3	2	2	2	-	1	-	-	-	1	-	-	-	-	3
CO4	2	2	2	2	2	-	1	-	-	-	1	-	1	-	-	3
CO5	2	3	2	2	1	-	1	-	-	-	-	-	1	-	-	3
TOTAL	3	3	3	3	3	1-	2	-	-	-	1	-	1	-	-	3

CE411/4 (R20): BRIDGE ENGINEERING

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- To explain various investigations to be conducted before constructing a bridge.
- To introduce various types of RC bridges and IRC loadings.
- To design T-beam bridge, RC slab culvert.
- To design pier and abutment for bridges.
- To design well foundation for bridges and design elastomeric pad bearing.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to-

CO1: Understand about the various investigations to be conducted before construct ring a bridge.

CO2: Know about various types of RC bridges and IRC loadings.

CO3: To design slab culvert, T-beam bridge.

CO4: To design substructure like piers and abutments.

CO5: Know various types of bearings, and types of foundations used for bridges.

UNIT – I

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.

UNIT – II

CONCRETE BRIDGES

Various types of bridges; I. R. C. Specifications for road bridges.

CULVERTS

Design of R. C. slab culvert.

UNIT – III

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 – IV

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 – V

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.

TEXT BOOK:

1) Essentials of Bridge Engineering by Dr. Johnson Victor; Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

REFERENCE BOOK:

1) Design of bridge structures by Jagadeesh and Jayaram, PHI Learning

CO-PO/PSO MATRIX MAPPING:

CE411/4 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	2	-	-	-	-	-	1	-	1	1	2	-	1
CO2	1	2	3	2	-	-	-	-	-	1	-	1	1	2	-	1
CO3	2	2	3	2	-	-	-	-	-	1	-	1	1	2	1	1
CO4	2	2	3	2	-	-	-	-	-	1	-	1	1	2	1	1
CO5	2	2	3	2	-	-	-	-	-	1	-	1	1	2	1	1
TOTAL	3	3	3	3	-	-	-	-	-	1	-	1	1	2	1	1

CE412/1 (R20): REPAIR& REHABILITATION OF STRUCTURES

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

To make the student understand the numerous reasons of cracking in buildings. Diagnose the roof cause and suggest necessary precautions to stop the loss and treat them with the latest polymers and chemicals to retrieve the structure to original position. Strengthen techniques used to rehabilitate the structure to its original form.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: Evaluating the reasons behind cracking in masonry, framed structures.

CO2: Understanding the behavior of repair materials, polymers and grouting chemicals used for renovation in buildings.

CO3: Analyze the extent of damage, crack width, depth and prepare the substrate for repair.

CO4: Diagnose various reasons for corrosion and repairing the elements subjected to corrosion.

CO5: Identifying the weakest zone or deteorated part of a structural element and strength it.

UNIT-I

INTRODUCTION

Maintenance, rehabilitation, repair, retrofit and strengthening, need for rehabilitation of structures.

CRACKS IN R.C. BUILDINGS

Various cracks in R.C. buildings, causes and effects

MAINTENANCE

Maintenance importance of maintenance, routine and preventive maintenance.

DAMAGES TO MASONRY STRUCTURES

Various damages to masonry structures and causes

UNIT-II

REPAIR MATERIALS

Various repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials

SPECIAL MORTARS AND CONCRETES

Polymer Concrete and Mortar, Quick setting compounds

GROUTING MATERIALS

Gas forming grouts, Salfoalumate grouts, Polymer grouts, Acrylate and Urethane grouts.

BONDING AGENTS

Latex emulsions, Epoxy bonding agents.

PROTECTIVE COATINGS

Protective coatings for Concrete and Steel

FRP sheets

UNIT-III

DAMAGE DIAGNOSIS AND ASSESSMENT

Visual inspection, Non Destructive Testing using Rebound hammer, Ultra sonic pulse velocity, Semi destructive testing, Probe test, Pull out test Chloride penetration test, Carbonation, Carbonation depth testing, Corrosion activity measurement

SUBSTRATE PREPARATION

Importance of substrate/surface preparation, General surface preparation methods and procedure, Reinforcing steel cleaning.

UNIT-IV

CRACK REPAIR

Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Auto genous healing, Overlays, Repair to active cracks, Repair to dormant cracks.

CORROSION OF EMBEDDED STEEL IN CONCRETE

Corrosion of embedded steel in concrete, Mechanism, Stages of corrosion damage, Repair of various corrosion damaged of structural elements (slab, beam and columns)

UNIT-V

JACKETING

Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, Reinforced concrete jacketing, Steel jacketing, FRP jacketing.

STRENGTHENING

Strengthening, Beam shear strengthening, Flexural strengthening

TEXT BOOKS:

1) "Repair and protection of concrete structures" by Noel P.Mailvaganam, CRC press London.
2) "Concrete repair and maintenance Illustrated" by Peter.H.Emmons, Galgotia publishers.
3) "Earthquake resistant design of structures" by Pankaj agarwal, Manish shrikande, PHI.

REFERENCE BOOKS:

1) "Failures and repair of concrete structures" by S.Champion, John wiley and sons.
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", CPWD, Indian buildings congress, IIT Madras, Narosa Publishing House.

CO-PO/PSO MATRIX MAPPING:

CE412/1 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	1	-	2	1	-	-	-	-	1	1	2	-	1
CO2	3	-	-	1	-	2	1	-	-	-	-	1	1	2	-	1
CO3	3	-	-	1	-	1	1	-	-	-	-	1	1	2	-	1
CO4	3	-	-	1	-	2	1	-	-	-	-	1	1	2	-	1
CO5	3	-	-	1	-	1	1	-	-	-	-	1	1	2	-	1
TOTAL	3	-	-	1	-	3	1	-	-	-	-	3	1	3	-	1

CE412/2 (R20): WATERSHED MANAGEMENT

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

This course will enable students to:

CO1: Define goals and objectives to address water resources problems.

CO2: Understand Federal, State, regional, and local policies as they apply to watershed management.

CO3: Delineate a watershed utilizing GIS mapping techniques.

CO4: Develop and implement a watershed management plan.

CO5: Examine the various engineering, institutional, governance, legal, and financial frameworks needed for successful implementation of a watershed management plan.

UNIT – I

INTRODUCTION: Concept of watershed development, objectives of watershed development, need for watershed development, Characteristics of Watersheds: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socioeconomic characteristics.

UNIT - II

PRINCIPLES OF EROSION:

Types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion-Universal soil loss equation. Measures to Control Erosion: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams, rock-fill dams, brushwood dam, Gabion.

UNIT - III

WATER HARVESTING:

Techniques of rain water harvesting- rain water harvesting from roof top, surface flow harvesting, subsurface flow harvesting, stop dams, farm ponds and dugout ponds, percolation tanks.

UNIT - IV

LAND MANAGEMENT:

Land use and Land capability classification, management of forest, agricultural, grassland and wild land, land grading operation, Reclamation of saline and alkaline soils.

UNIT - V

WATERSHED MODELLING:

Data of watershed for modelling, application and comparison of watershed models, model calibration and validation, advances of watershed models. Integrated and multidisciplinary approach for watershed management.

TEXT BOOKS:

1) 'Watershed Management' by Das MM and M.D Saikia, PHI Learning Pvt. Ltd, 2013.
2) 'Land and Water Management' by Murthy.VVN, Kalyani Publications, 2007.
3) 'Watershed Management' by Murthy J V S, New Age International Publishers, 2006.

REFERENCE BOOKS:

1) 'Water Resource Engineering'byWurbs R A and James R A, Prentice Hall Publishers, 2002.
2) 'Watershed Hydrology' by Black P E, Prentice Hall, 1996.

CO-PO/PSO MATRIX MAPPING:

CE412/2 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	1	-	2	1	-	-	-	-	1	1	2	-	1
CO2	3	-	-	1	-	2	1	-	-	-	-	1	1	2	-	1
CO3	3	-	-	1	-	1	1	-	-	-	-	1	1	2	-	1
CO4	3	-	-	1	-	2	1	-	-	-	-	1	1	2	-	1
CO5	3	-	-	1	-	1	1	-	-	-	-	1	1	2	-	1
TOTAL	3	-	-	1	-	3	1	-	-	-	-	3	1	3	-	1

CE412/3 (R20): STRUCTURAL HEALTH MONITORING

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- To impart the student, the concept of monitoring a structure health in all aspects by properly maintaining it periodically.
- To make the student familiarize with all the methods of assessing the structures present situation.
- Make them know how to restrengthen a old structure with proper testing and designing the same.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: To Understand the importance of structural health monitoring.

CO2: To understand and analyze the use of various sensors, NDT techniques to assess the structure health.

CO3: To make them learn and fix the perfect method of structural health monitoring suitable for the given structure.

CO4: To assess the requirement of retrofit to the structure by diagnosing the deficiency and deteoration factors.

CO5: To learn the methods of retrofitting a structure to its required form.

UNIT – I

INTRODUCTION OF STRUCTURAL HEALTH MONITORING:

Need of Structural Health Monitoring, Definition & Concept of SHM, SHM & Biomimetic Comparison of SHM with NDT, Types & Components of SHM, Procedure of SHM, Objectives & Operational Evaluations of SHM, Advantages of SHM.

UNIT – II

INSTRUMENTATIONS & SENSORS FOR SHM:

Basics of Instrumentations & Measurements, Classifications, Input-Output Configurations of Instruments, Static & Dynamic Charecteristics, Functions. Various Types of Electromechanical, Electronics & Digital Instruments for SHM. Data Acquisition Systems-Types, Hardware & It's Components. Basics of Sensors, Transducers & Actuators, Classification of Sensors, Characteristics & Working Principles of Various Types of Sensors like Strain Gauges, LVDT, Accelerometers etc. Concept of Smart Materials & Smart Structures with SHM, Basics of Smart Materials like Piezoelectric, Shape Memory Alloys, ER & MR Fluids.

UNIT - III

METHODS OF SHM:

Methodologies and Monitoring Principles, Local & Global Techniques for SHM, Static & Dynamic Field Testing, Short & Long-Term Monitoring, Active & Passive Monitoring. Vibration Based SHM Techniques - Use & Demonstration of Dynamic Properties of Structures for Damage Detection & SHM, Ambient Vibration Test, Acoustic Emission Technique, Electromechanical Impedance Technique, Wave Propagation Based Techniques, Fibre Optics Based Techniques, Remote & Wireless SHM Techniques, IoT Application in SHM, Artificial Intelligence & Machine Learning in SHM.

UNIT – IV

STRUCTURAL ASSESSMENT:

Structural Assessment & Need for retrofitting: Introduction to health assessment of structures, structural damages & failures, Principles of structural assessment, Classification & levels of assessment, Current scenario of infrastructure through case studies.

UNIT – V

RETROFITTING OF STRUCTURES:

Concept of repair & retrofitting of structures: Case studies of structural & foundation failure, performance problems, responsibility & accountability, causes of distress in structural members, design and material deficiencies, factors causing extensive Deterioration. Retrofitting of structures: Fundamental of retrofitting, Flow of retrofitting process, Methods of retrofitting, Materials for retrofitting (conventional and smart materials), selection of retrofitting methods.

NOTE: *Two questions of 14 marks each will be given from each unit out of which one is to be answered.*

TEXT BOOKS:

1) Structural Health Monitoring, Daniel Balageas, Peter Fritzen, Alfredo Guemes, John Wiley & Sons,2006.
2) Health Monitoring of Structural Materials and Components Methods with Applications by Douglas E.

REFERENCE BOOKS:

1) Adams, John Wiley and Sons, 2007. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan.
2) Taylor and Francis Group, London, UK, 2006.
3) Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc,2007.

CO-PO/PSO MATRIX MAPPING:

CE412/3 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	2	2	-	1	-	-	-	-	-	1	1	3	-	1
CO2	1	-	2	2	-	1	-	-	-	-	-	1	1	3	-	1
CO3	2	-	2	2	-	1	-	-	-	-	-	1	1	3	-	1
CO4	2	-	2	2	-	1	-	-	-	-	-	1	1	3	-	1
CO5	2	-	2	2	-	1	-	-	-	-	-	1	1	3	-	1
TOTAL	3	-	3	3	-	3	-	-	-	-	-	3	1	3	-	1

CE412/4 (R20): ADVANCED STRUCTURAL DESIGN

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

To demonstrate a comprehensive understanding of typical RCC designs used in the field and make them learn and design these elements with better strength, stability and service.

At the end of the Course/Subject, the students will be able to:

COURSE OUTCOMES:

CO1: To understand and design different types of combined foundations.

CO2: To evaluate the capacity of deep piles and design of various types of piles and pile caps.

CO3: To understand the behavior of domes and design them.

CO4: To analyze the building frames for different loading conditions.

CO5: To restrengthen the elements of an RCC structure deficient in shear, flexure and axial loads.

UNIT – I

COMBINED FOOTINGS

Combined Footings, Strap Footings, Strip Footings.

UNIT – II

PILE FOUNDATIONS

Soil design of a pile, Structural design of a pile, Loads on pile group, Design of a pile cap.

UNIT - III

DOMES

Stresses in domes, Formulas for forces in spherical domes, Design of spherical domes.

UNIT – IV

FUNDAMENTALS IN THE DESIGN OF MULTI-STOREYED BUILDINGS

Framed buildings, Masonary Buildings, Loads, Structural Layout, gravity Load calculation, Wind & earthquake load calculations, Computer Methods.

UNIT – V

STRENGTHENING OF RC MEMBERS

Column Jacketing, Strengthing of Beams in Shear & Flexure underpinning.

TEXT BOOKS:

1) Structural Health Monitoring, Daniel Balageas, Peter Fritzen, Alfredo Guemes, John Wiley & Sons, 2006.
2) Health Monitoring of Structural Materials and Components Methods with Applications by Douglas E.

REFERENCE BOOKS:

1) Adams, John Wiley and Sons, 2007. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan.
2) Taylor and Francis Group, London, UK, 2006.
3) Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2007.

CO-PO/PSO MATRIX MAPPING:

CE412/4 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	2	-	-	-	-	-	-	-	1	1	3	-	1
CO2	1	2	3	2	-	-	-	-	-	-	-	1	1	3	-	1
CO3	2	2	3	2	-	-	-	-	-	-	-	1	1	3	-	1
CO4	2	2	3	2	-	-	-	-	-	-	-	1	1	3	-	1
CO5	2	2	3	2	-	-	-	-	-	-	-	1	1	3	-	1
TOTAL	3	3	3	3	-	-	-	-	-	-	-	3	1	3	-	1

CE413/1 (R20): DISASTER MANAGEMENT

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

The objectives of the course are

- To Understand basic concepts in Disaster Management
- To Understand Types and Categories of Disasters
- To Understand Risk and Vulnerability
- To Understand the stages and role of disaster management
- To understand Impacts of Disasters Key Skills

COURSE OUTCOMES:

After completion of this course, students will be able to-

CO1	the application of Disaster Concepts to Management
CO2	Analyzing Relationship between Development and Disasters.
CO3	Ability to understand Categories of Disasters
CO4	realization of the responsibilities to society

UNIT-I

CONCEPT OF DISASTER

Terminology of Disaster Management (DM), Definition, Factors and Significance; Difference between Hazard and Disaster; Classification of Disasters: Natural and Manmade Disasters, Difference, Nature, Types and Magnitude.

NATURAL DISASTER

Vegetal Cover floods, droughts – Earthquakes – landslides, Avalanches – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast.

UNIT-II

MAN MADE DISASTER

Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism -threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management. Nuclear reactor, Meltdown, War and Conflicts.

UNIT-III

RISK AND VULNERABILITY

Overview of disaster scenario in India: Vulnerability of profile of India with respect to various disasters, vulnerabilitymapping including disaster – pone areas, communities, places.Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable development, Climate change risk rendition .

Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction.

UNIT-IV

COMPONENTS OF DISASTER MANAGEMENT CYCLE

Disaster Management cycle – Five priorities for action; Disaster prevention, mitigation - Pre-Disaster Mitigation Efforts, preparedness - Education, Outreach and Training, Business Continuity & Emergency Management Planning, disaster response - Immediate Response to Stakeholders Establish Business Recovery Center and relief, recovery - Post-Disaster Economic Recovery Plan.

ROLE OF TECHNOLOGY IN DISASTER MANAGEMENTS

Geospatial information in agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS. Application of Remote Sensing, Data from Meteorological and Other Agencies, media reports: governmental and Community Preparedness.

UNIT-V

MULTI-SECTIONAL ISSUES, EDUCATION AND COMMUNITY PREPAREDNESS

Regulations of Disaster Management: Disaster Management Act 2005, National Policy on Disaster Management 2009, National Disaster Management Plan 2016, Organizational structure of disaster mitigation agencies at various levels.

Impact of disaster on poverty and deprivation - Education in disaster risk reduction Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resilience- building community capacity for action.

TEXT BOOKS:

1) An Introduction of Disaster Management- Natural Disasters & Vulnerable Hazards– S.Vaidyanathan: CBS Punblishers& Distributors Pvt. Ltd.
2) Natural Hazards & Disaster Management, Vulnerability and Mitigation by RB Singh-Rawat Publications
3) 'Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
4) 'Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt. Ltd.

REFERENCE BOOKS:

1) 'Disaster Management' edited by H K Gupta (2003), Universities press.
2) 'Disaster Management – Global Challenges and Local Solutions' by Rajib shah & R R Krishnamurthy (2009), Universities press.

3) R. Nishith, Singh AK, "Disaster Management in India: Perspectives, Issues and strategies" New Royal Book Company."
4) N. G. Dhawan and A. S. Khan, Disaster Management and Preparedness, 1/e, CBS Publication, 2014.
5) R. K. Dave, Disaster Management in India: Challenges and Strategies, Prowess Publishing, 2018.

CO-PO/PSO MATRIX MAPPING:

CE413/1 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	1	1	2	1	1	2	2	-	2	3	1	1	2
CO2	3	1	1	1	2	1	1	1	3	3	-	1	3	1	1	2
CO3	3	1	1	1	3	1	1	1	3	3	-	1	3	1	1	2
CO4	3	1	1	1	3	1	1	2	3	3	1	1	3	1	1	2
TOTAL	3	1	1	1	3	2	1	2	3	3	1	2	3	3	1	2

CE413/2 (R20): STRUCTURAL SYSTEMS

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

The objectives of the course are to build on the student's knowledge on the theory and application of structures and to introduce the students to concept of structural systems.

COURSE OUTCOMES:

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

1) Identify the concept of plates using various approaches.
2) Analyze the thin plates subjected to different loading and boundary conditions.
3) Discuss the behaviour of shells and their classifications and stress strain and force displacement relationship.
4) Analyze different types of shells and frames subjected to different loading criterion and boundary conditions.
5) Discuss the advance construction techniques like PEB Structures etc.

UNIT – I

Construction and form, Structure and Form Equilibrium under simple tension or compression, the catenary and the arch, the simply supported beam, the domical shell.

UNIT – II

STRUCTURAL ELEMENTS: Beams and slabs Arches and catenaries; vaults, domes and curved membranes; Trusses, Portal frames and space frames. Relation between structure and architecture.

UNIT – III

STRUCTURAL SYSTEMS: single- and double-layer grids; braced domes, ribbed domes, plate type domes, Network domes, Lamella domes, Geodesic domes, Grid domes. Braced and folded structures.

UNIT – IV

SPACE FRAMES: Folded plates, shells, cyclonical shells, Hyperbolic paraboloids, free forms.

Cable structures: Simply curved suspended roofs, combination of cables and struts.

UNIT –V

CURTAIN WALLS: Types of Curtainwalls and their Components Structural problems, construction and erection.

TEXT BOOKS:

1) Architecture and Structuralism by Candela, Felix. 1963.
2) Developments in Structural Form by Lane, Allen. Penguin Books ltd, London, 1975.
3) Structure and Architecture, by Macdonald, J. Angus 2nd ed. Architectural Press, Oxford, 2003.
4) Contemporary Structures in Architecture by Michaels, Leonard. 1950.

REFERENCE BOOKS:

1) Curtain Walls: Design Manual by Schall, Rolf. Reinhold Pub., New York, 1962.
2) Structure and Form in Modern Architecture by Siegel, Curt. Crosby Lockwood and son Ltd., London, 1962.
3) Principles of Space structures by Subramanian, N. Wheeler and Co., Allahabad, 1983

CO-PO/PSO MATRIX MAPPING:

CE413/2 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	-	-	-	-	3	3	1	3	-	-
CO2	3	3	3	3	3	3	-	-	-	-	3	3	-	3	-	-
CO3	3	3	3	3	3	3	-	-	-	-	3	3	1	3	-	-
CO4	3	3	3	3	3	3	-	-	-	-	3	3		3	-	-
CO5	3	3	3	3	3	3	-	-	-	-	3	3	-	3	-	-
TOTAL	3	3	3	3	3	3	-	-	-	-	3	3	1	3	-	-

CE413/3 (R20): URBAN HYDROLOGY

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

CO1: The students would be prepared to analyse urban storm water systems, urban precipitation and storm water runoff.

CO2: The students would be prepared to learn quantification of impacts of climate change on short duration high intensity rainfall in urban areas.

CO3: The students would be go for Case studies of several cities in India are dealt with, in the seminars presented by the students,

CO4: The students would be prepared an exposure to a variety of urban flooding problems.

CO5: The students would be prepared to exposure to the entire urban water cycle is also provided.

UNIT- I

Introduction: Urbanisation and its effect on water cycle – urban hydrologic cycle – trends in urbanisation – Effect of urbanisation on hydrology.

UNIT- II

Precipitation Analysis: Importance of short duration of rainfall and runoff data, methods of estimation of time of concentration for design of urban drainage systems, Intensity-Duration - Frequency (IDF) curves, design storms for urban drainage systems.

UNIT- III

Approaches to urban drainage: Time of concentration, peak flow estimation approaches, rational method, NRCS curve number approach, runoff quantity and quality, wastewater and storm water reuse, major and minor systems.

UNIT -IV

Elements of drainage systems: Open channel, underground drains, appurtenances, pumping, source control. Master drainage plans: Issues to be concentrated upon – typical urban drainage master plan, planning objectives, comprehensive planning,

use of models in planning.

UNIT- V

Analysis and Management: Storm water drainage structures, design of storm water network- Best Management Practices–detention and retention facilities, swales, constructed wetlands, models available for storm water management.

TEXT BOOKS:

1) ‘Manual on Drainage in Urbanisedarea’by Geiger W. F., J Marsalek, W. J. Rawls andF.C.Zuidema, (1987volumes) UNESCO,
2) Urban Hydrology’ by Hall M J (1984), Elsevier Applied Science Publisher.
3) Hydrology – Quantity and Quality Analysis’ by Wanielista M P and Eaglin (1997), Wiley and Sons.
4) Urban Hydrology, Hydraulics and Storm water Quality: Engineering Applications and Computer Modelling’ by Akan A.O and R.L. Houghtalen (2006), Wiley International.

REFERENCE BOOKS:

1) Storm water Detention for Drainage’ by Stahre P and Urbonas B (1990), Water Quality and
2) CSO Management, Prentice Hall.
3) Urban water cycle processes and interactions’ by Marsalek et. al. (2006), Publication No. 78,
4) UNESCO, Paris (http: //www.bvsde.paho.org/bvsacd/cd63/149460E.pdf)
5) Frontiers in Urban Water Management – Deadlock or Hope’ by Maksimovic C and J A Tejada - Guibert(2001), IWAPublishing.

CO-PO/PSO MATRIX MAPPING:

CE413/3 (R20)	Program Outcomes (PO’s)												Program Specific Outcomes (PSO’s)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	-	-	-	-	-	-	-	1	1	1	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	1	1	1	-	-
CO3	2	3	2	1	-	-	-	-	-	-	-	1	1	2	-	1
CO4	3	2	3	2	-	-	-	-	-	-	-	1	1	2	-	1
CO5	3	2	2	1	-	-	-	-	-	-	-	1	1	2	-	1
TOTAL	3	3	3	3	-	-	-	-	-	-	-	3	1	3	-	1

CE413/4 (R20): EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

L-3	T-0	P-0	M-100	C-3

COURSE LEARNING OBJECTIVES:

The objective of this course is:

- Familiarize Students with Engineering Seismology
- Equip student with concepts of Structural Dynamics
- Understand Concepts of Seismic Design
- Familiarize with Design philosophies for Seismic loading
- Familiarize students with various IS codal provisions for ductile design and detailing

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1 Understand the seismology, tectonic plates and seismic zones in India.

CO2 Acquaint with the principle's Structural dynamics

CO3 Idea of Codal Provisions. (IS 1893 & 13920)

CO4 Determine the lateral forces generated in the structure due to earthquake.

CO5 Apply the concept of ductile detailing in RC structures. Design Principles of earthquake resistant of concrete members.

UNIT-I

ENGINEERING SEISMOLOGY – rebound theory – plate tectonics – seismic waves - Earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations – near ground and far ground rotation and their effects

UNIT-II

INTRODUCTION TO STRUCTURAL DYNAMICS: Fundamental objective of Dynamic analysis – Types of prescribed loadings – Formulation of the Equations of Motion– Elements of a Vibratory system – Degrees of Freedom – Oscillatory motion – Simple Harmonic Motion – Free Vibrations of Single Degree of Freedom (SDOF) systems – Undamped and Damped – Critical damping – Logarithmic decrement – Forced vibrations of SDOF systems – Harmonic excitation – Dynamic magnification factor.

UNIT-III

SEISMIC DESIGN CONCEPTS– EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) – Building system – frames – shear wall – braced frames – layout design of Moment Resisting Frames (MRF) – ductility of MRF – Infill wall – Non structural elements.

UNIT-IV

Calculation of equivalent lateral force- Design Base Shear- Storey Shear, Estimation of Natural period of Structure, Computation of Response acceleration Coefficient- Zone factor- Seismic weight- Response reduction factors- Seismic Coefficient Method. Seismic Analysis and design of simple 2-storied RC Building frame – Equivalent static lateral force method and response spectrum method. (IS1893)

UNIT-V

DESIGN AND DUCTILE DETAILING OF BEAMS AND COLUMNS OF FRAMES-Concept of strong column weak beams, Ductility criteria for earthquake resistant design, Ductile detailing of flexural members as per IS 13920- Longitudinal reinforcement, Shear reinforcement, Anchorage of reinforcement- Development length, Lap Splices.

TEXT BOOKS:

1) 'Earthquake Resistant Design of Structures' -Pankaj Agarwal and Manish Shri Khande, Prentice – Hall of India, 2007, New Delhi.
2) 'Earthquake Resistant Design of Building Structures' by Vinod Hosur, Wiley India Ltd.
3) 'Reinforced Concrete Design'by A. K. Jain.

REFERENCE BOOKS:

1) 'Introduction to the Theory of Seismology' by Bullen K.E., Great Britain at the University Printing houses, Cambridge University Press 1996.
2) Elements of Earthquake Engineering by Jai Krishna, A.R.Chandrasekaran and Brijesh Chandra, Second Edition(1994), South Asian Publishers, New Delhi.
3) Dynamics of Structures by A.K.Chopra,, Prentice Hall India

CO-PO/PSO MATRIX MAPPING:

CE413/4 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	2	3	2	1	1	1	1	2	3	1	2	2	1
CO2	3	2	2	2	2	1	1	1	1	1	-	2	2	2	3	1
CO3	2	2	1	1	1	1	2	1	1	-	-	1	2	3	3	1
CO4	3	2	2	1	2	1	1	1	1	-	-	1	2	3	3	1
CO5	3	2	2	1	2	1	1	1	1	-	-	1	2	3	3	1
TOTAL	3	3	3	3	3	3	2	1	1	1	2	3	2	3	2	1

CE414/1 (R20): CONSTRUCTION& PROJECT MANAGEMENT

L-3	T-0	P-0	M-100	C-3

COURSE LEARNING OBJECTIVES:

The objective of this course is -

- To introduce to the student the concept of project management
- To introduce the network drawing and monitoring.
- To introduce the introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate
- To introduce the production and construction equipment and machinery.
- To introduce the importance of safety in construction projects.

COURSE OUTCOMES:

Upon successful completion of this course, student will be able to-

CO1 Learners shall appreciate the scope and challenges of typical construction projects.

CO2 Make the learners able to draft the notice inviting tender and tender Documents for projects.

CO3 Plan the project as well as to execute the project as per the initial plan.

CO4 Control the project cost over run and time overrun by proper Scheduling and Resource allocation &leveling.

CO5 Understand the optimization of resources. And Equipment selection and utilization, Costs.

UNIT – I

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

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.

UNIT – III

COST CONTROL

Direct cost; Indirect cost; TOTAL project cost; Optimization of cost through networks.

RESOURCE MANAGEMENT (MANPOWER)

Introduction; Resource smoothing; Resource leveling.

QUALITY CONTROL

Importance of quality; Elements of quality; Quality assurance techniques; Documentation; TOTAL quality management.

UNIT – IV

CONSTRUCTION EQUIPMENT

Different types of construction equipment and their use in Constriction Industry; Factors affecting selection of Equipments; Owning and operating the equipment; Equipment maintenance.

UNIT – V

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, replacement analysis, Inflation.

TEXT BOOKS:

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

REFERENCE BOOKS:

1) Construction Engineering and Management by Dr. S. Seetharaman; Umesh Publications, NaiSarark, Delhi.
2) Construction Planning, Equipment & Methods by Peurifoy R. L.; Mc Graw – Hill International Book Company.

CO-PO/PSO MATRIX MAPPING:

CE414/1 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	1	-	1	-	1	1	-	-	-	-	3	3	-
CO2	1	2	2	2	2	-	1	-	-	-	-	-	-	3	3	-
CO3	2	3	2	2	2	-	-	-	-	-	-	-	-	3	3	-
CO4	1	3	3	2	2	1	1	-	-	-	-	-	-	3	3	-
CO5	1	3	2	2	1	2	1	-	-	-	-	-	-	3	3	-
TOTAL	3	3	3	3	2	2	1	1	1	-	-	-	-	3	3	-

CE414/2 (R20): ARTIFICIAL INTELLIGENCE

L-3	T-0	P-0	M-100	C-3

COURSE OUTCOMES:

Upon successful completion of this course, the student shall be able to:

CO1: Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.

CO2: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

CO3: Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.

CO4: Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.

CO5: Demonstrate proficiency in applying scientific method to models of machine learning.

UNIT – I

Introduction of Artificial Intelligence (AI) techniques, potential benefits of AI techniques and its limitations, Fuzzy sets and Crisp sets.

UNIT – II

Fuzzy Union, Fuzzy Intersection, Membership functions, fuzzification, fuzzy to crisp conversions, defuzzificattion, Theoretical representations of fuzzy sets and its application to project scheduling.

UNIT – III

Aggregation Procedures, Fuzzy decision Making, Multi objective decision making, Minimax Criteria, Dominance Criteria, Applications of Fuzzy set theory in engineering for evaluation of alternatives, tender evaluation etc.

UNIT – IV

Need for Optimization, Fuzzy Linear Programming, symmetric Fuzzy Linear programming, tolerance interval, and its application to various engineering problems.

UNIT – V

Introduction to neural networks, artificial neural networks, Perception, XOR problem, learning by weights, Back propagation algorithm, activation functions, Introduction to Genetic Alogorithms (GA)

TEXT BOOK:

1) Fuzzy logic with engineering applications by Timothy J. Ross, McGraw-Hill, Inc.

REFERENCE BOOKS:

1) Zimmerman, H. J. (1996). "Fuzzy set theory ." Allied Publishers, India.
2) Dubios, D., and Prade, H. “Fuzzy sets and Systems: theory and applications.” Academic Press, New York, 1980.
3) Neural Networks, Fuzzy logic and Genetic Algorithms by Rajasekharan and Pai, PHI Learning.

CO-PO/PSO MATRIX MAPPING:

CE414/2 (R20)	Program Outcomes (PO’s)												Program Specific Outcomes (PSO’s)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	1	-	-	2	-	-	-	1	1	-	-	3
CO2	3	2	2	1	3	-	-	1	-	-	-	1	1	-	-	3
CO3	2	3	2	1	2	-	-	3	-	-	-	1	1	-	-	1
CO4	3	2	3	2	3	-	-	3	-	-	-	1	1	-	-	1
CO5	3	2	2	1	2	-	-	1	-	-	-	1	1	-	-	1
TOTAL	3	3	3	2	3	-	-	2	-	-	-	1	1	-	-	2

CE414/3 (R20): INFRASTRUCTURE FOR SMART CITY PLANNING

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- It is expected that the students, after going through this course, will have developed a good knowledge of the issues involved as well as policies aimed at improving urban infrastructure in India.
- They would also be equipped with necessary skills in developing sustainable approaches and strategies for efficient provision and management of urban infrastructure.

COURSE OUTCOMES:

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

CO1: Understand the issues & challenges in the Smart City

CO2: To develop skills required for planning & formulation of Contracts and Agreements in Smart City

CO3: To analyse and integrate the processes for Contract execution and control in Smart City

UNIT – I

INTRODUCTION

Understanding – Dimensions – Global experience, Global standards and performance bench marks, Practice codes. India 100 smart cities policy and mission, Smart city planning and development, Financing smart cities development, Governance of smart cities.

UNIT – II

GREEN BUILDING CONCEPTS AND SUSTAINABLE DEVELOPMENT

Green projects in smart cities, sustainability–green building–Rating system–Energy efficient building–energy saving systems

UNIT – III

WATER SUPPLY AND DRAINAGE

Water–sources of water, treatment and storage, transportation and distribution, quality, networks, distribution losses, water harvesting, recycling and reuse, norms and standards of provision, institutional arrangements, planning provisions and management issues. Sanitation–points of generation, collection, treatment, disposal, norms and standards, grey water disposal, DEWATS, institutional arrangements, planning provisions and management issues. Municipal and other wastes–generation, typology, quantity, collection, storage, transportation, treatment, disposal, recycling and reuse, wealth from waste, norms and standards, institutional arrangements, planning provisions and management issues. Power–Sources of power procurement, distribution networks, demand assessment, norms and standards, planning provisions and management.

UNIT- IV

SMART URBAN TRANSPORT SYSTEMS

Elements of Infrastructure (Physical, Social, Utilities and services), Basic definitions, concepts, significance and importance; Data required for provision and planning of urban networks and services; Resource analysis, Provision of infrastructure. Role of transport, types of transport systems, evolution of transport modes, transport problems and mobility issues. Urban form and Transport patterns, land use–transport cycle, concept of accessibility. Hierarchy, capacity and geometric design elements of roads and intersections. Basic principles of Transport infrastructure design. Urban transport planning process–Transport, environment and safety issues. Principles and approaches of Traffic Management, Transport System Management.

UNIT – V

E- GOVERNANCE AND IOT

The concept of management, concept of e-management & e-business, e-Government Principles, Form e-Government to e-governance, e-governance and developing countries, Designing and Implementing e-Government Strategy, E governance: Issues in implementation. IOT fundamentals, protocols, design and development, data analytics and supporting services, case studies.

TEXT BOOKS:

1) Allen G.Noble, (Eds) Regional Development and Planning for the 21st Century: New Priorities and New Philosophies, Aldershot, USA
2) Andy Pike, Andres Rodriguez-Pose, John Tomaney Handbook of Local and Regional Development, Taylor & Francis
3) Andreas Faludi and Sheryl Goldberg Fifty years of Dutch National Physical Planning, Alexandrine Press, Oxford
4) Daniel G. Parolek, AIA, Karen Parolek, Paul C. Crawford, FAICP. Form Based Codes: A Guide for Planners, Urban Designers, Municipalities, and Developers, John Wiley & Sons.

CO-PO/PSO MATRIX MAPPING:

CE414/3 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	1	-	-	2	-	-	-	1	1	-	-	3
CO2	3	2	2	1	3	-	-	1	-	-	-	1	1	-	-	3
CO3	2	3	2	1	2	-	-	3	-	-	-	1	1	-	-	1
CO4	3	2	3	2	3	-	-	3	-	-	-	1	1	-	-	1
CO5	3	2	2	1	2	-	-	1	-	-	-	1	1	-	-	1
TOTAL	3	3	3	3	3	-	-	2	-	-	-	1	1	-	-	2

CE414/4 (R20): GREEN TECHNOLOGY

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

- Understanding the importance and evolution of green technology.
- To facilitate the students to achieve a clear conceptual understanding of role of green technology in industry, government institution.
- Explain about pollution prevention, life cycle costing, carbon credit.
- To enable the students about conventional energy resources, non conventional energy resources and problems related to them.
- To bring awareness about green fuels, biomass energy, wind energy and their social and economical impacts.

COURSE OUTCOMES:

After completion of this course, students will be able to-

CO1: Conceptual knowledge of green technology

CO2: Know the Role of green technology in different fields.

CO3: To analyze pollution prevention, life cycle, costing, carbon credit.

CO4: Capability to integrate different types of energy resources.

CO5: Advocacy of stragic recommendations on usage of green fuels, biomass energy, wind energy.

UNIT- I

INTRODUCTION: Green Technology – definition- Importance – Historical evolution – advantages and disadvantages of green technologies-factors affecting green technologies-Role of Industry, Government and Institutions – Industrial Ecology – role of industrial ecology in green technology.

Cleaner Production (CP): Definition – Importance – Historical evolution - Principles of Cleaner Production–Benefits–Promotion – Barriers – Role of Industry,

UNIT- II

CLEANER PRODUCTION PROJECT DEVELOPMENT AND IMPLEMENTATION: Government and Institutions – clean development mechanism, reuse, recovery, recycle, raw material substitution-Wealth from waste, case studies.

Overview of CP Assessment Steps and Skills, Process Flow Diagram, Material Balance, CP Option Generation – Technical and Environmental Feasibility analysis – Economic valuation of alternatives - TOTAL Cost Analysis – CP Financing – Preparing a Program Plan – Measuring Progress- ISO 14000.

UNIT- III

Pollution Prevention and Cleaner Production Awareness Plan – Waste audit – Environmental Statement, carbon credit, carbon sequestration, carbon trading, Life Cycle Assessment - Elements of LCA – Life Cycle Costing – Eco Labelling.

UNIT -IV

Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Non-conventional energy sources: Solar Energy-solar energy conversion technologies and devices, their principles, working and application.

UNIT- V

Green Fuels – Definition-benefits and challenges – comparison of green fuels with conventional fossil fuels with reference to environmental, economical and social impacts-public policies and market-driven initiatives.

Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in Indian context; tidal and geothermal energy.

TEXT BOOKS:

1) 'Pollution Prevention: Fundamentals and Practice' by Paul L Bishop (2000), McGraw Hill International.
2) 'Cleaner Production Audit' by Prasad Modak, C.Visvanathan and Mandar Parasnis (1995), Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok
3) 'Non-conventional Energy Sources' by Rai G.D.

REFERENCE BOOKS:

1) 'Pollution Prevention and Abatement Handbook – Towards Cleaner Production' by World Bank Group (1998), World Bank and UNEP, Washington D.C.
2) 'Handbook of Organic Waste Conversion' by Bewik M.W.M.
3) 'Energy, The Solar Hydrogen Alternative' by Bokris J.O.
4) 'Solar Energy' by Sukhatme S.P.
5) 'Waste Energy Utilization Technology' by Kiang Y. H.

CO-PO/PSO MATRIX MAPPING:

CE414/4 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	-	-	2	-	-	-	-	1	1	3	-	1
CO2	1	2	2	2	-	-	2	-	-	-	-	1	1	3	-	1
CO3	1	2	2	2	-	-	2	-	-	-	-	1	1	3	-	1
CO4	1	2	2	2	-	-	2	-	-	-	-	1	1	3	-	1
CO5	1	2	2	2	-	-	2	-	-	-	-	1	1	3	-	1
TOTAL	1	2	2	2	-	-	2	-	-	-	-	1	1	3	-	1

CE415 (R20): ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

L-3	T-0	P-0	M-100	C-3

COURSE OBJECTIVES:

The course should enable the students to:

- Understand the concept of Traditional knowledge and its importance
- Know the need and importance of protecting traditional knowledge
- Know the various enactments related to the protection of traditional knowledge.
- Understand the concepts of Intellectual property to protect the traditional knowledge.

COURSE OUTCOMES:

After successful completion of this course, students will be able to:

CO1: Understand and elucidate the basic knowledge of traditional knowledge to develop the physical and social changes on traditional knowledge system.

CO2: Discuss different characteristics of Indigenous Knowledge (IK) to differentiate it with formal, western and traditional knowledge.

CO3: Describe the significance of traditional knowledge protection to communicate the traditional knowledge information.

CO4: Recognize the role of government on traditional knowledge to measure its impact on global economy.

CO5: Explain the acts related to schedule tribes, traditional forest dwellers, plants protection and farmers to inculcate the legal protection information.

UNIT I:

INTRODUCTION TO CULTURE: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II:

INDIAN LANGUAGES, CULTURE AND LITERATURE: The role of Sanskrit, Significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of South India.

UNIT III:

RELIGION AND PHILOSOPHY: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious reform movements in Modern India(selected movements only).

UNIT IV:

FINE ARTS IN INDIA: (ARTS, TECHNOLOGY & ENGINEERING): Indian painting, Indian handicrafts, music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (Ancient, Medieval and Modern), Science and Technology in India, development of science in ancient, medieval and modern India.

UNIT V:

EDUCATION SYSTEM IN INDIA: Education in Ancient, Medieval and Modern India, aims of Education, subjects, languages, science and scientists of Ancient India, Medieval and Modern India.

REFERENCE BOOKS:

1) Kapil Kapoor, "Text and Interpretation: The India Tradition", ISBN: 81246033375, 2005
2) "Science and Samskrit", SamskritaBhartiPublisher, ISBN 13: 978-8187276333, 2007
3) NCERT, "Position paper on Arts, Music, Dance and Theatre", ISBN: 81-7450 494- X, 200.

CO-PO/PSO MATRIX MAPPING:

CE415 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	-	-	2	-	-	-	-	1	1	3	-	1
CO2	1	2	2	2	-	-	2	-	-	-	-	1	1	3	-	1
CO3	1	2	2	2	-	-	2	-	-	-	-	1	1	3	-	1
CO4	1	2	2	2	-	-	2	-	-	-	-	1	1	3	-	1
CO5	1	2	2	2	-	-	2	-	-	-	-	1	1	3	-	1
TOTAL	1	2	2	2	-	-	2	-	-	-	-	1	1	3	-	1

CE416 (R20): MOOC’s

L-3	T-0	P-0	M-100	C-3

CE451 (R20): QUANTITY ESTIMATION & PROJECT MANAGEMENT LAB

L-0	T-0	P-3	M-100	C-2

COURSE OBJECTIVES:

The course should enable the students to:

1) Summarize the basic principal and standard methods for working out quantities in estimating.
2) Demonstrate the detailed estimate of buildings and workout rate analysis of the various items of work.
3) Understand the material requirements as per specified norms and standards.
4) Assess the valuation of buildings and provide practical knowledge of standard specifications of items of buildings construction.

COURSE OUTCOMES:

CO1: Understand the preparation of an Abstract Estimate and detailed estimate of building.

CO2: Determine earth work quantity for roads and canals.

CO3: Understand preparation of Notice inviting tender document for bidding, tendering process and examining rate analysis of civil works.

CO4: Design bar bending schedule for reinforcement works, Identify specifications and Tendering process for contracts and create various tender documents for bidding purpose.

CO5: Evaluate the valuation of building for different specifications and create new technologies to develop concrete estimating methods.

CYCLE-1

QUANTITY SURVEYING

(At least **SIX** of the following using softwares 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

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

CYCLE-2

PROJECT MANAGEMENT

(Any **THREE** of the following using softwares like MS Project / Primavera etc.)

1) Preparing the Project management report for a single storey residential building/Road/Canal by using the Bar Chart/Mile stone chart.
2) Preparing the Project management report for a single storey residential building by using the network technique (PERT/CPM).
3) Preparing the Project management report for a B.T.Road by using the network technique (PERT/CPM).
4) Preparing the Project management report for a Canal by using the network technique (PERT/CPM).

CYCLE-3

(At least **THREE** of the following by using softwares like MS Excel)

1) Quantity estimation of RCC roof slab and preparing schedule of bars
2) Quantity estimation of RCC beam and preparing schedule of bars
3) Quantity estimation of RCC Column with foundation footing and preparing schedule of bars
4) Quantity estimation of RCC retaining wall and preparing schedule of bars

CO-PO/PSO MATRIX MAPPING:

CE451 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	1	1	-	-	2	-	-	-	-	1	1	-	3	1
CO2	1	2	2	2	-	-	2	-	-	-	-	1	1	-	3	1
CO3	1	2	2	2	-	-	2	-	-	-	-	1	1	-	3	1
CO4	1	2	2	2	-	-	2	-	-	-	-	1	1	-	3	1
CO5	1	2	2	2	-	-	2	-	-	-	-	1	1	-	3	1
TOTAL	1	2	2	2	-	-	2	-	-	-	-	1	1	-	3	1

CE452 (R20): INDUSTRIAL / RESEARCH INTRENSHIP

L-0	T-0	P-0	M-100	C-3

SEMESTER VIII

B.Tech. CIVIL ENGINEERING

SEMESTER-VIII

CE461 (R20): PROJECT WORK

L-0	T-0	P-0	M-150	C-8

CE462 (R20): SEMINAR

L-0	T-0	P-0	M-50	C-2

CE463 (R20): MOOC

L-0	T-0	P-0	M-100	C-2

CEM001 (R20): BASICS OF CIVIL ENGINEERING

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

The objectives of this course:

- To in calculate the essentials of civil engineering field to the students of all branches of engineering.
- To provide the students an illustration of the significance of the civil engineering profession in satisfying societal needs.

COURSE OUTCOMES:

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

CO1: The students will be able to illustrate the fundamental aspects of civil engineering.

CO2: The student will be able to plan and set out a building.

CO3: Students will be able to explain the concepts of surveying for making horizontal and vertical measurements.

CO4: They will be able to illustrate the uses of various building materials and explain the method of construction of different components of a building.

CO5: Students will be able to discuss about various services in a building.

UNIT - I

Scope of Civil Engineering: Introduction: Impact of Infrastructural Development on the Economy of a Country, Role of Civil Engineers, Importance of Planning, Scheduling and Construction Management.

SURVEYING: Introduction: Surveying and levelling, Object and uses, Primary divisions, Fundamental principles, Classification of surveying, Plans and maps, Scales, Units of measure.

UNIT – II

COMPASS SURVEYING: Types and uses of compass, Bearings, Whole Circle Bearings, and Reduced Bearings, Computation of angles; Meridians; declinations and dip of needle; Local attraction; compass surveying field work.

ELEVATION MEASUREMENTS: Levelling, object and uses, terms used in levelling, levelling instruments, methods of levelling, recording and methods of reducing, errors in levelling, contours; characteristics and applications. Modern Tools of Surveying and Mapping: Introduction to Theodolite, Electronic Distance Measurement Instruments, TOTAL Station, Global Positioning System, Remote Sensing and Geographic Information System.

UNIT – III

Construction Materials Requirement, types, uses, properties and importance of Civil Engineering materials like Stone, Bricks, Lime, Cement, Ferrous and Non Ferrous Metals, Ceramic Materials, Timber, Sand, Aggregate, Mortar and Concrete, Paints and Varnishes, Glass, Plastic, Conducting, Magnetic, and Miscellaneous Materials .

UNIT – IV

ELEMENTS OF BUILDING CONSTRUCTION PLANNING: Elementary principles and basic requirements of a building planning, layout of residential & industrial buildings. Construction: Classification of buildings based upon occupancy and structure, Design Loads, Common building components, their functions, and nominal dimensions. Elements of building drawing. Introduction to building byelaws.

UNIT - V

Need for protected water supply system, Objectives of Water supply systems, Water borne diseases, Role of Environmental Engineers, Evolution of Water supply system.

Estimation of water demand for a city or town, Per capita consumption, Factors affecting Per capita consumption, Fire demand, Fluctuations in demand, Prediction of Population.

TEXT BOOKS / REFERENCE BOOKS:

1) Surveying Vol. I & II, Dr. B. C. Punamia Laxmi Publication, Delhi
2) Building Construction, Dr. B. C. Punamia Laxmi Publication, Delhi
3) Engineering Material, Dr. S.C. Rangwal, Charotar Pub. House
4) Envionmental Engineering by S.K.Duggal
5) Civil Engineering Material, Jakson and Dhir, ELBS Publishing London
6) Civil Engg. Drawing, S. C. Rangwal, Charotar Pub. House Anand
7) Elements of Civil Engineering (IV Edition) by S.S. Bhavikatti, New Age International Publisher, New Delhi, 3rd edition.

CO-PO/PSO MATRIX MAPPING:

CEM 001 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	-	-	-	-	-	3	3	3	-	-
CO2	3	3	3	3	3	3	-	-	-	-	-	3	3	3	-	-
CO3	3	3	3	3	3	3	-	-	-	-	-	3	3	3	-	-
CO4	3	3	3	3	3	3	-	-	-	-	-	3	3	3	-	-
CO5	3	3	3	3	3	3	-	-	-	-	-	3	3	3	-	-
TOTAL	3	3	3	3	3	3	-	-	-	-	-	3	3	3	-	-

CEM002 (R20): MODERN CONSTRUCTION MATERIALS

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

To study and understand the properties of modern construction materials used in construction such as special concretes, metals, composites, water proofing compounds, non-weathering materials, and smart materials.

COURSE OUTCOMES:

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

CO1: Explain the various types of special concretes.

CO2: Select the different processing of steel and applications of coating.

CO3: Explain the manufacturing process and applications of polymer composites.

CO4: Identify the different flooring materials and application of façade materials.

CO5: Apply the knowledge of smart and intelligent materials in construction field.

UNIT - I

INTRODUCTION OF ENGINEERING MATERIALS

Introduction of Engineering Materials, Properties of the engineering materials, need of advanced materials in civil engineering.

UNIT-II

SPECIAL CONCRETES-Concretes, Behaviour of concretes – Properties and Advantages of High Strength and High-Performance Concrete – Properties and Applications of Fiber Reinforced Concrete, Self-compacting concrete, Alternate Materials to concrete on high performance & high Strength concrete.

UNIT-III

METALS -Types of Steels – Manufacturing process of steel – Advantages of new alloy steels –Properties and advantages of aluminium and its products – Types of Coatings &Coatings to reinforcement – Applications of Coatings.

UNIT-IV

COMPOSITES-Types of Plastics – Properties & Manufacturing process – Advantages of Reinforced polymers – Types of FRP – FRP on different structural elements – Applications of FRP.

UNIT-V

OTHER MATERIALS -Types and properties of Water Proofing Compounds – Types of Non-weathering Materials and its uses – Types of Flooring and Facade Materials and its application, concrete admixtures and construction chemicals.

TEXT BOOKS:

1) P.C.Varghese, '*Building Materials*', 2nd Edition, 2015, Prentice-Hall, India.

REFERENCE BOOKS:

1) William D. Callister Jr., David G. Rethwisch, '*Materials Science and Engineering: An introduction',* 9th Edition, 2013, John Wiley .
2) V. Raghavan, '*Materials Science and Engineering*', 6th Edition, 2015,
3) Prentice Hall India Learning Private Limited.
4) R.A. Higgins, '*Properties of Engineering Materials*', 2nd Edition, 1994, Industrial Press.

CO-PO/PSO MATRIX MAPPING:

CEM 002 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	3	-	3	-	3	3	1	3	-	-
CO2	3	3	3	3	3	3	3	-	-	-	3	3	-	3	-	-
CO3	3	3	3	3	3	3	3	-	-	-	3	3	1	3	-	-
CO4	3	3	3	3	3	3	-	-	-	-	3	3		3	-	-
CO5	3	3	3	3	3	3	-	-	-	-	3	3	-	3	-	-
TOTAL	3	3	3	3	3	3	2	-	3	-	3	3	1	3	-	-

CEM003 (R20): FUNCTIONAL EFFICIENCY OF BUILDINGS

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES / COURSE OUTCOMES:

- To understand the norms for Building envelope, including thermal and acoustic performance requirements for walls, roofs, and windows for Energy efficient design and construction of buildings.
- To understand the energy performance standards for buildings, energy auditing and automation in various building services with integration for energy conservation.
- To understand the Design for energy efficiency of the buildings
- To understand the concept of Noise and Buildings Natural ventilation.

UNIT - I

Environmental Factors: Tropical environments and site environments, Human response to environments - Thermal, Noise, Visual; Comfort indices.

UNIT - II

Thermal environment for Buildings: Heat exchange of building with environment; Effect of solar radiation; Thermal properties of material and sections and their influence. Steady and periodic heat transfer in buildings.

UNIT - III

Design for energy efficiency: Selection of envelope elements - Orientations, shape, Glasses and shading devices.

UNIT - IV

Natural ventilation: Purpose of ventilation, Mechanisms, Fenestration Design for natural ventilation.

UNIT - V

Noise and Buildings: Basic acoustics and noise, Planning, Sound in free field, protection against external noise. Internal noise sources and protection against air borne & structure borne noise.

TEXT BOOKS:

1) Koenigsberger, O.H., Ingersoll, T.G., Mayhew, A., Szokolay,S.V., “Climatic Design - Manual of Tropical Housing and Building”, Orient Longman Private Ltd. Chennai, India, 2006.
2) Croome, J.D. & Roberts, B.M.,"Air-Conditioning And Ventilation of Buildings Vol-I". Pergamon Press.
3) Foreman, J.E.K.,"Sound Analysis and Noise Control". Van Nostrand Reinhold. 1990.
4) Z. Maekawa, Jens H. Rindel, P. Lord, Environmental and Architectural Acoustics, CRC Press, 2011.

CO-PO/PSO MATRIX MAPPING:

CEM 003 (R20)	Program Outcomes (PO’s)												Program Specific Outcomes (PSO’s)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	3	-	3	-	3	3	1	3	-	-
CO2	3	3	3	3	3	3	3	-	-	-	3	3	-	3	-	-
CO3	3	3	3	3	3	3	3	-	-	-	3	3	1	3	-	-
CO4	3	3	3	3	3	3	-	-	-	-	3	3		3	-	-
CO5	3	3	3	3	3	3	-	-	-	-	3	3	-	3	-	-
TOTAL	3	3	3	3	3	3	-	-	-	-	3	3	1	3	-	-

CEM004 (R20): CONSTRUCTION MANAGEMENT

L-3	T-0	P-0	M-100	C-4

COURSE LEARNING OBJECTIVES:

The objective of this course is:

- To introduce to the student, the concept of project management including network drawing and monitoring
- To introduce various equipment's like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery, related to constriction.
- To introduce the importance of safety in construction projects

COURSE OUTCOMES:

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

CO1	appreciate the importance of construction planning
CO2	understand the functioning of various earth moving equipment
CO3	Contractual Relation and Contract Management
CO4	Resource Scheduling, Project Monitoring:
CO5	apply the gained knowledge to project management and construction techniques

UNIT- I

INTRODUCTION TO CIVIL ENGINEERING PROJECT MANAGEMENT:

General Scope, Useful Terms, Life Cycle, Phases of Construction, Challenges, Functions, Responsibility of an engineer etc.

UNIT- II

CONTRACTUAL RELATION AND CONTRACT MANAGEMENT: Various parties involved, Contracts-Types, Stages of awarding contract, Disputes and Arbitration.

UNIT -III

NETWORK BASED PROJECT MANAGEMENT TECHNIQUES: Time Management - Work Break Down Structure, Project Planning, Events, Activities, Scheduling Techniques, Gantt Charts, AoN, Time-Cost Trade-offs, Illustrations & Exercises.

UNIT -IV

RESOURCE SCHEDULING, PROJECT MONITORING:

Resource- Allocation, Leveling, Applying Improvement Factor. Precedence Diagram Method, earned value of money concept, Project Control Process.

UNIT -V

INTRODUCTION TO CONSTRUCTION TECHNOLOGY: Quality in Construction, Safety in Construction, Earthwork, Form work, Concreting, Drilling and Blasting, Piling, Dewatering.

TEXT BOOK:

1) B.C. Punmia & K.K. Khandelwal, ‘*Project planning and control with PERT and CPM*’,4th Edition, 2016, Laxmi Publications Pvt. Ltd.

REFERENCE BOOKS:

1) Schexnayder, C. J. and Mayo, R. E., ‘*Construction Management Fundamentals’*, 2nd Edition, 2008, International Edition, McGraw-Hill.
2) Peurifoy, R. L., Schexnayder, C. J. and Shapira, A., ‘*Construction Planning,*
3) *Equipment, and Methods’*, 8th Edition, 2010, Tata McGraw-Hill, New Delhi. 7th Edison.

CO-PO/PSO MATRIX MAPPING:

CEM 004 (R20)	Program Outcomes (PO’s)												Program Specific Outcomes (PSO’s)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	1	-	1	-	-	-	-	-	-	1	3	-	-
CO2	1	2	2	2	2	-	1	-	-	-	-	-	-	3	-	-
CO3	2	3	2	2	2	-		-	-	-	-	-	1	3	-	-
CO4	1	3	3	2	2	1	1	-	-	-	-	-	-	3	-	-
CO5	1	3	2	2	1	2	1	-	-	-	-	-	-	3	-	-
TOTAL	3	3	3	3	3	3	1	-	-	-	-	-	1	3	-	-

CEM005 (R20): SMART CITIES

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

- To understand the concept of smart city and associated challenges.
- To understand latest technologies used in intelligent building.
- To understand process of planning and drafting a plan for smart city.
- To understand the importance of different smart system

COURSE OUTCOMES:

After completion of this course, students will be able to

CO1: Acquaint knowledge on smart cities planning and development

CO2: Identify components of infrastructure and Prepare infrastructure plan for smart city.

CO3: Understand smart transport system for smart cities and its application

CO4: Develop work break down structure, scheduling and project management of smart cities

CO5: Study of water resources systems for smart city and its application

UNIT – I

UNDERSTANDING INCLUSIVE PLANNING:

Definition and components; urban consultations; basic principles of urban consultation, process of urban consultations; urban strategic planning, good urban governance, subsidiarity, equity, efficiency, transparency and accountability, civic engagement and citizenship, security; valuing difference and working with diversity; liveable cities.

UNIT – II

STAKEHOLDERS PROFILE AND NEEDS, ACCESS TO SHELTER, SERVICES AND LIVELIHOODS:

Urban Poor, Informal Sector, Gender, Children, Elderly, Disabled, Displaced people, etc.; Slums - dimensions, causative factors, determinants, location characteristics of settlements; Informal sector - growth, characteristics, functions, economic contributions, linkages with formal sector, impact on Urban Development.

UNIT – III

PARTICIPATORY PLANNING PROCESS AND POLICIES, PROGRAMMES AND LEGISLATION:

Methods, role of stakeholders (including civil society organizations), etc.; Related Acts, Five year plans, policies and programmes at various levels.

UNIT- IV

SMART CITIES:

Innovation economy (Innovation in industries, clusters, districts of a city; Knowledge workforce: Education and employment; Creation of knowledge-intensive companies); Urban Infrastructure (Transport, Energy/ Utilities, protection of the environment and safety); Governance (Administration services to citizens, participatory and direct democracy, services to the citizen, quality of life).

UNIT – V

PLANNING INTERVENTIONS:

Inclusive zoning, development and building regulations, Slum Improvement; drafting strategic urban development plans – objectives and key actors; planning framework for actions, process of drafting the plan, key considerations; urban design and decision-making; city transport for all; water supply and sanitation, urban disaster management, management through decentralization.

REFERENCE BOOKS:

1) Jo Beall (1997); “A city for all: valuing differences and working with diversity”; Zed books limited, London.
2) UN-Habitat; “Inclusive and sustainable urban planning: a guide for municipalities”; Volume 3: Urban Development Planning (2007); United Nations Human Settlements Programme.
3) Arup Mitra; “Insights into inclusive growth, employment and wellbeing in India”; Springer (2013), New Delhi .
4) William J. V. Neill (2004); “Urban Planning and cultural identity”; Routledge, London.
5) John S. Pipkin, Mark E. La Gory, Judith R. Balu (Editors); “Remaking the city: Social science perspective on urban design”; State University of New York Press, Albany.
6) Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; NatašaPichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science.
7) "Draft Concept Note on Smart City Scheme". Government of India - Ministry of Urban Development.

CO-PO/PSO MATRIX MAPPING:

CEM 005 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	-	-	-	3	2	2	-	-	1	-	1	-	-	2
CO2	1	-	-	-	-	3	2	2	-	-	1	-	1	-	-	2
CO3	1	-	-	-	-	3	2	2	-	-	1	-	1	-	-	3
CO4	1	-	-	-	-	3	2	2	-	-	1	-	1	-	-	3
CO5	1	-	-	-	-	3	2	2	-	-	1	-	1	-	-	3
TOTAL	1	-	-	-	-	3	2	2	-	-	1	-	1	-	-	3

CEM006 (R20): URBAN PLANNING

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

The main objectives of this course are:

- To introduce the discipline of planning and planning history.
- To expose planning theory and practice.
- To make aware of the institutional mechanism involved in planning and implementation process.

COURSE OUTCOMES:

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

CO1: Understand the planning process, theory and practice and its role in planning of cities.

CO2: Appreciate of the role of historical developments in planning and its evolution and trace these influences to the current situation.

CO3: Understand the institutional mechanisms involved in urban planning.

CO4: Develop capacity to understand multiple often conflicting factors to be balanced in planning for an urban area.

UNIT- I

BASIC ISSUES

Definition of Human settlement, Urban area, Town, City, Urbanization, Suburbanization, Urban sprawl, Peri - urban areas, Central Business District (CBD), Classification of urban areas – Trend of Urbanization at International, National, Regional and State level.

UNIT- II

PLANNING PROCESS

Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Surveys and Questionnaire Design.

UNIT- III

DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION

Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, Development Control Rules, Transfer of Development Rights, Special Economic Zones- Development of small town and smart cities-case studies.

UNIT- IV

PLANNING AND DESIGN OF URBAN DEVELOPMENT PROJECTS

Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects.

UNIT -V

LEGISLATION, DEVELOPMENT AND MANAGEMENT OF URBAN SYSTEM

Town and Country Planning Act, Land Acquisition and Resettlement Act etc., Urban Planning Standards and Regulations, Involvement of Public, Private, NGO, CBO and Beneficiaries.

TEXT BOOKS:

1) Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002
2) George Chadwick, A Systems view of planning, Pergamon press, Oxford 1978
3) Singh V.B, Revitalised Urban Administration in India, Kalpaz publication, Delhi, 2001
4) Edwin S. Mills and Charles M. Becker, Studies in Urban development, A World Bank publication, 1986.

CO-PO/PSO MATRIX MAPPING:

CEM 006 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	3	-	3	-	3	3	1	3	-	-
CO2	3	3	3	3	3	3	3	-	-	-	3	3	-	3	-	-
CO3	3	3	3	3	3	3	3	-	-	-	3	3	1	3	-	-
CO4	3	3	3	3	3	3	-	-	-	-	3	3		3	-	-
CO5	3	3	3	3	3	3	-	-	-	-	3	3	-	3	-	-
TOTAL	3	3	3	3	3	3	-	-	-	-	3	3	1	3	-	-

CEHT101 (R20): ALTERNATIVE BUILDING MATERIALS & TECHNOLOGIES

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

This course will enable students to understand the environmental issues due to building materials and the energy consumption in manufacturing building materials. Study the various masonry blocks, masonry mortar and structural behavior of masonry under compression. Study the alternative building materials in the present context. Understand the alternative building technologies which are followed in present construction field.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: Solve the problems of Environmental issues concerned to building materials.

CO2: Suggest appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements.

CO3: Analyze different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.

CO4: Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material

CO5: Understanding the cost saving techniques in planning and design.

UNIT - I

INTRODUCTION: Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry, and Environmental friendly and cost effective building technologies. Requirements for building of different climatic regions. Traditional building methods and vernacular architecture.

UNIT – II

ALTERNATIVE BUILDING MATERIALS: Characteristics of building blocks for walls, Stones and Laterite blocks, Bricks and hollow clay blocks. Concrete blocks. Stabilized blocks: Mud Blocks, Steam Cured Blocks, Fal-G Blocks and Stone Masonry Block.

UNIT – III

a) LIME-POZZOLANA CEMENTS Raw materials, Manufacturing process, Properties and uses.

b) Fibre reinforced concretes. Matrix materials. Fibers: metal and synthetic Properties and Applications, Fibre reinforced plastics, Matrix materials Fibers: organic and synthetic. Properties and applications Building materials from agro and industrial wastes. Types of agro wastes. Types of industrial and mine wastes. Properties and applications. Field quality control test methods.

UNIT – IV

ALTERNATIVE BUILDING TECHNOLOGIES: Alternative for wall construction. Types, Construction method. Masonry mortars. Types. Preparation. Properties. Alternative roofing system. Concepts. Filler slabs. Composite beam panel roofs. Masonry vaults and domes, and nominal dimensions. Elements of building drawing. Introduction to building byelaws.

UNIT - V

COST EFFECTIVE BUILDING DESIGN: Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost Analysis: Case studies using alternatives.

TEXT BOOKS / REFERENCE BOOKS:

1) Properties of Concrete-A.M.Neville. Pitman Publishing Limited-London.
2) Alternative building methodologies for engineers and architects, K.S. Jagadish and B.V.Venkatarama Reddy, Indian Institute of Science, Bangalore.
3) Structural Masonry by Arnold W. Hendry.
4) Light weight concrete- Academic kiado- Rudhai .G – Publishing home of Hungarian Academy of Sciences 1963.
5) Low cost Housing – G.C. Mathur.
6) Modern trends in housing in developing countries – A.G. Madhava RaoD.S.Ramachandra Murthy & G.Annamalai

CO-PO/PSO MATRIX MAPPING:

CEHT 101 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	1	2	1
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	1	2	1
CO3	2	2	3	-	-	-	-	-	-	1	-	-	1	2	2	1
CO4	2	2	3	-	-	-	-	-	-	1	-	-	1	2	2	1
CO5	2	2	3	-	-	-	-	-	-	1	-	-	1	2	2	1
TOTAL	3	3	3	3	-	-	-	-	-	1	-	-	1	3	3	1

CEHT102 (R20): PRE-STRESSED CONCRETE

L-3	T-0	P-0	M-100	C-4

COURSE LEARNING OBJECTIVES:

- Familiarize Students with concepts of prestressing
- Equip student with different prestressing systems and devices
- Understand losses of prestress including short and long term losses
- Familiarize students with analysis and design of prestressed concrete members under flexure, shear and torsion

COURSE OUTCOMES:

After completion of this course, students will be able to –

CO1	Understand different methods of prestressing
CO2	Estimate effective prestress including short and long term losses
CO3	Analyze and design prestressed concrete beams under flexure
CO4	Understand the relevant IS Code provisions for prestressed concrete
CO5	Understand about the Transfer OfPrestress & Anchorage Zone Stresses

UNIT - I

INTRODUCTION

BASIC CONCEPTS OF PRESTRESSING: Historical development; Need for High strength steel and High strength concrete; Advantages and limitations of Prestressed concrete. Materials For Prestressed Concrete- High strength concrete; High tensile steel.

PRESTRESSING 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 OFPRESTRESS 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

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 MEMBERS

Importance of control of deflections; Factors influencing deflections; Short term deflections of uncracked members

UNIT - III

FLEXURAL STRENGTH OF PRESTRESSED CONCRETE SECTIONS:

Types of flexural failure; Flexural strength of prestressed concrete sections as per IS1343.

DESIGN OF SECTIONS FOR FLEXURE AS PER IS1343

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 sections for the limit state of collapse in flexure.

UNIT - IV

Design for Shear and Torsion: Shear and Principal Stresses; Ultimate shear resistance of prestressed concrete members and design of shear reinforcement as per IS 1343: 2012. Design for Torsion, Design for Combined bending, shear and torsion.

COMPOSITE BEAMS: Different Types- Propped and Unpropped- stress distribution- Differential shrinkage- Analysis of composite beams- Deflection of determinate composite beam.

UNIT - V

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.

TEXT BOOKS:

1) Prestressed Concrete by N. Krishna Raju; Tata McGraw - Hill Publishing Company Limited, New Delhi.
2) Prestressed Concrete by K.U.Muthu PHI Learning Pvt. Ltd.

REFERENCE BOOKS:

1) Design of Prestressed Concrete Structures by T.Y. Lin & Ned H. Burns; John Wiley & Sons
2) Prestressed Concrete by Pandit&Gupta, CBS Publishers
3) Pre-stressed concrete by P. Dayaratnam, Oxford & IBH
4) Prestressed Concrete by N.RajaGopalan,Narosa Publishing House .
5) Code IS 1343.

CO-PO/PSO MATRIX MAPPING:

CEHT 102 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	-	2	1	1	1	2	-	-	1	3	1	2	-
CO2	2	2	2	2	3	1	1	1	2	1	2	1	3	2	2	-
CO3	1	2	2	1	2	1	1	1	2	1	-	-	3	2	2	-
CO4	1	1	1	1	1	1	1	-	-	-	-	-	3	2	2	-
CO5	2	2	2	2	3	1	2	-	2	-	-	1	3	1	2	-
TOTAL	3	3	3	3	3	3	3	1	3	1	1	1	3	3	3	-

CEHT103 (R20): STBILITY OF STRUCTURES

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

- Students able to evaluate and compare modern techniques and methods in structural stability.
- Student will become familiar with concept of Torsional buckling under different loading.
- Students evaluate and calculate lateral buckling of beams in pure bending.
- Students know that calculating of critical loads for buckling in rectangular plates.
- Students know the concept of buckling of shells for axially compressed cylindrical shells.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: Understand the concept of structural stability, and approach for design for stability.

CO2: Understand the concept of torsion buckling under different loading.

CO3: Understand the concept of lateral buckling of beams for cantilever and simply supported beams.

CO4: Understand the concept of lateral buckling of rectangular plates.

CO5: Understand the concept of buckling of axially compressed cylindrical shells.

UNIT - I

BUCKLING OF COLUMNS AND FRAMES

Introduction; Euler's column formula; Alternate form of the differential equation for determining critical loads; The use of beam-column theory in calculating the critical loads; Buckling of frames; The energy method; Buckling of a bar under distributed axial load; Buckling of bars with sudden change in cross section; Inelastic buckling of bars.

UNIT - II

TORSIONAL BUCKLING: Pure torsion of thin-walled bars of open cross section; Non-uniform torsion of thinwalled bars of open cross section; Torsional buckling under axial loading; Combined flexural and torsional buckling.

UNIT - III

LATERAL BUCKLING OF BEAMS

Differential equations for lateral buckling; Lateral buckling of beams in pure bending; Lateral buckling of cantilever and simply supported beams of narrow rectangular and I sections subjected to concentrated load.

UNIT - IV

Buckling of Rectangular Plates: Methods of calculation of critical loads; Buckling of simply supported rectangular plates uniformly compressed in one direction; Buckling of simply supported rectangular plates uniformly compressed in two perpendicular directions; Buckling of uniformly compressed rectangular plates simply supported along two opposite sides perpendicular to the direction of compression and having various edge conditions along the other two sides.

UNIT - V

Buckling of Shells: Introduction to buckling of axially compressed cylindrical shells.

TEXT BOOKS:

1) Theory of elastic stability by Timoshenko & Gere, McGraw Hill, 1961.
2) Background to buckling by Allen and Bulson, McGraw-Hill, 1980.
3) Structural stability – Theory and implementation by WF Chen and EM Lui, Elsevier, 1987.

REFERENCE BOOKS:

1) Principles of elastic stability by A.Chajes, Prentice-Hall, 1974.
2) Stability of structures – Principles and applications by CH Yoo and SC Lee, Butterworth Heinemann, 2011.

CO-PO/PSO MATRIX MAPPING:

CEHT103 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	2	-	-	-	-	-	1	-	1	1	2	-	1
CO2	1	2	3	2	-	-	-	-	-	1	-	1	1	2	-	1
CO3	2	2	3	2	-	-	-	-	-	1	-	1	1	2	1	1
CO4	2	2	3	2	-	-	-	-	-	1	-	1	1	2	1	1
CO5	2	2	3	2	-	-	-	-	-	1	-	1	1	2	1	1
TOTAL	3	3	3	3	-	-	-	-	-	1	-	1	1	3	1	1

CEHT104 (R20): ADVANCED THEORY AND DESIGN OF RCC STRUCTURES

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

To make the student learn and idealize the various failure modes of RCC elements in Shear, flexure and torsion under adverse conditions and understand the design aids to make them Stable under any given loading.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: To understand the behavior of members in shear, flexure and torsion.

CO2: To detail a structure such that it is effective for all types of loading.

CO3: To analyze and design a shear wall based on its shape and position.

CO4: To analyze and design of slabs using equivalent frame method.

CO5: To learn how to analyze the efficiency of slab using failure pattern suggested by yield line theory.

UNIT - I

BEHAVIOUR OF RCC MEMBERS IN SHEAR AND TORSION

Kani's theory for shear; Skew bending theory for torsion; Different modes of failure; Design of beams in combined shear, bending and torsion

UNIT - II

DETAILING OF RCC STRUCTURES

Basic principles of detailing – Truss analogy, Directional changes, General layout of reinforcement; Beam-column joints – Strut- and-Tie model, Detailing; Beam-to girder joints; Corners and T-Joints; Brackets and corbels

UNIT - III

DESIGN OF SHEAR WALLS

Introduction Classification of shear walls; Classification according to behaviour; Loads on shear walls; Design of rectangular and flanged shear walls.

UNIT - IV

FLAT SLABS

Shear in flat slabs and flat plates – One-way shear, Two-way (punching) shear, Shear due to unbalanced moment, Shear reinforcement design; Equivalent frame analysis of flat slabs – Historical development and definition of equivalent frame, Moment of inertia of slab-beams, Theoretical column stiffnesses, Use of published data for flat slabs, equivalent column method, arrangement of live load, Reduction in negative moments, Design procedure.

UNIT - V

YIELD LINE ANALYSIS OF SLABS

Introduction; Upper and lower bound theorems; Rules for yield lines; Analysis by segment equilibrium; Analysis by virtual work; Orthotropic reinforcement and skewed yield lines; special conditions at edges and corners; Fan patterns at concentrated loads; Limitations of yield line theory.

TEXT BOOKS:

1) Advanced reinforced concrete design by P.C.Varghese, Prentice-Hall of India, 2005.
2) Reinforced concrete structural elements by P.Purushothaman, Tata McGraw-Hill, 1984.
3) Reinforced concrete design by S.U. Pillai and D.Menon, Tata McGraw-Hill, 2003.
4) Design of reinforced concrete structures by N.Subramanian, Oxford University Press, 2013.

REFERNCE BOOKS:

1) Design of concrete structures by A.H.Nilson, McGraw-Hill, 1997.
2) Reinforced concrete structures by R.Park and T.Paulay, John Wiley & Sons, 1975

CO-PO/PSO MATRIX MAPPING:

CEHT104 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	2	-	-	-	-	-	-	-	1	1	3	-	1
CO2	1	2	3	2	-	-	-	-	-	-	-	1	1	3	-	1
CO3	2	2	3	2	-	-	-	-	-	-	-	1	1	3	-	1
CO4	2	2	3	2	-	-	-	-	-	-	-	1	1	3	-	1
CO5	2	2	3	2	-	-	-	-	-	-	-	1	1	3	-	1
TOTAL	3	3	3	3	-	-	-	-	-	-	-	3	1	3	-	1

CEHT201 (R20): ALTERNATIVE BUILDING MATERIALS & TECHNOLOGIES

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

This course will enable students to understand the environmental issues due to building materials and the energy consumption in manufacturing building materials. Study the various masonry blocks, masonry mortar and structural behavior of masonry under compression. Study the alternative building materials in the present context. Understand the alternative building technologies which are followed in present construction field.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: Solve the problems of Environmental issues concerned to building materials.

CO2: Suggest appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements.

CO3: Analyze different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.

CO4: Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material

CO5: Understanding the cost saving techniques in planning and design.

UNIT - I

INTRODUCTION: Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry, and Environmental friendly and cost effective building technologies. Requirements for building of different climatic regions. Traditional building methods and vernacular architecture.

UNIT – II

ALTERNATIVE BUILDING MATERIALS: Characteristics of building blocks for walls, Stones and Laterite blocks, Bricks and hollow clay blocks. Concrete blocks. Stabilized blocks: Mud Blocks, Steam Cured Blocks, Fal-G Blocks and Stone Masonry Block.

UNIT – III

a) LIME-POZZOLANA CEMENTS Raw materials, Manufacturing process, Properties and uses.

b) Fibre reinforced concretes. Matrix materials. Fibers: metal and synthetic Properties and Applications, Fibre reinforced plastics, Matrix materials Fibers: organic and synthetic properties and applications Building materials from agro and industrial wastes. Types of agro wastes. Types of industrial and mine wastes. Properties and applications. Field quality control test methods.

UNIT – IV

ALTERNATIVE BUILDING TECHNOLOGIES: Alternative for wall construction. Types, Construction method. Masonry mortars. Types. Preparation. Properties. Alternative roofing system. Concepts. Filler slabs. Composite beam panel roofs. Masonry vaults and domes, and nominal dimensions. Elements of building drawing. Introduction to building byelaws.

UNIT - V

COST EFFECTIVE BUILDING DESIGN: Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost Analysis: Case studies using alternatives.

TEXT BOOKS / REFERENCE BOOKS:

1) Properties of Concrete-A.M.Neville. Pitman Publishing Limited-London.
2) Alternative building methodologies for engineers and architects, K.S. Jagadish and B.V. Venkatarama Reddy, Indian Institute of Science, Bangalore.
3) Structural Masonry by Arnold W. Hendry.
4) Light weight concrete- Academic kiado- Rudhai .G – Publishing home of Hungarian Academy of Sciences 1963.
5) Low cost Housing – G.C. Mathur.
6) Modern trends in housing in developing countries – A.G. Madhava Rao D.S.Ramachandra Murthy & G.Annamalai

CO-PO/PSO MATRIX MAPPING:

CEHT 201 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	1	2	1
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	1	2	1
CO3	2	2	3	-	-	-	-	-	-	1	-	-	1	2	2	1
CO4	2	2	3	-	-	-	-	-	-	1	-	-	1	2	2	1
CO5	2	2	3	-	-	-	-	-	-	1	-	-	1	2	2	1
TOTAL	3	3	3	-	-	-	-	-	-	1	-	-	1	3	3	1

CEHT202 (R20): GROUND IMPROVEMENT TECHNIQUES

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

The students will try to learn-

- The importance and fundamentals of ground improvement techniques for measuring field parameters by using traditional and modern methods involved in civil construction.
- The mechanical methods and suitable equipment to proliferate the ground for making the soil to withstand all the loads acting on it.
- The physical, chemical and hydraulic modification methods and its applications for strengthen the soil.
- The applications of modern methods in civil construction alteration works, short creating, soil reinforcement, soil nailing, bolting involved in inclusion and confinement process.

COURSE OUTCOMES:

After successful completion of the course, students will be able to-

CO1	Identify the purpose of ground improvement techniques to obtain the suitable
CO2	List the problematic soils and its characteristics to select the suitable method for ground improvement.
CO3	Illustrate the various methods of ground improvement techniques to increase load bearing capacity of beneath and surface soils
CO4	Apply the methods of physical, chemical, mechanical and hydraulic for obtaining void less soils.
CO5	Explain the various grouting techniques and its applications for improving load bearing of beneath soils.

UNIT - I

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.

UNIT - II

MECHANICAL MODIFICATION:

Terminology and aims of mechanical modification, compaction purposes and strategies, Methods of compaction: Laboratory procedures-Dynamic compaction, kneading compaction, static compaction; shallow surface compaction-static rollers, impact and vibratory equipment, operational aspects of shallow compaction; Deep compaction techniques: precompression, explosion, heavy tamping, vibration, compaction grouting; Hydromechanical compaction-hydraulic fill, dry fill with subsequent spraying or flooding, compaction of rock fill with water jets.

UNIT - III

HYDRAULIC MODIFICATION:

Objectives and techniques, traditional dewatering methods-open sumps and ditches, mvacuum dewatering wells; Filtration, drainage and seepage control with geosynthetics-Geotextiles definition and types, geotextile applications, Basic functions of geotextiles; Preloading and use of vertical drains-Purpose of preloading and vertical drains, Methods of providing vertical drains-cylindrical sand drains, geosynthetic drains, Pre loading with vertical drains-radial consolidation, combined radial and vertical consolidation.

UNIT - IV

PHYSICAL AND CHEMICAL MODIFICATION:

Terminology, construction techniques and typical uses; Types of admixtures and their effect on soil properties-Granular admixtures, Cement stabilization and cement columns, Lime stabilization and lime columns, Stabilization using bitumen and emulsions, Stabilization using industrial wastes.

UNIT - V

MODIFICATION BY INCLUSIONS AND CONFINEMENT:

Concept of soil reinforcement; Reinforced soil as a homogeneous composite material-Elastic theory, strength theories; Discrete soil-reinforcement action; Reinforced earth and other strip reinforcing methods-standard materials and dimensions, failure modes; Development of design procedures-Original standard analysis, Tieback analysis - Rankine type analysis, Coulomb type analysis. Retaining walls with metallic strip reinforcement; step-by-step-design procedure using metallic strip reinforcement; Retaining walls with geotextile reinforcement; Retaining walls with Geogrid reinforcement-General, design procedure for geogrid-reinforced retaining wall. Insitu Ground reinforcement: Ground Anchors-Typical applications, types and components; Rock bolts- Typical applications, types and components; Soil nailing-Different soil nailing systems and applications, The importance of construction sequence, Analysis of nailed soil, Special considerations for slope stabilization.

TEXT BOOKS:

1) Hausmann M.R (1990) Engineering Principles of ground modification, McGraw-Hill Education(India) Private Limited, New Delhi.
2) Ground improvement Techniques, P.Purushothama Raju, Laxmi Publications Pvt. Ltd., New Delhi.

CO-PO/PSO MATRIX MAPPING:

CEHT202 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	1	-	1	-	1	1	-	-	-	1	3	3	-
CO2	1	2	2	2	2	-	1	-	-	-	-	-	-	3	3	-
CO3	2	3	2	2	2	-	-	-	-	-	-	-	1	3	3	-
CO4	1	3	3	2	2	1	1	-	-	-	-	-		3	3	-
CO5	1	3	2	2	1	2	1	-	-	-	-	-	-	3	3	-
TOTAL	3	3	3	3	3	3	1	1-	1	-	-	-	1	3	3	-

CEHT203 (R20): DESIGN OF EARTH RETAINING STRUCTIRES

L-3	T-0	P-0	M-100	C-4

COURSE LEARNING OBJECTIVES:

- To understand lateral earth pressure theories and pressure theories and design of retaining walls.
- To design anchored bulkheads by different methods.
- To understand pressure envelops and design of various components in braced cuts and cofferdams.

COURSE OUTCOME:

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

CO1: To understand the basics of earth dams, retaining structures, slopes, and cuts.

CO2: To understand and apply the basics of lateral earth pressure theories.

CO3: To apply geotechnical engineering principles for the design of earth dams, retaining structures, slopes, and cuts.

CO4: To analyze the stability of earth dams, slopes, cuts, and retaining structures

UNIT - I

Lateral Pressure: Basic concepts, Rankine and Coulomb earth pressure theories, graphical methods. Determining active and passive pressures: Culmanns, Rebhan's, logarithmic spiral methods, friction circle method. Consideration of surcharge, seepage, earth quake, 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

Anchored bulkheads: Classification of anchored bulkheads, free and fixed earth support methods. Rowe's theory for free earth supports and equivalent beam methods for fixed earth supports. Design of anchored rods and dead man.

UNIT - III

Braced cuts and Cofferdams: Braced excavations and stability of vertical cuts, lateral pressures in sand and clay, Braced and cellular cofferdams: uses, types, components, stability, piping and heaving. Stability of cellular cofferdams, cellular cofferdams in rock and in deep soils.

UNIT - IV

Earth dams- Stability analysis: Classification, seepage control in embankments and foundations, seepage analysis, stability analysis: upstream and down stream for steady seepage, rapid draw down, end of construction, method of slices and Bishop's method.

UNIT - V

Earth dams -Protection & Construction: Slope protection, filters, embankment construction materials and construction, quality control, grouting techniques. Instrumentation and performance observations in earth dams.

TEXT BOOKS:

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 Engineering for Embankment Dams By B. Singh & R. S. Varshney, A A Balkema Publishers, 1995.

REFERENCE BOOKS:

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.

CO-PO/PSO MATRIX MAPPING:

CEHT203 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	-	-	1	-	1	-	-	-	3	1	2	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	3	1	2	-	-
CO3	3	2	3	-	-	1	-	1	-	1	-	2	2	3	-	-
CO4	3	2	2	-	-	2	-	1	-	1	-	1	2	3	-	-
TOTAL	3	3	3	-	-	3	-	1	-	1	-	3	2	3	-	-

CEHT204 (R20): SOIL DYNAMICS AND MACHINE FOUNDATION

L-3	T-0	P-0	M-100	C-4

COURSE LEARNING OBJECTIVES:

The objective of this course is At the end of the Course, the Student will be able to:

- Develop basic knowledge in machine vibrations.
- Familiarize with dynamic properties of soil.
- Demonstrate the ability to design machine foundations.
- Demonstrate the ability to design foundations for Reciprocating and impact machines.
- Identify different Vibration isolation methods.

COURSE LEARNING OUTCOMES:

CO1	Students can understand the theory of vibrations.
CO2	Student can analysis the wave propagation and dynamic soil properties
CO3	Analysis of two degree freedom systems under free and forced vibration
CO4	Design of foundations for reciprocating and impact machines
CO5	Design the machine foundation with different criteria
CO6	Understand the types and methods – isolating materials and their properties

UNIT - I

THEORY OF VIBRATIONS

Basic definitions- Free and Forced vibrations with and without damping for Single degree freedom system- Resonance and its effect – Magnification – Logarithmic decrement – Transmissibility, Natural frequency of foundation soil system -Barkan's and IS methods – Pressure bulb concept.

UNIT - II

WAVE PROPAGATION AND DYNAMIC SOIL PROPERTIES

Elastic waves in Rods – Waves in elastic Half space, Field and Laboratory methods of determination – Uphole, Down hole and Cross hole methods – Cyclic plate load test – Block vibration test.

UNIT - III

MACHINE FOUNDATIONS

Design criteria, Permissible amplitudes and Bearing pressure, Degrees of freedom - Analysis under different modes of vibration of block foundation.

UNIT - IV

DESIGN OF FOUNDATIONS FOR RECIPROCATING AND IMPACT MACHINES

Analysis of Two Degree freedom systems under free and forced vibrations -Principles of Design of Foundations for reciprocating and impact machines as per IS code.

UNIT - V

VIBRATION ISOLATION

Types and methods – Isolating materials and their properties.

TEXT BOOKS:

1) Barkan, D., “Dynamics of Bases and Foundations”, 2nd Edition McGraw Hill Publishing, 1970.
2) Shamsher Prakash, “Soil Dynamics”, 3rd Edition, John Wiley, 2000.

REFERENCE BOOKS:

1) Richart, Hall and Woods, “Vibration of Soils and Foundations”, Prentice Hall, 1981.
2) Prasad.B.B., “Advance Soil Dynamics and Earthquake Engineering”, 1st Edition, PHI, 2011.
3) Srinivasulu.P and Vaidyanathan.G.V, “Handbook of Machine Foundations”, 2nd Edition, Tata McGraw Hill, 1999.

CO-PO/PSO MATRIX MAPPING:

CEHT 204 (R20)	Program Outcomes (PO’s)												Program Specific Outcomes (PSO’s)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	2	2	2	1	-	1	-	1	1	-	-	-	1	3	3	-
CO2	1	2	2	2	2	-	1	-	-	-	-	-	-	3	3	-
CO3	2	3	2	2	2	-		-	-	-	-	-	1	3	3	-
CO4	1	3	3	2	2	1	1	-	-	-	-	-		3	3	-
CO5	1	3	2	2	1	2	1	-	-	-	-	-	-	3	3	-
TOTAL	3	3	3	3	3	2	1	1	1	-	-	-	1	3	3	-

CEHT301 (R20): ALTERNATIVE BUILDING MATERIALS & TECHNOLOGIES

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

This course will enable students to understand the environmental issues due to building materials and the energy consumption in manufacturing building materials. Study the various masonry blocks, masonry mortar and structural behavior of masonry under compression. Study the alternative building materials in the present context. Understand the alternative building technologies which are followed in present construction field.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: Solve the problems of Environmental issues concerned to building materials.

CO2: Suggest appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements.

CO3: Analyze different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.

CO4: **R**ecommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material

CO5: Understanding the cost saving techniques in planning and design.

UNIT - I

INTRODUCTION: Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry, and Environmental friendly and cost effective building technologies. Requirements for building of different climatic regions. Traditional building methods and vernacular architecture.

UNIT – II

ALTERNATIVE BUILDING MATERIALS: Characteristics of building blocks for walls, Stones and Laterite blocks, Bricks and hollow clay blocks. Concrete blocks. Stabilized blocks: Mud Blocks, Steam Cured Blocks, Fal-G Blocks and Stone Masonry Block.

UNIT – III

a) LIME-POZZOLANA CEMENTS Raw materials, Manufacturing process, Properties and uses.
b) Fibre reinforced concretes. Matrix materials. Fibers: metal and synthetic Properties and Applications, Fibre reinforced plastics, Matrix materials Fibers: organic and synthetic .Properties and applications Building materials from agro and industrial wastes. Types of agro wastes. Types of industrial and mine wastes. Properties and applications. Field quality control test methods.

UNIT – IV

ALTERNATIVE BUILDING TECHNOLOGIES: Alternative for wall construction. Types, Construction method. Masonry mortars. Types. Preparation. Properties. Alternative roofing system. Concepts. Filler slabs. Composite beam panel roofs. Masonry vaults and domes, and nominal dimensions. Elements of building drawing. Introduction to building byelaws.

UNIT - V

COST EFFECTIVE BUILDING DESIGN: Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost Analysis: Case studies using alternatives.

TEXT BOOKS / REFERENCE BOOKS:

1) Properties of Concrete - A.M.Neville. Pitman Publishing Limited-London.
2) Alternative building methodologies for engineers and architects, K.S. Jagadish and B.V. Venkatarama Reddy, Indian Institute of Science, Bangalore.
3) Structural Masonry by Arnold W. Hendry.
4) Light weight concrete- Academic kiado- Rudhai .G – Publishing home of Hungarian Academy of Sciences 1963.
5) Low cost Housing – G.C. Mathur.
6) Modern trends in housing in developing countries – A.G. Madhava Rao D.S. Ramachandra Murthy & G.Annamalai

CO-PO/PSO MATRIX MAPPING:

CEHT 301 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	1	2	1
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	1	2	1
CO3	2	2	3	-	-	-	-	-	-	1	-	-	1	2	2	1
CO4	2	2	3	-	-	-	-	-	-	1	-	-	1	2	2	1
CO5	2	2	3	-	-	-	-	-	-	1	-	-	1	2	2	1
TOTAL	3	3	3	-	-	-	-	-	-	1	-	-	1	3	3	1

CEHT302 (R20): URBAN TRANSPORTATION &PLANNING

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

- To impart the knowledge of urban transportation system.
- Developing analytical and comprehensive approach to select appropriate mode of transportation.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: Apply up-to-date information for planning and operation of urban transport. Solve travel demand forecasting problems.

CO2: Attain knowledge on rates on trip generation models.

CO3: Evaluate the factors influencing the trip distribution and different methods.

CO4: Evaluate relative importance of various modes and their capacities.

CO5: Recommend most appropriate transport modes based on performance evaluation.

UNIT - I

URBAN TRAVEL DEMAND

Urban Development, transport problems and travel characteristics, Need for planning and overall planning process, Components of travel demand: Independent variables &Travel Attributes, Demand function and assumptions in demand estimation, Sequential travel demand modeling, Study Area: Zoning, cordon lines and screen lines Data requirements for demand estimation: Socio-Economic surveys, Land use Surveys, Traffic and Transport surveys, Study of reports and proposals.

UNIT - II

TRIP GENERATION

Trip characteristics, Factors influencing trip production and attraction, Trip rates, Zonal regression models, Category analysis, Personal trip generation models.

UNIT - III

TRIP DISTRIBUTION

Factors influencing trip distribution, Trip Length-Frequency Diagram, Growth Models: Growth factor methods, Linear Programming method, Opportunity models, Gravity opportunity model.

UNIT - IV

MODE CHOICE ANALYSIS

Factors influencing mode choice, Zonal regression models, Utility maximization, Discrete Choice Situation, Binary and multinomial logit models, Probability curves, Probit and nested logic models.

UNIT -V

PLAN PREPARATION AND EVALUATION

Types of plans: conceptual plans, master plan etc., Short term planning Vs long term planning, Corridor identification and evaluation techniques, Role of mass transit in urban transportation, Alternate systems of different mass transit systems, Multimodal integration and master plan preparation.

TEXT BOOK:

1) Dr. L.R. Kadiyali, "Traffic Engineering and Transport Planning", 6 thedition, Khanna Publishers, 1999.

REFERENCE BOOK:

1) Thirumurthy A.M., "Environmental Facilities and Urban Development in India – A System Dynamic Model for Developing Countries, Academic Foundations, 1 st Edition, India, 1992.

CO-PO/PSO MATRIX MAPPING:

CEHT302 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	1	-	-	-	-	1	1	-	1	1	-	3	-
CO2	3	1	-	2	-	-	-	-	1	1	-	1	1	-	3	-
CO3	3	1	-	2	-	-	-	-	1	1	-	1	1	-	3	-
CO4	3	1	-	2	-	-	-	-	1	-	-	1	1	-	3	-
CO5	3	1	-	2	-	-	-	-	1	1	-	1	1	-	3	-
TOTAL	3	3	-	3	-	-	-	-	1	1	1	3	1	1	3	-

CEHT303 (R20): TRAFFIC ENGINEERING

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

To introduce fundamental knowledge of traffic engineering so that students can understand and be able to deal with traffic issues including safety, planning, design, operation and control. Students will learn and be able to use software such as Highway Capacity Software and Synchro in traffic engineering projects.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: Understand the elements of highway safety and approaches to accidents studies.

CO2: Understand the traffic characteristics such as microscopic and macroscopic speed & density.

CO3: Design the traffic control devices using various methods.

CO4: Utilize modern software tools to estimate traffic measures such as LOS.

CO5: Understand the benefits and cost of intelligent highway vehicle system.

HIGHWAY ENGINEERING

UNIT – I

COMPONENTS OF THE TRAFFIC SYSTEM:

Human-Vehicle–Environment System; characteristics of Road users, Vehicles, Highways and their classification; Traffic Studies: Inventories; Volume studies; Speed, Travel time and Delay studies; Intersection studies; Pedestrian studies; Parking studies; Accident studies.

UNIT- II

TRAFFIC CHARACTERISTICS:

Microscopic and macroscopic flow characteristics: Time headways; Temporal, spatial and model flow patterns; Interrupted and Un interrupted traffic. Microscopic and macroscopic speed characteristics: Vehicular speed Trajectories; Speed characteristics – Mathematical distribution; Speed and travel time variations; Travel time and delay studies. Microscopic and Macroscopic density characteristics: Distance headway characteristics; Car following theories; Density measurement techniques; Density contour maps.

UNIT- III

TRAFFIC CONTROL DEVICES & HIGHWAY SAFETY: Traffic signs & Markings; Signal Warrants; Signal phasing and Development of phase plans; Fixed and Vehicle activated signals; Webster method; ARRB method; Drew's Method; IRC method; Signal coordination; Area Traffic control. Accident characteristics – Road – Driver – Vehicle; Accident recording and Analysis; Highway Safety Improvement Program; Safety Audit.

UNIT- IV

HIGHWAY CAPACITY AND LEVEL OF SERVICE:

Capacity and level of service; Factors affecting Capacity and LOS; Capacity of Rural Highways, Capacity of Urban Roads; HCM and IRC standards.

UNIT - V

INTELLIGENT VEHICLE – HIGHWAY SYSTEMS: Traffic surveillance and monitoring; IVHS programs, Role of IVHS, IVHS categories, Benefits and Costs of IVHS, Categories of ITS.

TEXT BOOKS:

1) ‘Traffic Engineering: Theory and Practice’ by Pignataro LJ., Prentice hall, Inc
2) ‘Traffic and Transport planning’ by Kadiyali L.R., Khanna Publishers.

REFERENCE BOOKS:

1) ‘Traffic Engineering’ by Rogu P. Roess, Elena S. Prassas and William R. Mc Shane, Pearson India Education Services pvt. Ltd.
2) Traffic and Highway Engineering by Garber and Hoel, Cengage Learning India pvt. Ltd., Noida, New Delhi.

CO-PO/PSO MATRIX MAPPING:

CEHT303 (R20)	Program Outcomes (PO’s)												Program Specific Outcomes (PSO’s)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	-	-	-	1	2	-	1	1	-	3	-
CO2	2	2	1	-	-	-	-	-	1	2	-	1	1	-	3	-
CO3	3	2	1	-	-	-	-	-	1	2	-	1	1	-	3	-
CO4	3	2	2	-	1	-	-	-	1	2	-	1	1	-	3	-
CO5	3	2	2	-	1	-	-	-	1	2	-	1	1	-	3	-
TOTAL	3	3	3	-	1	-	-	-	1	2	-	1	1	1	3	-

CEHT304 (R20): PAVEMNT ANALYSIS & DESIGN

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

This course is designed to review the fundamentals of design and practices of transportation engineering within the Civil Engineering curriculum. Students will design the flexible and rigid pavements using different methods.

COURSE OUTCOMES:

At the end of the Course/Subject, the students will be able to:

CO1: Understand the factors affecting design of pavements due to wheel loads and tyre pressure.

CO2: Analyze the stresses in pavements.

CO3: Understand, analyze and Design the flexible pavement with IRC 37.

CO4: Understand, analyze and Design the rigid pavement with IRC 58.

CO5: Understand the construction, maintenance and repairs of flexible and rigid pavements.

UNIT – I

Types of pavement-factors affecting design of pavements-wheel loads-type pressure- contact pressure, Material characteristics-Environmental and other factors.

UNIT-II

Stresses in rigid pavement- layered systems concept-one layer system- Boussinesq Two layer system – Burmister theory for pavement design.

UNIT – III

Stress in rigid pavement-relative stiffness of slab, modulus of sub-grade reaction- stresses due to warping, stresses due to loads, stresses due to friction. Pavement design: IRC method of flexible pavement design.

UNIT-VI

IRC method of rigid pavement design –joints-Dowel & Tie bar. Highway material tests-Bituminous material tests.

UNIT-V

Highway construction –Gravel, WBM, Bituminous pavements types- cement concrete roads. Failure in Rigid & Flexible pavements, Highway maintenance- special repairs.

TEXT BOOKS:

1) Highway Engineering-S.K.Khanna & C.J.Justo, Nemchand & Bros.,7th Edition (2000).
2) Principles and Practices of highway Engineering – Dr.L.R.Kadiyali & Dr.N.B.Lal – Khanna publishers- (2003).

REFERENCE BOOK:

1) Principles of Pavement Design-Yoder & Wit Zorac- John Willey & Sons.

INDIAN STANDARD CODES:

1) IRC Code for Flexible pavement-IRC-37-2001.
2) IRC Code for Rigid pavement-IRC-58-2002.

CO-PO/PSO MATRIX MAPPING:

CEHT 304 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	1	-	-	1	-	-	1	-	3	-
CO2	2	2	3	1	-	-	1	-	1	1	-	-	1	-	3	-
CO3	2	2	3	1	-	-	1	-	1	1	-	-	1	-	3	-
CO4	2	2	3	1	-	-	1	-	1	1	-	-	1	-	3	-
CO5	2	2	3	1	-	-	1	-	1	-	-	-	1	-	3	-
TOTAL	3	3	3	1	-	-	1	-	1	1	-	-	1	-	3	-

CEHT401 (R20): AIRPOLLUTION & CONTROL

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

The main objectives of this course are:

- To provide general understanding of quality of air and impact on local and global effects of air pollution on human, materials, properties and vegetation.
- To study the fate and transport of air pollutants and its measurement techniques.
- To discuss the various types of air pollution control equipment and their design principles and limitation.

COURSE OUTCOMES:

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

CO1: Identify the major sources of air pollution and understand their effects on health and environment.

CO2: Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.

CO3: Choose and design control techniques for particulate and gaseous emissions.

CO4: Classify and identify the sources of air pollutants and predict the effects of air pollutant on human health and environment.

CO5: Apply and relate the significance of various air pollution dispersion models.

CO6: Design various air pollution control equipment and evaluate its use

UNIT - I

INTRODUCTION: Air Pollution – Definitions, Scope, Significance and Episodes, Air Pollutants – Classifications – Natural and Artificial – Primary and Secondary, point and Non-Point, Line and Areal Sources of air pollution- stationary and mobile sources.

EFFECT OF AIR POLLUTANTS: Effects of Air pollutants on man, material and vegetation: Global effects of air pollution – Green House effect, Heat Islands, Acid Rains, Ozone Holes etc.

UNIT – II

THERMODYNAMICS OF AIR POLLUTION: Thermodynamics and Kinetics of Air-pollution – Applications in the removal of gases like SOx, NOx, CO, HC etc., air-fuel ratio. Computation and Control of products of combustion.

UNIT – III

METEOROLOGY OF AIR POLLUTION: Meteorology and plume Dispersion; properties of atmosphere; Heat, Pressure, Wind forces, Moisture and relative Humidity, Influence of Meteorological phenomena on Air Quality-wind rose diagrams.

UNIT – IV

AIR POLLUTION CONTROL – PARTICULATE MATTER: Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design and operation of control. Equipment's – Settling Chambers, Centrifugal separators, filters Dry and Wet scrubbers, Electrostatic precipitators.

AIR POLLUTION CONTROL – GASEOUS: General Methods of Control of NOx and SOx emissions – In-plant Control Measures, process changes, dry and wet methods of removal and recycling.

UNIT - V

AIR QUALITY MANAGEMENT: Air Quality Management – Monitoring of SPM, SO; NO and CO Emission Standards, Ambient Air Quality Standards. Conduct of Air pollution survey.

TEXT BOOKS:

1) Rao M.N. Rao H.V.N., "Air Pollution", Tata McGraw Hill Company, 2nd Edition, 1998.
2) Wark and Warner, "Air Pollution", Harper & Row, New York, 3rd Edition, 1989.
3) Murali Krishna VSG K, "Air Pollution", Kushal& Co, Kakinada, 2nd Edition.
4) Trivedi R.K and Goel P.K., "An introduction to Air Pollution", B.S. Publications, 2nd Q Edition 2009.

CO-PO/PSO MATRIX MAPPING:

CEHT401 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	-	3	3	3	3	3	-	3	-		3	-	3	-	-
CO2	3	3	3	3	3	3	3	-	3	-		3	-	-	-	-
CO3	3	3	3	3	3	3	3	-	3	-	3	3	-	3	-	-
CO4	3	-	3	3	3	3	3	3	3	-	3	3	-	-	-	3
CO5	3	3	3	3	3	3	3	-	3	-	3	3	-	-	-	-
CO6	3	3	3	3	3	3	3	-	3	-	-	-	-	3	-	-
TOTAL	3	3	3	3	3	3	3	1	3	-	3	3	-	3	-	1

CEHT402 (R20): ENVIRONMENTAL IMPACT ASSESSMENT

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

The main objectives of this course are:

- Define and Classify Environmental Impacts and the terminology.
- Understands the environmental Impact assessment procedure.
- Explain the EIA methodology.
- List and describe environmental audits.

COURSE OUTCOMES:

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

CO1: Identify the environmental attributes to be considered for the EIA study.

CO2: Formulate objectives of the EIA studies.

CO3: Identify the methodology to prepare rapid EIA.

CO4: Prepare EIA reports and environmental management plans

UNIT- I

EIA–COMPONENTS AND METHODS: Definition- Concepts, types, Limitations-components of EIA process, environmental setting various factors, documentation and selection process, environmental indices and indicators for describing affected environment. -methodologies: background information, Adhoc, Checklist, interaction matrix and network methodologies

UNIT- II

EIA NOTIFICATION BY MINISTRY OF ENVIRONMENT AND FOREST (GOVT. OF INDIA): Provisions in the EIA notification, public participation- Public hearing, Categorization of Industries for seeking environmental clearance from concerned authorities, procedure for environmental clearance, procedure for conducting environmental impact assessment report, Rapid and Comprehensive EIA, general structure of EIA document, Environmental management plan, post environmental monitoring, Environmental audit.

UNIT- III

PREDICTION AND ASSESSMENT OF IMPACT ON AIR AND NOISE ENVIRONMENT: Basic information of air quality, identification of type and quantity of air pollutant, existing air quality and air quality standards, impact prediction and assessment, mitigation. Basic information of noise, existing noise levels and standards, prediction of noise levels and assessment of impact, mitigation.

UNIT- IV

PREDICTION AND ASSESSMENT OF IMPACT ON WATER AND SOIL ENVIRONMENT: Basic information of water quality (Surface water and groundwater), water quality standards, identification of impact, prediction of impact and assessment, mitigation. Background information of soil environment, soil characteristics, prediction and assessment of impact on soil and mitigation.

UNIT- V

PREDICTION AND ASSESSMENT OF IMPACT ON CULTURAL AND SOCIOECONOMIC ENVIRONMENT: Basic information on cultural resources, rules and regulations for identification of cultural resources like archaeological, historical structures, Cultural system, prediction and assessment of impact, mitigation. Basic information of socioeconomic environment – description of existing socioeconomic environment, prediction and assessment of impact, mitigation, resettlement and rehabilitation.

TEXT BOOK:

1) Environmental Impact Methodologies – Y AnjaneyuluValliManickam.

REFERENCE BOOKS:

1) Environmental Impact Assessment, Canter R.L., McGraw Hill International Edition, 1997.
2) Environmental Impact Analysis Handbook, John G. Rau and David C. Wooten (Ed), McGraw HillBook Company.
3) Environmental Impact Assessment Theory and Practice', Peter Wathern (Eds.) - Unwin Hyman, London (1988).
4) Guidelines from website of MOEF, GOI and CPCB.

CO-PO/PSO MATRIX MAPPING:

CEHT402 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	3	3	3	-	-	3	-	-	-	-
CO2	3	3	3	3	3	3	3	3	3	-	-	3	3	-	-	-
CO3	3	3	3	3	3	3	3	3	3	-	3	3	-	3	-	-
CO4	3	3	3	3	3	3	3	3	3	-	3	3	3	-	-	3
TOTAL	3	3	3	3	3	3	3	3	3	-	3	3	1	3	-	3

CEHT403 (R20): ADVANCED ENVIRONMENTAL ENGINEERING

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

The main objectives of this course are:

- To explain the importance of self-purification of streams and to derive Streeter- P helps equation and to discuss the effects of various pollutants on receiving streams.
- To introduce new concepts in biological treatment like nitrogen and phosphorous removal, anaerobic filters, RBC and U-tube aeration systems, their working principles and suitability.
- To understand the characteristics and the treatment and disposal methods of liquid wastes produced in Dairy industry, Sugar industry and Pulp & paper industry.
- To introduce various functional elements of urban solid waste management and to introduce various methods of solid waste treatment methods with special emphasis on recovery and reuse of solid waste.
- To introduce sources, global effects and the effects on human health, plants and materials of air pollution.

COURSE OUTCOMES:

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

CO1: Understand the importance of self-purification and the effects of various pollutants on receiving streams.

CO2: Update his knowledge in biological treatment with new and more advanced treatment methods.

CO3: Understand the characteristics and suggest suitable methods of treatment and disposal of industrial wastewater.

CO4: Suggest suitable methods for collection, transport, recovery, reuse and treatment of urban solid waste.

CO5: Understand global implications of air pollution and suggest suitable methods of control of particulate pollution depending on concentration and size of the particulate matter.

CO6: Acquire knowledge on noise pollution and suggest suitable noise control techniques according to the situation.

UNIT – I

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

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 – II

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.

UNIT – III

SOURCES AND CLASSIFICATION OF AIR POLLUTION

Stationary and mobile sources; Primary and secondary pollutants; Natural contaminants; Particulate matter; 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.

UNIT – IV

METEOROLOGY AND AIR POLLUTION

Atmospheric stability and temperature inversions; Maximum Mixing Depth; Wind direction and speed; Plume behaviors; Gaussian Dispersion Model; Plume rise; Wind rose.

CONTROL OF AIR POLLUTION

Objectives; Types of collection equipment: Settling chamber; Inertial separators; Cyclones; Filters; Electrostatic Precipitators; Scrubbers.

UNIT – V

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 such as compositing, incineration, sanitary landfill and pyrolysis.

TEXT BOOKS:

1) Wastewater Treatment by M.N. Rao and A.K. Datta; Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2) Environmental Pollution Control Engineering by C.S. Rao; Wiley Eastern Ltd., New Delhi.
3) Air Pollution by M.N. Rao and H.V.N. Rao; Tata McGraw – Hill Publishing Co. Ltd., New Delhi.

REFERENCE BOOKS:

1) Wastewater Engineering, Treatment, Disposal and Reuse by Metcalf & Eddy Inc.; Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
2) Water Supply and Wastewater Disposal by G.M. Fair et all; John Wiley & Sons.
3) Sewage Disposal and Air Pollution Engineering by S.K. Garg; Khanna Publications, Delhi.
4) Sewage and Sewage Treatment by S.K. Kshirasagar; Roorkee Publishing House, Roorkee.

CO-PO/PSO MATRIX MAPPING:

CEHT403 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	3	3	3	-	-	3	-	-	-	-
CO2	3	3	3	3	3	3	3	3	3	-	3	3	-	-	-	-
CO3	3	3	3	3	3	3	3	3	3	-	-	3	-	3	3	-
CO4	3	3	3	3	3	3	3	3	3	-	3	3	-	-	3	-
CO5	3	3	3	3	3	3	3	3	3	-	3	3	-	3	-	-
CO6	3	3	3	3	3	3	3	3	3	-	3	3	-	-	-	-
TOTAL	3	3	3	3	3	3	3	3	3	-	3	3	-	2	2	-

CEHT404 (R20): URBAN WASTE MANAGEMENT

L-3	T-0	P-0	M-100	C-4

COURSE OBJECTIVES:

The main objectives of this course are:

- Understanding of problems of municipal waste, biomedical waste, hazardous waste, industrial waste etc.
- Knowledge of legal, institutional and financial aspects of management of solid wastes.
- Become aware of Environment and health impacts solid waste mismanagement
- Understand engineering, financial and technical options for waste management.

COURSE OUTCOMES:

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

CO1: Understand the principles of sanitation and the sanitation ladder.

CO2: Describe the technical options for liquid waste management in urban and peri-urban settings.

CO3: Explain the waste management hierarchy and identify opportunities to minimize solid waste production.

CO4: Describe the complete process for both liquid and solid waste management, including collection, storage, transportation and treatment.

CO5: Understand the role and potential of private sector engagement in solid and liquid waste management.

UNIT-I

WASTE GENERATION AND CHARACTERIZATION

Types and sources of solid wastes: Residential Waste, Commercial and Institutional Waste, Industrial Waste, Construction and Demolition Waste, an overview of various techniques for Evaluation of parameters, Selection of Appropriate Technologies for waste treatment,

UNIT-II

LEGISLATIONS FOR WASTE MANAGEMENT.

Processing and Treatment of Solid Waste: Mechanical Treatment Material Recovery Facility, Recycling and Recovery, Types of Material Recovery Facilities, Design of Material Recovery Facilities, Processing and Treatment of Solid Waste.

UNIT-III

BIOLOGICAL TREATMENT

Biological methods for waste processing: Composting, Bio Methanization, Biodiesel, Bio hydrogen, Mechanical Biological Stabilization Processing and Treatment of Solid Waste: Thermal Treatment Incineration, Residues and its utilization, co-combustion, Pyrolysis, Gasification, Refuse Derived Fuel, solid recovered fuel.

UNIT-IV

EMERGING TECHNOLOGIES IN WASTE MANAGEMENT

Technologies under Development, Bio-fuels and bio-chemicals, Bio CNG, Technologies for Smart Waste Collection, use of SCADA systems for waste management, technical options for Construction and Demolition Waste Management.

UNIT-V

ENGINEERING DISPOSAL OF SW: Dumping of solid waste; sanitary landfills – site selection, Design and operation of sanitary landfills – Leachate collection & treatment. Identify methods of solid waste disposal during a site visit and follow safety precautions.

TEXT BOOKS:

1) Solid Waste Technology &Management, Thomas Christensen, (2011)., John wiley & sons, USA.
2) Waste Management Practices: Municipal, Hazardous and Industrial, John Pichtel (2014)., 2nd Ed., CRC Press, USA
3) Hand Book of Solid Waste Management, Tchobanoglous G., Frank Kreith., (2002), 2nd Ed., McGraw Hill, USA.
4) Manual on Municipal Solid Waste Management, CPHEEO (2016)., Ministry of Urban Development, India.

CO-PO/PSO MATRIX MAPPING:

CEHT404 (R20)	Program Outcomes (PO's)												Program Specific Outcomes (PSO's)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	3	3	3	-	-	3	-	-	-	-
CO2	3	3	3	3	3	3	3	3	3	-	3	3	-	-	-	-
CO3	3	3	3	3	3	3	3	3	3	-	-	3	-	3	3	-
CO4	3	3	3	3	3	3	3	3	3	-	3	3	-	-	3	-
CO5	3	3	3	3	3	3	3	3	3	-	3	3	-	3	-	-
TOTAL	3	3	3	3	3	3	3	3	3	-	3	3	-	2	2	-

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