KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI   ERODE – 638 060

TAMILNADU INDIA

Estd : 1984

REGULATIONS, CURRICULUM & SYLLABI – 2022

**(CHOICE BASED CREDIT SYSTEM AND
OUTCOME BASED EDUCATION)**

(For the students admitted during 2022 - 2023 and onwards)

BACHELOR OF ENGINEERING
IN
CIVIL ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638060

(Autonomous)

REGULATIONS 2022

CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

BACHELOR OF ENGINEERING (BE) / BACHELOR OF TECHNOLOGY (BTech) DEGREE PROGRAMMES

These regulations are applicable to all candidates admitted into BE/BTech Degree programmes from the academic year 2022 – 2023 onwards.

1. **DEFINITIONS AND NOMENCLATURE**

    In these Regulations, unless otherwise specified:

    i.   "University" means ANNA UNIVERSITY, Chennai.

    ii.   "College" means KONGU ENGINEERING COLLEGE.

    iii.   "Programme" means Bachelor of Engineering (BE) / Bachelor of Technology (BTech) Degree programme

    iv.   "Branch" means specialization or discipline of BE/BTech Degree programme, like Civil Engineering, Information Technology, etc.

    v.   "Course" means a Theory / Theory cum Practical / Practical course that is normally studied in a semester like Mathematics, Physics etc.

    vi.   "Credit" means a numerical value allocated to each course to describe the candidate's workload required per week.

    vii.   "Grade" means the letter grade assigned to each course based on the marks range   specified.

    viii. "Grade point" means a numerical value (0 to 10) allocated based on the grade assigned   to each course.

    ix.   "Principal" means Chairman, Academic Council of the College.

    x.   "Controller of Examinations (COE)" means authorized person who is responsible for all examination related activities of the College.

    xi.   "Head of the Department (HOD)" means Head of the Department concerned.

2. **PROGRAMMES AND BRANCHES OF STUDY**

The following programmes and branches of study approved by Anna University, Chennai and All India Council for Technical Education, New Delhi are offered by the College.

Programme	Branch
BE	Civil Engineering
	Mechanical Engineering
	Electronics and Communication Engineering
	Computer Science and Engineering
	Electrical and Electronics Engineering
	Electronics and Instrumentation Engineering
	Mechatronics Engineering
	Automobile Engineering
	Computer Science and Design
BTech	Chemical Engineering
	Information Technology
	Food Technology
	Artificial Intelligence and Data Science
	Artificial Intelligence and Machine Learning

3. ADMISSION REQUIREMENTS

3.1   First Semester Admission

The candidates seeking admission to the first semester of the eight semester BE / BTech Degree Programme:

Should have passed the Higher Secondary Examination (10 + 2) in the academic stream with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III subjects of the study conducted by the Government of Tamil Nadu or any examination of any other University or authority accepted by the Anna University, Chennai as equivalent thereto.

(OR)

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamil Nadu.

They should also satisfy other eligibility conditions as prescribed by the Anna University, Chennai and Directorate of Technical Education, Chennai from time to time.

3.2   Lateral Entry Admission

The candidates who hold a Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamilnadu or its equivalent are eligible to apply for Lateral entry admission to the third semester of BE / BTech.

<div align="center">(OR)</div>

The candidates who hold a BSc degree in Science(10+2+3 stream) with mathematics as one of the subjects at the BSc level from a recognised University are eligible to apply for Lateral entry admission to the third semester of BE / BTech. Such candidates shall undergo two additional Engineering course(s) in the third and fourth semesters as prescribed by the College.

They should also satisfy other eligibility conditions prescribed by the Anna University, Chennai and Directorate of Technical Education, Chennai from time to time.

4.   STRUCTURE OF PROGRAMMES

4.1   Categorisation of Courses

The BE / BTech programme shall have a curriculum with syllabi comprising of theory, theory cum practical, practical courses in each semester, professional skills training/industrial training, project work, internship, etc that have been approved by the respective Board of Studies and Academic Council of the College. All the programmes have well defined Programme Outcomes (PO), Programme Specific Outcomes (PSO) and Programme Educational Objectives (PEOs) as per Outcome Based Education (OBE). The content of each course is designed based on the Course Outcomes (CO). The courses shall be categorized as follows:

i.   Humanities and Social Sciences (HS) including Management Courses, English Communication Skills, Universal Human Values and Yoga & Values for Holistic Development.

ii.   Basic Science (BS) Courses

iii.   Engineering Science (ES) Courses

iv.   Professional Core (PC) Courses

v.   Professional Elective (PE) Courses

vi.   Open Elective (OE) Courses

vii.   Employability Enhancement Courses (EC) like Project work, Professional Skills/Industrial Training, Comprehensive Test & Viva, Entrepreneurships/Start ups and Internship / In-plant Training in Industry or elsewhere

viii.   Audit Courses (AC)

ix.   Mandatory Courses (MC) like Student Induction Program and Environmental Science.

x. Honours Degree Courses (HC)

4.2   Credit Assignment and Honours Degree

4.2.1. Credit Assignment

Each course is assigned certain number of credits as follows:

Contact period per week	Credits
1 Lecture / Tutorial Period	1
2 Practical Periods	1
2 Project Work Periods	1
40 Training / Internship Periods	1

The minimum number of credits to complete the BE/BTech programme is 168.

4.2.2 Honours Degree

If a candidate earns 18 to 20 additional credits in an emerging area, then he/she can be awarded with Honours degree mentioning that emerging area as his/her specialization. The respective board of studies shall recommend the specializations for honours degree and appropriate additional courses to be studied by the candidate which shall get approval from Academic Council of the institution. A candidate shall have not less than 7.5 CGPA and no history of arrears to opt for the honours degree and has to maintain the same during the entire programme.

Various specializations for various branches recommended by the respective boards of studies are given below:

SNo	Specializations for Honours degree in emerging areas	To be offered as Honours, Only for the following branches mentioned against the specialization
1.	Construction Technology	BE – Civil Engineering
2.	Smart Cities	BE – Civil Engineering
3.	Smart Manufacturing *	BE – Mechanical Engineering
4.	Computational Product Design *	BE – Mechanical Engineering
5.	Intelligent Autonomous Systems *	BE – Mechatronics Engineering
6.	E-Mobility *	BE – Automobile Engineering
7.	Artificial Intelligence and Machine Learning	BE – Electronics and Communication Engineering
8.	System on Chip Design *	BE – Electronics and Communication Engineering
9.	Electric Vehicles	BE – Electrical and Electronics Engineering
10.	Microgrid Technologies	BE – Electrical and Electronics Engineering
11.	Intelligent Sensors Technology *	BE – Electronics and Instrumentation Engineering

12.	Smart Industrial Automation *	BE – Electronics and Instrumentation Engineering
13.	Data Science	BE – Computer Science and Engineering
14.	Cyber Security	BE – Computer Science and Engineering
15.	Data Science	BTech – Information Technology
16.	Cyber Security	BTech – Information Technology
17.	Petroleum and Petrochemical Engineering *	BTech – Chemical Engineering
18.	Waste Technology *	BTech – Chemical Engineering
19.	Food Processing and Management *	BTech – Food Technology
20.	Virtual and Augumented Reality	BE- Computer Science and Design
21.	Data Science	BE- Computer Science and Design
22.	Internet of Things (IoT)	BTech – Artificial Intelligence and Data Science
23.	Blockchain	BTech – Artificial Intelligence and Data Science
24.	Internet of Things (IoT)	BTech – Artificial Intelligence and Machine Learning
25.	Blockchain	BTech – Artificial Intelligence and Machine Learning

*Title by KEC

The courses specified under Honours degree in the emerging area may include theory, theory cum practical, practical, project work, etc. under the particular specialization. A candidate can choose and study these specified courses from fourth semester onwards and he/she shall successfully complete the courses within the stipulated time vide clause 5. Total number of credits earned in each semester may vary from candidate to candidate based on the courses chosen. The registration, assessment & evaluation pattern and classification of grades of these courses shall be the same as that of the courses in the regular curriculum of the programme of the candidate vide clause 6, clause 7 and clause 15 respectively. A candidate can earn Honours degree in only one specialization during the entire duration of the programme.

4.3   Employability Enhancement Courses

A candidate shall be offered with the employability enhancement courses like project work, internship, professional skills training/industrial training, comprehensive test & viva, and entrepreneurships/start ups during the programme to gain/exhibit the knowledge/skills.

4.3.1 Professional Skills Training/ Indsutrial Training/Entrepreneurships/Start Ups/ Inplant Training

A candidate may be offered with appropriate training courses imparting programming skills, communication skills, problem solving skills, aptitude skills etc. It is offered in two phases as phase I in fourth semester and phase II in fifth semester including vacation periods and each phase can carry two credits.

(OR)

A candidate may be allowed to go for training at research organizations or industries for a required number of hours in fifth semester vacation period. Such candidate can earn two credits for this training course in place of Professional Skills Training course II in fifth semester. He/She shall attend Professional Skills Training Phase I in fourth semester and can earn two credits.

(OR)

A candidate may be allowed to set up a start up and working part-time for the start ups by applying his/her innovations and can become a student entrepreneur during BE/BTech programme. Candidates can set up their start up from fifth semester onwards either inside or outside of the college. Such student entrepreneurs may earn 2 credits in place of Professional Skills Training II. The area in which the candidate wants to initiate a start up may be interdisciplinary or multidisciplinary. The progress of the startup shall be evaluated by a panel of members constituted by the Principal through periodic reviews.

4.3.2 Comprehensive Test and Viva

The overall knowledge of the candidate in various courses he/she studied shall be evaluated by (i) conducting comprehensive tests with multiple choice questions generally with pattern similar to GATE and/or (ii) viva-voce examination conducted by a panel of experts assigned by the Head of the department. The members can examine the knowledge of the candidate by asking questions from various domains and the marks will be assigned based on their answers. This course shall carry two credits.

4.3.3 Full Time Project through Internships

The curriculum enables a candidate to go for full time project through internship during a part of seventh semester and/or entire final semester and can earn credits   vide clause 7.6 and clause 7.11.

A candidate is permitted to go for full time projects through internship in seventh semester with the following condition: The candidate shall complete a part of the seventh semester courses with a total credit of about 50% of the total credits of seventh semester including Project Work-II Phase-I in the first two months from the commencement of the seventh semester under fast track mode. The balance credits required to complete the seventh semester shall be earned by the candidate through either approved One/Two Credit Courses /Online courses / Self Study Courses or

Add/Drop courses as per clause 4.4 and clause 4.5 respectively.

A candidate is permitted to go for full time projects through internship during eighth semester. Such candidate shall earn the minimum number of credits required to complete eighth semester other than project through either approved One / Two Credit Courses /Online courses / Self Study Courses or Add/Drop courses as per clause 4.4 and clause 4.5 respectively.

Assessment procedure is to be followed as specified in the guidelines approved by the Academic Council.

4.3.4 A student shall go for in-plant training for duration of two weeks during the entire programme. It is mandatory for all the students.

4.4 One / Two Credit Courses / Online Courses / Self Study Courses

The candidates may optionally undergo One / Two Credit Courses / Online Courses / Self Study Courses as elective courses.

4.4.1 **One / Two Credit Courses:** One / Two credit courses shall be offered by the college with the prior approval from respective Board of Studies. A candidate can earn a maximum of six credits through one / two credit courses during the entire duration of the programme.

4.4.2 **Online Courses:** Candidates may be permitted to earn credits for online courses, offered by NPTEL / SWAYAM / a University / Other Agencies, approved by respective Board of Studies.

4.4.3 **Self Study Courses:** The Department may offer an elective course as a self study course. The syllabus of the course shall be approved by the respective Board of Studies. However, mode of assessment for a self study course will be the same as that used for other courses. The candidates shall study such courses on their own under the guidance of member of the faculty following due approval procedure. Self study course is limited to one per semester.

4.4.4 The elective courses in the final year may be exempted if a candidate earns the required credits vide clause 4.4.1, 4.4.2 and 4.4.3 by registering the required number of courses in advance.

4.4.5 A candidate can earn a maximum of 30 credits through all one / two credit courses, online courses and self study courses.

4.5 Flexibility to Add or Drop Courses

4.5.1 A candidate has to earn the total number of credits specified in the curriculum of the respective programme of study in order to be eligible to obtain the degree. However, if the candidate wishes, then the candidate is permitted to earn more than the total number of credits prescribed in the curriculum of the candidate's programme.

4.5.2 From the first to seventh semesters the candidates have the option of registering for additional elective/Honours courses or dropping of already registered additional elective/Honours courses within two weeks from the start of the semester. Add / Drop is only an option given to the candidates.

4.6 Maximum number of credits the candidate can enroll in a particular semester cannot exceed 30 credits.

4.7 The blend of different courses shall be so designed that the candidate at the end of the programme would have been trained not only in his / her relevant professional field but also would have developed to become a socially conscious human being.

4.8 The medium of instruction, examinations and project report shall be English.

5. DURATION OF THE PROGRAMME

5.1 A candidate is normally expected to complete the BE / BTech Degree programme in 8 consecutive semesters/4 Years (6 semesters/3 Years for lateral entry candidate), but in any case not more than 14 semesters/7 Years (12 semesters/6 Years for lateral entry candidate).

5.2 Each semester shall consist of a minimum of 90 working days including continuous assessment test period. The Head of the Department shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus for the course being taught.

5.3 The total duration for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum duration specified in clause 5.1 irrespective of the period of break of study (vide clause 11) or prevention (vide clause 9) in order that the candidate may be eligible for the award of the degree (vide clause 16). Extension beyond the prescribed period shall not be permitted.

6. COURSE REGISTRATION FOR THE EXAMINATION

6.1 Registration for the end semester examination is mandatory for courses in the current semester as well as for the arrear courses failing which the candidate will not be permitted to move on to the higher semester. This will not be applicable for the courses which do not have an end semester examination.

6.2 The candidates who need to reappear for the courses which have only continuous assessment shall enroll for the same in the subsequent semester, when offered next, and repeat the course. In this case, the candidate shall attend the classes, satisfy the attendance requirements (vide clause 8) and earn continuous assessment marks. This will be considered as an attempt for the purpose of classification.

6.3 If a candidate is prevented from writing end semester examination of a course due to lack of attendance, the candidate has to attend the classes, when offered next, and fulfill the attendance requirements as per clause 8 and earn continuous assessment marks. If the course, in which the candidate has a lack of attendance, is an elective, the candidate may register for the same or any other elective course in the subsequent semesters and that will be considered as an attempt for the purpose of classification.

6.4 A candidate shall register for the chosen courses as well as arrear courses (if any vide clause 6.2 and 6.3) from the list of courses specified under Honours degree.

7. ASSESSMENT AND EXAMINATION PROCEDURE FOR AWARDING MARKS

7.1 The BE/BTech programmes consist of Theory Courses, Theory cum Practical courses, Practical courses, Comprehensive Test and Viva, Project Work, Industrial Training /Professional Skills Training, Internship/In-plant Training and Entrepreneurships/ Start ups. Performance in each course of study shall be evaluated based on (i) Continuous Assessments (CA) throughout the semester and (ii) End Semester Examination (ESE) at the end of the semester except for the courses which are evaluated based on continuous assessment only. Each course shall be evaluated for a maximum of 100 marks as shown below:

Sl. No.	Category of Course	Continuous Assessment Marks	End Semester Examination Marks
1.	Theory	40	60
2.	Theory cum Practical (The distribution of marks shall be decided based on the credit weightage assigned to theory and practical components)	50	50
3.	Practical	60	40
4.	Professional Skills Training / Comprehensive Test & Viva / Entrepreneurships / Start ups / Project Work I / Mandatory Course/Industrial Training/ Universal Human Values / Yoga and Values for Holistic Development	100	---
5.	Project Work II Phase I / Project Work II Phase II / Internships	50	50
6.	One / Two credit Course	The distribution of marks shall be decided based on the credit weightage assigned	---
7.	All other Courses		

7.2 Examiners for setting end semester examination question papers for theory courses, theory cum practical courses and practical courses and evaluating end semester examination answer scripts, project works, internships and entrepreneurships/start ups shall be appointed by the Controller of Examinations after obtaining approval from the Principal.

7.3 **Theory Courses**

For all theory courses out of 100 marks, the continuous assessment shall be 40 marks and the end semester examination shall be for 60 marks. However, the end semester examinations shall be conducted for 100 marks and the marks obtained shall be reduced to 60. The continuous assessment tests shall be conducted as per the schedule laid down in the academic schedule. The total of the continuous assessment marks and the end semester examination marks shall be rounded off to the nearest integer.

7.3.1 The assessment pattern for awarding continuous assessment marks shall be as follows:

Sl. No.	Type	Max. Marks	Remarks
1.	Test - I	20	Average of best 2 tests (20 marks)
	Test - II	20	
	Test - III	20	
2.	Tutorial: (Tutorial/Problem Solving (or) Simulation (or) Simulation & Mini Project (or) Mini Project (or) Case Studies (or) Any other relevant to the course)	15	Type of assessment is to be chosen based on the nature of the course and to be approved by Principal
3.	Others: Assignment / Paper Presentation in Conference / Seminar / Comprehension / Activity based learning / Class notes	05	To be assessed by the Course Teacher based on any one type.
	Total	40	Rounded off to the one decimal place

However, the assessment pattern for awarding the continuous assessment marks may be changed based on the nature of the course and is to be approved by the Principal.

7.3.2 A reassessment test or tutorial covering the respective test or tutorial portions may be conducted for those candidates who were absent with valid reasons (Sports or any

other reason approved by the Principal).

7.3.3 The end semester examination for theory courses shall be for a duration of three hours and shall be conducted between November and January during odd semesters and between April and June during even semesters of every year.

7.4   Theory cum Practical Courses

For courses involving theory and practical components, the evaluation pattern as per the clause 7.1 shall be followed. Depending on the nature of the course, the end semester examination shall be conducted for theory and the practical components. The apportionment of continuous assessment and end semester examination marks shall be decided based on the credit weightage assigned to theory and practical components approved by Principal.

7.5   Practical Courses

For all practical courses out of 100 marks, the continuous assessment shall be for 60 marks and the end semester examination shall be for 40 marks. Every exercise / experiment shall be evaluated based on the candidate's performance during the practical class and the candidates' records shall be maintained.

7.5.1 The assessment pattern for awarding continuous assessment marks for each course shall be decided by the course coordinator based on rubrics of that particular course, and shall be based on rubrics for each experiment.

7.5.2 The end semester examination shall be conducted for a maximum of 100 marks for duration of 3 hours and reduced to 40 marks. The appointment of examiners and the schedule shall be decided by chairman of Board of Study of the relevant board.

7.6   Project Work II Phase I / Project Work II Phase II

7.6.1 Project work shall be assigned to a single candidate or to a group of candidates not exceeding 4 candidates in a group. The project work is mandatory for all the candidates.

7.6.2 The Head of the Department shall constitute review committee for project work. There shall be two assessments by the review committee during the semester. The candidate shall make presentation on the progress made by him/her before the committee.

7.6.3 The continuous assessment and end semester examination marks for Project Work II Phase I /Project Work II Phase II and the Viva-Voce Examination shall be distributed as below.

Continuous Assessment (Max. 50 Marks)						End Semester Examination (Max. 50 Marks)			
Zeroth Review		Review I (Max.. 20 Marks)		Review II (Max. 30 Marks)		Report Evaluation (Max. 20 Marks)	Viva - Voce (Max. 30 Marks)		
Rv. Com	Super visor	Review Committee (excluding supervisor)	Super visor	Review Committee (excluding supervisor)	Super visor	Ext. Exr.	Super visor	Exr.1	Exr.2
0	0	10	10	15	15	20	10	10	10

7.6.4 The Project Report prepared according to approved guidelines and duly signed by the Supervisor shall be submitted to Head of the Department. The candidate(s) must submit the project report within the specified date as per the academic schedule of the semester. If the project report is not submitted within the specified date then the candidate is deemed to have failed in the Project Work and redo it in the subsequent semester.

7.6.5 If a candidate fails to secure 50% of the continuous assessment marks in the project work, he / she shall not be permitted to submit the report for that particular semester and shall have to redo it in the subsequent semester and satisfy attendance requirements.

7.6.6 The end semester examination of the project work shall be evaluated based on the project report submitted by the candidate in the respective semester and viva-voce examination by a committee consisting of two examiners and supervisor of the project work.

7.6.7 If a candidate fails to secure 50 % of the end semester examination marks in the project work, he / she shall be required to resubmit the project report within 30 days from the date of declaration of the results and a fresh viva-voce examination shall be conducted as per clause 7.6.6.

7.6.8 A copy of the approved project report after the successful completion of viva-voce examination shall be kept in the department library.

7.7 **Project Work I / Industrial Training**

The evaluation method shall be same as that of the Project Work II as per clause 7.6 excluding 7.6.3, 7.6.5, 7.6.6 and 7.6.7. The marks distribution is given below.

Continuous Assessment (Max. 100 Marks)								
Zeroth Review		Review I (Max.. 20 Marks)		Review II (Max.. 30 Marks)		Review III (Max. 50 Marks)		
						Report Evaluation (Max. 20 Marks)	Viva - Voce (Max. 30 Marks)	
Review Committee	Supervisor	Review Committee (excluding supervisor)	Supervisor	Review Committee (excluding supervisor)	Supervisor	Review Committee	Supervisor	Review Committee
0	0	10	10	15	15	20	10	20

If a candidate fails to secure 50 % of the continuous assessment marks in this course, he / she shall be required to resubmit the project report within 30 days from the date of declaration of the results and a fresh viva-voce examination shall be conducted.

7.8 **Professional Skills Training**

Phase I training shall be conducted for minimum of 80 hours in 3rd semester vacation and during 4th semester. Phase II training shall be conducted for minimum of 80 hours in 4th semester vacation and during 5th semester. The evaluation procedure shall be approved by the board of the offering department and Principal.

7.9 **Comprehensive Test and Viva**

A candidate can earn 2 credits by successfully completing this course. The evaluation procedures shall be approved by the Principal.

7.10 **Entrepreneurships/ Start ups**

A start up/business model may be started by a candidate individually or by a group of maximum of three candidates during the programme vide clause 4.3.1. The head of the department concerned shall assign a faculty member as a mentor for each start up.

A review committee shall be formed by the Principal for reviewing the progress of the Start ups / Business models, innovativeness, etc. The review committee can recommend the appropriate grades for academic performance for the candidate(s) involved in the start ups. This course shall carry a maximum of two credits in fifth semester and shall be evaluated through continuous assessments for a maximum of 100 marks vide clause 7.1. A report about the start ups is to be submitted to the review committee for evaluation for each start up and the marks will be given to Controller of Examinations after getting approval from Principal.

7.11   In-Plant Training

Each candidate shall go for In-Plant training for a duration of minimum of two weeks during the entire programme of study and submit a brief report about the training undergone and a certificate issued from the organization concerned.

7.12   One / Twe Credit Courses

For all one/ two credit courses out of 100 marks, the continuous assessment shall be 50 marks and the model examination shall be for 50 marks. Minimum of two continuous assessments tests shall be conducted during the one / two credit course duration by the offering department concerned. Model examination shall be conducted at the end of the course.

7.13   Online Course

The Board of Studies will provide methodology for the evaluation of the online courses. The Board can decide whether to evaluate the online courses through continuous assessment and end semester examination or through end semester examination only. In case of credits earned through online mode from NPTEL / SWAYAM / a University / Other Agencies approved by Chairman, Academic Council, the credits may be transferred and grades shall be assigned accordingly.

7.14   Self Study Course

The member of faculty approved by the Head of the Department shall be responsible for periodic monitoring and evaluation of the course. The course shall be evaluated through continuous assessment and end semester examination. The evaluation methodology shall be the same as that of a theory course.

7.15   Audit Course

A candidate may be permitted to register for specific course not listed in his/her programme curriculum and without undergoing the rigors of getting a 'good' grade, as an Audit course, subject to the following conditions.

The candidate can register only one Audit course in a semester starting from   second semester subject to a maximum of two courses during the entire programme of study. Such courses shall be indicated as 'Audit' during the time of registration itself. Only courses currently offered for credit to the candidates of other branches can be audited.

A course appearing in the curriculum of a candidate cannot be considered as an audit course. However, if a candidate has already met the Professional Elective and Open Elective credit requirements as stipulated in the curriculum, then, a Professional Elective or an Open Elective course listed in the curriculum and not taken by the candidate for credit can be considered as an audit course.

Candidates registering for an audit course shall meet all the assessment and examination requirements (vide clause 7.3) applicable for a credit candidate of that course. Only if the candidate obtains a performance grade, the course will be listed in the semester Grade Sheet and in the Consolidated Grade Sheet along with the grade SC (Successfully Completed). Performance grade will not be shown for the audit course.

Since an audit course has no grade points assigned, it will not be counted for the purpose of

GPA and CGPA calculations.

7.16 Mandatory Courses

A candidate joined in first semester shall attend and complete a mandatory course namely Student Induction Program of duration three weeks at the beginning of first semester. The candidates studying in second year shall attend and complete another one mandatory course namely Environmental Science. No credits shall be given for mandatory courses and shall be evaluated through continuous assessment tests only vide clause 7.1 for a maximum of 100 marks each. Upon the successful completion, these courses will be listed in the semester grade sheet and in the consolidated grade sheet with the grade "SC" (Successfully Completed). Since no grade points are assigned, these courses will not be counted for the purpose of GPA and CGPA calculations.

7.17 Universal Human Values (UHV) and Yoga and Values for Holistic Development (YVHD)

Courses YVHD shall be offered to all first year candidates of all BE/ BTech programmes to impart knowledge on yoga and human values. Course UHV shall be offered to all the second year BE/ BTech students. These courses shall carry a maximum of 100 marks each and shall be evaluated through continuous assessment tests only vide clause 7.1. The candidate(s) can earn 2 credits for UHV and 1 credit for YVHD by successfully completing these courses. Two continuous assessment tests will be conducted and the average marks will be taken for the calculation of grades.

8. REQUIREMENTS FOR COMPLETION OF A SEMESTER

8.1 A candidate who has fulfilled the following conditions shall be deemed to have   satisfied the requirements for completion of a semester and permitted to appear for the examinations of that semester.

8.1.1 Ideally, every candidate is expected to attend all classes and secure 100 % attendance. However, a candidate shall secure not less than 80 % (after rounding off to the nearest integer) of the overall attendance taking into account the total number of working days in a semester.

8.1.2 A candidate who could not satisfy the attendance requirements as per clause 8.1.1 due to medical reasons (hospitalization / accident / specific illness) but has secured not less than 70 % in the current semester may be permitted to appear for the current semester examinations with the approval of the Principal on payment of a condonation fee as may be fixed by the authorities from time to time. The medical

certificate needs to be submitted along with the leave application. A candidate can avail this provision only twice during the entire duration of the degree programme.

A candidate who could not satisfy the attendance requirements as per clause 8.1.1 due to his/her entrepreneurships/ start ups activities, but has secured not less than 60 % in the current semester can be permitted to appear for the current semester examinations with the recommendation of review committee and approval from the Principal.

8.1.3 In addition to clause 8.1.1 or 8.1.2, a candidate shall secure not less than 60 % attendance in each course.

8.1.4 A candidate shall be deemed to have completed the requirements of study of any semester only if he/she has satisfied the attendance requirements (vide clause 8.1.1 to 8.1.3) and has registered for examination by paying the prescribed fee.

8.1.5 Candidate's progress is satisfactory.

8.1.6 Candidate's conduct is satisfactory and he/she was not involved in any indisciplined activities in the current semester.

8.2. The candidates who do not complete the semester as per clauses from 8.1.1 to 8.1.6 except 8.1.3 shall not be permitted to appear for the examinations at the end of the semester and not be permitted to go to the next semester. They have to repeat the incomplete semester in next academic year.

8.3 The candidates who satisfy the clause 8.1.1 or 8.1.2 but do not complete the course as per clause 8.1.3 shall not be permitted to appear for the end semester examination of that course alone. They have to repeat the incomplete course in the subsequent semester when it is offered next.

9. **REQUIREMENTS FOR APPEARING FOR END SEMESTER EXAMINATION**

9.1 A candidate shall normally be permitted to appear for end semester examination of the current semester if he/she has satisfied the semester completion requirements as per clause 8, and has registered for examination in all courses of that semester. Registration is mandatory for current semester examinations as well as for arrear examinations failing which the candidate shall not be permitted to move on to the higher semester.

9.2 When a candidate is deputed for a National / International Sports event during End Semester examination period, supplementary examination shall be conducted for such a candidate on return after participating in the event within a reasonable period of time. Such appearance shall be considered as first appearance.

9.3 A candidate who has already appeared for a course in a semester and passed the examination is not entitled to reappear in the same course for improvement of letter grades / marks.

10. **PROVISION FOR WITHDRAWAL FROM EXAMINATIONS**

10.1   A candidate may, for valid reasons, be granted permission to withdraw from appearing for the examination in any regular course or all regular courses registered in a particular semester. Application for withdrawal is permitted only once during the entire duration of the degree programme.

10.2   The withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination (vide clause 9) and has applied to the Principal for permission prior to the last examination of that semester after duly recommended by the Head of the Department.

10.3   The withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction/First Class.

10.4   If a candidate withdraws a course or courses from writing end semester examinations, he/she shall register the same in the subsequent semester and write the end semester examinations. A final semester candidate who has withdrawn shall be permitted to appear for supplementary examination to be conducted within reasonable time as per clause 14.

10.5   The final semester candidate who has withdrawn from appearing for project viva-voce for genuine reasons shall be permitted to appear for supplementary viva-voce examination within reasonable time with proper application to Controller of Examinations and on payment of prescribed fee.

11. PROVISION FOR BREAK OF STUDY

11.1   A candidate is normally permitted to avail the authorised break of study under valid reasons (such as accident or hospitalization due to prolonged ill health or any other valid reasons) and to rejoin the programme in a later semester. He/She shall apply in advance to the Principal, through the Head of the Department, stating the reasons therefore, in any case, not later than the last date for registering for that semester examination.   A candidate is permitted to avail the authorised break of study only once during the entire period of study for a maximum period of one year. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for the break of study.

11.2   The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance shall be governed by the rules and regulations in force at the time of rejoining.

11.3   The candidates rejoining in new Regulations shall apply to the Principal in the prescribed format through Head of the Department at the beginning of the readmitted semester itself for prescribing additional/equivalent courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.

11.4   The total period of completion of the programme reckoned from the commencement of the semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5 irrespective of the period of break of study in order to qualify for the award of the degree.

11.5 If any candidate is prevented for want of required attendance, the period of prevention shall not be considered as authorized break of study.

11.6 If a candidate has not reported to the college for a period of two consecutive semesters without any intimation, the name of the candidate shall be deleted permanently from the college enrollment. Such candidates are not entitled to seek readmission under any circumstances.

12. PASSING REQUIREMENTS

12.1 A candidate who secures not less than 50 % of total marks (continuous assessment and end semester examination put together) prescribed for the course with a minimum of   45 % of the marks prescribed for the end semester examination in all category of courses vide clause 7.1 except for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course in the examination.

12.2 A candidate who secures not less than 50 % in continuous assessment marks prescribed for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course. If a candidate secures less than 50% in the continuous assessment marks, he / she shall have to re-enroll for the same in the subsequent semester and satisfy the attendance requirements.

12.3 For a candidate who does not satisfy the clause 12.1, the continuous assessment marks secured by the candidate in the first attempt shall be retained and considered valid for subsequent attempts. However, from the fourth attempt onwards the marks scored in the end semester examinations alone shall be considered, in which case the candidate shall secure minimum 50 % marks in the end semester examinations to satisfy the passing requirements.

13. REVALUATION OF ANSWER SCRIPTS

A candidate shall apply for a photocopy of his / her semester examination answer script within a reasonable time from the declaration of results, on payment of a prescribed fee by submitting the proper application to the Controller of Examinations. The answer script shall be pursued and justified jointly by a faculty member who has handled the course and the course coordinator and recommended for revaluation. Based on the recommendation, the candidate can register for revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for revaluation and the results will be intimated to the candidate concerned. Revaluation is permitted only for Theory courses and Theory cum Practical courses where end semester examination is involved.

14. SUPPLEMENTARY EXAMINATION

If a candidate fails to clear all courses in the final semester after the announcement of final end semester examination results, he/she shall be allowed to take up supplementary examinations to be conducted within a reasonable time for the courses of final semester alone, so that he/she gets a chance to complete the programme.

15. AWARD OF LETTER GRADES:

For all the passed candidates, the relative grading principle is applied to assign the letter grades.

Marks / Examination Status	Letter Grade	Grade Point
Based on the relative grading	O (Outstanding)	10
	A+ (Excellent)	9
	A (Very Good)	8
	B+ (Good)	7
	B (Average)	6
	C (Satisfactory)	5
Less than 50	U (Reappearance)	0
Successfully Completed	SC	0
Withdrawal	W	-
Absent	AB	-
Shortage of Attendance in a course	SA	-

The Grade Point Average (GPA) is calculated using the formula:

$$\text{GPA} = \frac{\sum[(\text{course credits}) \times (\text{grade points})] \text{ for all courses in the specific semester}}{\sum(\text{course credits}) \text{ for all courses in the specific semester}}$$

The Cumulative Grade Point Average (CGPA) is calculated from first semester (third semester for lateral entry candidates) to final semester using the formula

$$\text{CGPA} = \frac{\sum[(\text{course credits}) \times (\text{grade points})] \text{ for all courses in all the semesters so far}}{\sum(\text{course credits}) \text{ for all courses in all the semesters so far}}$$

The GPA and CGPA are computed only for the candidates with a pass in all the courses.

The GPA and CGPA indicate the academic performance of a candidate at the end of a semester and at the end of successive semesters respectively.

A grade sheet for each semester shall be issued containing Grade obtained in each course, GPA and CGPA.

A duplicate copy, if required can be obtained on payment of a prescribed fee and satisfying other procedure requirements.

Withholding of Grades: The grades of a candidate may be withheld if he/she has not cleared his/her dues or if there is a disciplinary case pending against him/her or for any other reason.

16. **ELIGIBILITY FOR THE AWARD OF DEGREE**

A candidate shall be declared to be eligible for the award of the BE / BTech Degree provided the candidate has

i. Successfully completed all the courses under the different categories, as specified in the regulations.

ii. Successfully gained the required number of total credits as specified in the curriculum corresponding to the candidate's programme within the stipulated time (vide clause 5).

iii. Successfully passed any additional courses prescribed by the respective Board of Studies whenever readmitted under regulations other than R-2022 (vide clause 11.3)

iv. No disciplinary action pending against him / her.

17. **CLASSIFICATION OF THE DEGREE AWARDED**

17.1 **First Class with Distinction:**

17.1.1. A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry candidates) in the **First Appearance** within eight consecutive semesters (six consecutive semesters for lateral entry candidates) excluding the authorized break of study (vide clause 11) after the commencement of his / her study.

- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.

- Should have secured a CGPA of not less than 8.50

(OR)

17.1.2 A candidate who joins from other institutions on transfer or a candidate who gets readmitted and has to move from one regulations to another regulations and who qualifies for the award of the degree (vide clause 16) and satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry candidates) in the **First Appearance** within eight consecutive semesters (six consecutive semesters for lateral entry candidates) excluding the authorized break of study (vide clause 11) after the commencement of his / her study.

- Submission of equivalent course list approved by the respective Board of studies.

- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.

- Should have secured a CGPA of not less than 9.00

17.2 **First Class:**

A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have passed the examination in First

class:

- Should have passed the examination in all the courses of all eight semesters (six semesters for lateral entry candidates) within ten consecutive semesters (eight consecutive semesters for lateral entry candidates) excluding authorized break of study (vide clause 11) after the commencement of his / her study.

- Withdrawal from the examination (vide clause 10) shall not be considered as an appearance.

- Should have secured a CGPA of not less than 6.50

17.3   Second Class:

All other candidates (not covered in clauses 17.1 and 17.2) who qualify for the award of the degree (vide clause 16) shall be declared to have passed the examination in Second Class.

17.4   A candidate who is absent for end semester examination in a course / project work after having registered for the same shall be considered to have appeared for that examination for the purpose of classification.

17.5   Honors Degree:

A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have earned the BE/BTech degree with Honours (vide clause 16 and clause 4.2.2):

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry candidates) in the **First Appearance** within eight consecutive semesters (six consecutive semesters for lateral entry candidates) excluding the authorized break of study (vide clause 11) after the commencement of his / her study.

- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.

- Should have secured a CGPA of not less than 7.50

18.   MALPRACTICES IN TESTS AND EXAMINATIONS

If a candidate indulges in malpractice in any of the tests or end semester examinations, he/she shall be liable for punitive action as per the examination rules prescribed by the college from time to time.

19.   AMENDMENTS

Notwithstanding anything contained in this manual, the Kongu Engineering College through the Academic council of the College, reserves the right to modify/amend without notice, the Regulations, Curricula, Syllabi, Scheme of Examinations, procedures, requirements, and rules pertaining to its BE / BTech programme.

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B.E. - CIVIL ENGINEERING CURRICULUM UNDER R2022
(For the candidates admitted from academic year 2022-23 onwards)

SEMESTER – I

Course Code	Course Title	Hours/Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
	Theory/Theory with Practical								
22EGT11	Communication Skills - I	3	0	0	3	40	60	100	HS
22MAC11	Matrices and Ordinary Differential Equations	3	1*	2*	4	50	50	100	BS
22PHT11	Physics for Civil Engineering	3	0	0	3	40	60	100	BS
22CET11	Construction Materials and Practices	3	0	0	3	40	60	100	PC
22CSC11	Problem Solving and Programming in C	3	0	2	4	100	0	100	ES
22MET11	Engineering Drawing	2	1	0	3	40	60	100	ES
Practical/ Employability Enhancement									
22MEL11	Engineering Practices Laboratory	0	0	2	1	60	40	100	ES
22PHL11	Physics Laboratory for Civil Engineering	0	0	2	1	60	40	100	BS
22VEC11	Yoga and Values for Holistic Development	-	-	-	1	100	0	100	HS
22MNT11	Student Induction Program	-	-	-	0	100	0	100	MC
	Total				**23**				

*Alternate weeks

SEMESTER – II

Course Code	Course Title	Hours/Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/ Theory with Practical									
22EGT21	Communication Skills – II	3	0	0	3	40	60	100	HS
22MAC21	Multivariable Calculus and Complex Analysis	3	1*	2*	4	50	50	100	BS
22CYT21	Chemistry for Civil Engineering	3	0	0	3	40	60	100	BS
22CEC21	Surveying and Geomatics	3	0	2	4	50	50	100	PC
22CSC21	Fundamentals of Data Structures	3	0	2	4	50	50	100	ES
22CET21	Engineering Mechanics	3	0	0	3	40	60	100	ES
22TAM01	Heritage of Tamils	1	0	0	1	100	0	100	HS
Practical/ Employability Enhancement									
22CEL21	Computer Aided Building Drawing Laboratory	0	0	2	1	60	40	100	PC
22CYL21	Chemistry Laboratory for Civil Engineering	0	0	2	1	60	40	100	BS
	Total			**24**					

*Alternate Weeks

B.E. – CIVIL ENGINEERING CURRICULUM UNDER R2022

SEMESTER – III

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
22ITC32	Introduction to Python	3	0	2	4	50	50	100	ES
22CEC31	Concrete Technology	3	0	2	4	50	50	100	PC
22CET31	Mechanics of Materials	3	1	0	4	40	60	100	PC
22CET32	Fluid Mechanics and Hydraulics Engineering	3	0	0	3	40	60	100	PC
22CET33	Construction Engineering and Management	3	0	0	3	40	60	100	PC
22TAM02	Tamils and Technology	1	0	0	1	100	0	100	HS
Practical / Employability Enhancement									
22CEL31	Strength of Materials Laboratory	0	0	2	1	60	40	100	ES
22CEL32	Fluid Mechanics and Hydraulics Engineering Laboratory	0	0	2	1	60	40	100	PC
22MNT31	Environmental Science	2	0	0	0	100	0	100	MC
22EGL31	Communication Skills Development Laboratory	0	0	2	1	60	40	100	HS
Total Credits to be earned					**22**				

SEMESTER – IV

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
22MAT41	Numerical Methods for Engineers	3	1	0	4	40	60	100	BS
22CEC41	Geotechnical Engineering - I	2	0	2	3	50	50	100	PC
22CEC42	Environmental Engineering	2	0	2	3	50	50	100	PC
22CET41	Design of RC Elements	3	1	0	4	40	60	100	PC
22CET42	Structural Analysis	3	1	0	4	40	60	100	PC
Practical / Employability Enhancement									
22CEL41	Computer Aided Building Information Modelling Laboratory	0	0	2	1	60	40	100	PC
22CEL42	Computer Aided Structural Design Laboratory - I	0	0	2	1	60	40	100	PC
22GCL41/ 22GCI41	Professional Skills Training I / Industrial Training I*	--	--	--	2	100	0	100	EC
Total Credits to be earned					**22**				

*80 Hours of Training

B.E. CIVIL ENGINEERING CURRICULUM – R2022
<mark>**(For the candidates admitted from academic year 2022-23 onwards)**</mark>

SEMESTER – V

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Cate gory
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
22CEC51	Transportation Engineering	2	0	2	3	50	50	100	PC
22CET51	Geotechnical Engineering-II	3	0	0	3	40	60	100	PC
22CET52	Water Resources and Irrigation Engineering	3	0	0	3	40	60	100	PC
22CET53	Design of Steel Structures	3	1	0	4	40	60	100	PC
	Professional Elective-I	3	0	0	3	40	60	100	PE
	Open Elective-I	3	1/0	0/2	4	40/ 50	60/ 50	100	OE
Practical / Employability Enhancement									
22CEL51	Computer Aided Structural Design Laboratory-II	0	0	2	1	60	40	100	PC
22CEL52	Computational Laboratory for Construction Management	0	0	2	1	60	40	100	PC
22GCL51/ 22GCI 51	Professional Skills Training II / Industrial Training II *	--	--	--	2	100	0	100	EC
Total Credits to be earned					**24**				

*80 Hours of Training

SEMESTER – VI

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Cate gory
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
22CET61	Estimation and Quantity Surveying	3	0	0	3	40	60	100	PC
22CET62	Pre-Engineered Buildings	3	0	0	3	40	60	100	PC
	Professional Elective-II	3	0	0	3	40	60	100	PE
	Open Elective-II	3	1/0	0/2	4	40/ 50	60/ 50	100	OE
Practical / Employability Enhancement									
22CEL61	Structural Engineering Laboratory	0	0	2	1	60	40	100	PC
22CEL62	Computer Aided Structural Detailing Laboratory	0	0	2	1	60	40	100	PC
22GEP61	Comprehensive Test and Viva	---	---	---	2	100	0	100	EC
22CEP61	Project Work-I	---	---	8	4	50	50	100	EC
22GET31	Universal Human Values	2	0	0	2	100	0	100	HS
Total Credits to be earned					**23**				

SEMESTER – VII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Cate gory
		L	T	P		CA	ESE	Total	
	Theory/Theory with Practical								
22GCT71	Engineering Economics and Management	3	0	0	3	40	60	100	HS
	Professional Elective-III	3	0	0	3	40	60	100	PE
	Professional Elective-IV	3	0	0	3	40	60	100	PE
	Professional Elective-V	3	0	0	3	40	60	100	PE
	Open Elective - III	3	0	0	3	40	60	100	OE
Practical / Employability Enhancement									
22CEP71	Project Work-II Phase-I	0	0	10	5	50	50	100	EC
Total Credits to be earned					**20**				

SEMESTER – VIII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
	Professional Elective-VI	3	0	0	3	40	60	100	PE
	Open Elective-IV	3	0	0	3	40	60	100	OE
Practical / Employability Enhancement									
22CEP81	Project Work-II Phase-II	0	0	8	4	50	50	100	EC
Total Credits to be earned					**10**				

Total Credits: 166

Course Code	Course Title	L	T	P	Credit	Domain/ Stream
	LIST OF PROFESSIONAL ELECTIVES					
		Hours/Week				
	Semester 5					
	Elective I					
22CEE01	Design of Pre-stressed Concrete Structures	3	0	0	3	SE
22CEE02	Operations Research	3	0	0	3	CEM
22CEE03	Solid and Hazardous Waste Management	3	0	0	3	EE
22CEE04	Railway, Airport and Harbor Engineering	3	0	0	3	TE
22CEE05	Ground Improvement Techniques	3	0	0	3	GE
22CEE06	Remote Sensing and Geographical Information System	3	0	0	3	BG
	Semester 6					
	Elective II					
22CEE07	Advanced Structural Analysis	3	0	0	3	SE
22CEE08	Contract Management	3	0	0	3	CEM
22CEE09	Environmental Impact Assessment	3	0	0	3	EE
22CEE10	Traffic Engineering and Management	3	0	0	3	TE
22CEE11	Environmental Geo-technology	3	0	0	3	GE
22CEE12	Engineering Geology	3	0	0	3	BG
	Semester 7					
	Elective III					
22CEE13	Advanced Steel Design	3	0	0	3	SE
22CEE14	Architecture and Town Planning	3	0	0	3	CEM
22CEE15	Air and Noise Pollution Control Engineering	3	0	0	3	EE
22CEE16	Urban Transportation Planning	3	0	0	3	TE
22CEE17	Rock Mechanics	3	0	0	3	GE
22CEE18	Finite Element Methods	3	0	0	3	BG
22GEE02	Total Quality Management	3	0	0	3	
	Elective IV					
22CEE19	Earthquake Engineering and Design	3	0	0	3	SE
22CEE20	Sustainable Engineering	3	0	0	3	CEM
22CEE21	Industrial Waste Management	3	0	0	3	EE
22CEE22	Public Transportation Systems	3	0	0	3	TE
22CEE23	Site Investigation and Soil Exploration	3	0	0	3	GE
22CEE24	Green Building	3	0	0	3	BG
22GEE01	Fundamentals of Research	3	0	0	3	BG
	Elective V					

22CEE25	Design of Prefabricated Structures	3	0	0	3	SE
22CEE26	Construction Equipment and Management	3	0	0	3	CEM
22CEE27	Surface Hydrology	3	0	0	3	WRE
22CEE28	Intelligent Transport System	3	0	0	3	TE
22CEE29	Reinforced Soil Structures	3	0	0	3	GE
22CEE30	Safety in Construction Practices	3	0	0	3	BG
Semester 8						
Elective VI						
22CEE31	Basics of Bridge Engineering	3	0	0	3	SE
22CEE32	Advanced Reinforced Concrete Design	3	0	0	3	SE
22CEE33	Distress Monitoring and Rehabilitation of Structures	3	0	0	3	CEM
22CEE34	Water Power Engineering	3	0	0	3	WRE
22CEE35	Transportation Economics	3	0	0	3	TE
22CEE36	Geotechnical Earthquake Engineering	3	0	0	3	GE
22CEE37	Disaster Preparedness and Planning	3	0	0	3	BG

Domain/Stream Abbreviations: SE - Structural Engineering, CEM - Construction Engineering & Management, EE - Environmental Engineering, WRE - Water Resources Engineering, TE - Transportation Engineering, GE - Geotechnical Engineering, BG – Branch General

B.E. DEGREE IN CIVIL ENGINEERING
CURRICULUM UNDER REGULATIONS 2022
(For candidates admitted in the academic year 2023-24)

SEMESTER – I

Course Code	Course Title	Hours/Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
	Theory/Theory with Practical								
22EGT11	Communication Skills I	3	0	0	3	40	60	100	HS
22MAC11	Matrices and Ordinary Differential Equations	3	1*	2*	4	50	50	100	BS
22PHT11	Physics for Civil Engineering	3	0	0	3	40	60	100	BS
22CSC11	Problem Solving and Programming in C	3	0	2	4	50	50	100	ES
22MET11	Engineering Drawing	2	1	0	3	40	60	100	ES
22TAM01	Heritage of Tamils	1	0	0	1	100	0	100	HS
Practical/ Employability Enhancement									
22GCL11	Foundation Laboratory – Manufacturing, Design and Robotics	0	0	6	3	100	0	100	ES
22PHL11	Physics Laboratory for Civil Engineering	0	0	2	1	60	40	100	BS
22VEC11	Yoga and Values for Holistic Development	-	-	-	1	100	0	100	HS
22MNT11	Student Induction Program	-	-	-	0	100	0	100	MC
	Total				**23**				

SEMESTER – II

Course Code	Course Title	Hours/Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/ Theory with Practical									
22EGT21	Communication Skills II	3	0	0	3	40	60	100	HS
22MAC21	Multivariable Calculus and Complex Analysis	3	1*	2*	4	50	50	100	BS
22CYT21	Chemistry for Civil Engineering	3	0	0	3	40	60	100	BS
22CSC21	Fundamentals of Data Structures	3	0	2	4	50	50	100	ES
22CET21	Engineering Mechanics	3	0	0	3	40	60	100	PC
22TAM02	Tamils and Technology	1	0	0	1	100	0	100	HS
Practical/ Employability Enhancement									
22GCL21	Foundation Laboratory – Electrical, IoT and Web	0	0	6	3	100	0	100	ES
22CYL21	Chemistry Laboratory for Civil Engineering	0	0	2	1	60	40	100	BS
	Total				**22**				

L – Lecture, T – Tutorial, P – Practical, C – Credits, CA – Continuous Assessment, ESE – End Semester Examination,

B.E. CIVIL ENGINEERING CURRICULUM – R2022
(For candidates admitted in the academic year 2023-24)

SEMESTER – III

Course Code	Course Title	L	T	P	Credit	CA	ESE	Total	Category
		Hours / Week				**Maximum Marks**			Cate gory
Theory/Theory with Practical									
22ITC32	Introduction to Python	3	0	2	4	50	50	100	ES
22CEC21	Surveying and Geomatics	3	0	2	4	50	50	100	PC
22CEC31	Concrete Technology	3	0	2	4	50	50	100	PC
22CET31	Mechanics of Materials	3	1	0	4	40	60	100	ES
22CET32	Fluid Mechanics and Hydraulics Engineering	3	0	0	3	40	60	100	PC
Practical / Employability Enhancement									
22CEL31	Strength of Materials Laboratory	0	0	2	1	60	40	100	PC
22CEL32	Fluid Mechanics and Hydraulics Engineering Laboratory	0	0	2	1	60	40	100	PC
22MNT31	Environmental Science	2	0	0	0	100	0	100	MC
22EGL31	Communication Skills Development Laboratory	0	0	2	1	60	40	100	HS
Total Credits to be earned					**22**				

SEMESTER – IV

Course Code	Course Title	L	T	P	Credit	CA	ESE	Total	Category
		Hours / Week				**Maximum Marks**			Cate gory
Theory/Theory with Practical									
22MAT41	Numerical Methods for Engineers	3	1	0	4	40	60	100	BS
22CET33	Construction Engineering and Management	3	0	0	3	40	60	100	PC
22CEC41	Geotechnical Engineering-I	2	0	2	3	50	50	100	PC
22CEC42	Environmental Engineering	2	0	2	3	50	50	100	PC
22CET42	Structural Analysis	3	1	0	4	40	60	100	PC
Practical / Employability Enhancement									
22CEL21	Computer Aided Building Drawing Laboratory	0	0	2	1	60	40	100	PC
22CEL42	Computer Aided Structural Design Laboratory-I	0	0	2	1	60	40	100	PC
22GCL41/ 22GCI41	Professional Skills Training I / Industrial Training I*	--	--	--	2	50	50	100	EC
Total Credits to be earned					**21**				

*80 Hours of Training**

B.E. CIVIL ENGINEERING CURRICULUM – R2022
(For candidates admitted in the academic year 2023-24)

SEMESTER – V									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22CET41	Design of RC Elements	3	1	0	4	40	60	100	PC
22CET51	Geotechnical Engineering-II	3	0	0	3	40	60	100	PC
22CEC51	Transportation Engineering	2	0	2	3	50	50	100	PC
22CET52	Water Resources and Irrigation Engineering	3	0	0	3	40	60	100	PC
	Professional Elective-I	3	0	0	3	40	60	100	PE
	Open Elective-I	3	1/0	0/2	4	40	60	100	OE
Practical / Employability Enhancement									
22CEL41	Computer Aided Building Information Modelling Laboratory	0	0	2	1	60	40	100	PC
22CEL51	Computer Aided Structural Design Laboratory-II	0	0	2	1	60	40	100	PC
22GCL51/ 22GCI51	Professional Skills Training II / Industrial Training II*	0	0	0	2	50	50	100	EC
Total Credits to be earned					**24**				

SEMESTER – VI									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
22CET53	Design of Steel Structures	3	1	0	4	40	60	100	PC
22CET61	Estimation and Quantity Surveying	3	0	0	3	40	60	100	PC
	Professional Elective-II	3	0	0	3	40	60	100	PE
	Open Elective-II	3	1/0	0/2	4	40	60	100	OE
Practical / Employability Enhancement									
22CEL61	Structural Engineering Laboratory	0	0	2	1	60	40	100	PC
22CEL62	Computer Aided Structural Detailing Laboratory	0	0	2	1	60	40	100	PC
22GEP61	Comprehensive Test and Viva	---	---	---	2	100	0	100	EC
22CEP62	Project Work-I	---	---	10	5	50	50	100	EC
22GCT31	Universal Human Values	2	0	0	2	100	0	100	HS
Total Credits to be earned					**25**				

B.E. CIVIL ENGINEERING CURRICULUM – R2022
(For candidates admitted in the academic year 2023-24)

SEMESTER – VII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
22CET62	Pre-Engineered Buildings	3	0	0	3	40	60	100	PC
22GCT71	Engineering Economics and Management	3	0	0	3	40	60	100	HS
	Professional Elective-III	3	0	0	3	40	60	100	PE
	Professional Elective-IV	3	0	0	3	40	60	100	PE
	Open Elective - III	3	0	0	3	40	60	100	OE
Practical / Employability Enhancement									
22CEP72	Project Work-II Phase-I	0	0	3	6	50	50	100	EC
Total Credits to be earned					**21**				

SEMESTER – VIII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
	Professional Elective-V	3	0	0	3	40	60	100	PE
	Open Elective-IV	3	0	0	3	40	60	100	OE
Practical / Employability Enhancement									
22CEP81	Project Work-II Phase-II	0	0	8	4	50	50	100	EC
Total Credits to be earned					**10**				

Total Credits: 168

Course Code	Course Title	Hours/Week			Credit	Domain/Stream
		L	T	P		
LIST OF PROFESSIONAL ELECTIVES (2023-24)						
Semester 5						
Elective I						
22CEE01	Design of Prestressed Concrete Structures	3	0	0	3	SE
22CEE02	Operations Research	3	0	0	3	CEM
22CEE03	Solid and Hazardous Waste Management	3	0	0	3	EE
22CEE04	Railway, Airport and Harbor Engineering	3	0	0	3	TE
22CEE05	Ground Improvement Techniques	3	0	0	3	GE
22CEE06	Remote Sensing and Geographical Information System	3	0	0	3	BG
Semester 6						
Elective II						
22CEE07	Advanced Structural Analysis	3	0	0	3	SE
22CEE08	Contract Management	3	0	0	3	CEM
22CEE09	Environmental Impact Assessment	3	0	0	3	EE
22CEE10	Traffic Engineering and Management	3	0	0	3	TE
22CEE11	Environmental Geo-technology	3	0	0	3	GE
22CEE12	Engineering Geology	3	0	0	3	BG
Semester 7						
Elective III						
22CEE13	Advanced Steel Design	3	0	0	3	SE
22CEE14	Architecture and Town Planning	3	0	0	3	CEM
22CEE15	Air and Noise Pollution Control Engineering	3	0	0	3	EE
22CEE16	Urban Transportation Planning	3	0	0	3	TE
22CEE17	Rock Mechanics	3	0	0	3	GE
22CEE18	Finite Element Methods	3	0	0	3	BG
22GEE02	Total Quality Management	3	0	0	3	
Elective IV						
22CEE19	Earthquake Engineering and Design	3	0	0	3	SE
22CEE20	Sustainable Engineering	3	0	0	3	CEM
22CEE21	Industrial Waste Management	3	0	0	3	EE
22CEE22	Public Transportation Systems	3	0	0	3	TE
22CEE23	Site Investigation and Soil Exploration	3	0	0	3	GE
22CEE24	Green Building	3	0	0	3	BG
22GEE01	Fundamentals of Research	3	0	0	3	BG
22CEE25	Design of Prefabricated Structures	3	0	0	3	SE
22CEE26	Construction Equipment and Management	3	0	0	3	CEM
22CEE27	Surface Hydrology	3	0	0	3	WRE

22CEE28	Intelligent Transport System	3	0	0	3	TE
22CEE29	Reinforced Soil Structures	3	0	0	3	GE
22CEE30	Safety in Construction Practices	3	0	0	3	BG
Semester 8						
Elective V						
22CEE31	Basics of Bridge Engineering	3	0	0	3	SE
22CEE32	Advanced Reinforced Concrete Design	3	0	0	3	SE
22CEE33	Distress Monitoring and Rehabilitation of Structures	3	0	0	3	CEM
22CEE34	Water Power Engineering	3	0	0	3	WRE
22CEE35	Transportation Economics	3	0	0	3	TE
22CEE36	Geotechnical Earthquake Engineering	3	0	0	3	GE
22CEE37	Disaster Preparedness and Planning	3	0	0	3	BG

Domain/Stream Abbreviations: SE - Structural Engineering, CEM - Construction Engineering & Management, EE - Environmental Engineering, WRE - Water Resources Engineering, TE - Transportation Engineering, GE - Geotechnical Engineering, BG – Branch General

OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE)
(Offered by Department of Civil Engineering)

S. No.	Course Code	Course Name	L	T	P	C	Sem
1.	22CEX01	Remote Sensing and its Applications	3	0	2	4	5
2.	22CEO01	Disaster Management	3	1	0	4	6
3.	22CEO02	Introduction to Smart Cities	3	0	0	3	7
4.	22CEO03	Environmental Health and Safety	3	0	0	3	7
5.	22CEO04	Infrastructure Planning and Management	3	0	0	3	8
6.	22CEO05	Environmental Laws and Policy	3	0	0	3	8

LIST OF OPEN ELECTIVE COURSES OFFERED BY CHEMISTRY DEPARTMENT

1. 22CYO01 - INSTRUMENTAL METHODS OF ANALYSIS

2. 22CYO02 - CHEMISTRY CONCEPTS FOR COMPETITIVE EXAMINATIONS

3. 22CYO03 – ORGANIC CHEMISTRY FOR INDUSTRY

4. 22CYO04 - CORROSION SCIENCE AND ENGINEERING

5. 22CYO05 - CHEMISTRY OF COSMETICS IN DAILY LIFE

6. 22CYO06 – NANOCOMPOSITE MATERIALS

7. 22CYO07 - WASTE AND HAZARDOUS WASTE MANAGEMENT

8. 22CYO08 - CHEMISTRY IN EVERY DAY LIFE

9. 22CYO09 - CHEMISTRY OF NUTRITION FOR WOMEN HEALTH

GENERAL OPEN ELECTIVE
(Common to All BE/BTech branches)

S.No.	Course Code	Course Title	L	T	P	C	Offering Dept.	Semester
1	22GEO01	German Language Level 1	4	0	0	4	ECE	
2	22GEO02	Japanese Language Level 1	4	0	0	4	ECE	
3	22GEO03	Design Thinking for Engineers	3	1	0	4	CSE	V
4	22GEO04	Innovation and Business Model Development	3	1	0	4	MTS	VI
5	22GEO05	German Language Level 2	4	0	0	4	ECE	

6	22GEO06	German Language Level 3	3	0	0	3	ECE	
7	22GEO07	German Language Level 4	3	0	0	3	ECE	
8	22GEO08	Japanese Language Level 2	4	0	0	4	ECE	
9	22GEO09	Japanese Language Level 3	3	0	0	3	ECE	
10	22GEO10	Japanese Language Level 4	3	0	0	3	ECE	
11	22GEX01	NCC Studies (Army Wing) – I	3	0	2	4	EEE	V/VI
12	22GEX02	NCC Studies (Air Wing) – I	3	0	2	4	IT	V/VI
13	22GEO11	French Language Level 1	4	0	0	4	ECE	
14	22GEO12	French Language Level 2	4	0	0	4	ECE	
15	22GEO13	French Language Level 3	3	0	0	3	ECE	
16	22GEO14	Spanish Language Level 1	4	0	0	4	ECE	
17	22GEO15	Spanish Language Level 2	4	0	0	4	ECE	
18	22GEO16	Spanish Language Level 3	3	0	0	3	ECE	
19	22GEO17	Entrepreneurship Development	3	0	0	3	MTS	VII

22EGT11 - COMMUNICATION SKILLS I							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**All B.E./B.Tech. Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**I**	**HS**	**3**	**0**	**0**	**3**

Preamble	This course is designed to impart required levels of Communication Skills and Proficiency in English language necessary for different professional contexts.	
Unit – I	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Parts of speech **-** Tenses **-** Types of sentences**:** Assertive, Imperative, Interrogative & Exclamatory **–** Affirmative & Negative **-** Gerunds & Infinitives **- Vocabulary:** Affixes **-** Synonyms & Antonyms **- Listening:** Types of listening **-** Barriers to listening **-** Listening to short talks **-** TV shows **- Speaking:** Verbal & Non-verbal communication **-** Pair conversation **-** Role play **- Reading:** Types of Reading **–** Intensive: scanning, word by word, survey **- Writing:** Dialogue writing, Informal Letters **-** Paragraph writing		
Unit – II	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Voices **-** Impersonal passives **- Vocabulary:** Homonyms, Homophones & Homographs **- Listening:** Importance of listening **-** Listening to announcements & radio broadcasts **- Speaking:** Persuasive & Impromptu talks **-** Narrating a story **- Reading:** Reading comprehension **-** Articles from Newspapers/Magazines **-** Cloze exercises **- Writing:** Essay writing, Jumbled sentences		
Unit – III	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Prepositions **- Vocabulary:** Compound Nouns **- Listening:** Listening to TED Talks, Commentaries **- Speaking:** Self Introduction **- Reading:** Extensive: speed, skimming **-** Identifying lexical & contextual meanings **- Writing:** Instructions & Warnings **-** Formal letters: Seeking permission for Industrial visits & Inviting guests		
Unit – IV	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Articles & Determiners **- Vocabulary:** Technical Vocabulary **-** Analogy **-** Unscrambling words **-** Logical reasoning **- Listening:** Listening to conversations **- Speaking:** Tongue twisters **-** Skill Sharing **-** Note-taking **- Reading:** Note making **-** Paraphrasing & Summarizing **- Writing:** Recommendations & Suggestions **-** Business letters: Enquiry, Calling for quotations & placing orders		
Unit – V	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**	**9**
Grammar: Cause and effect expressions **- Vocabulary:** Abbreviations & acronyms, Definitions **Listening:** Listening to eminent personalities **- Speaking:** Commonly mispronounced words **-** Welcome address, Chief guest address & Vote of thanks **- Reading -** IELTS type passages **- Writing:** Preparing transcript for a speech **-** Interpreting news articles & advertisements		
		Total:45

TEXT BOOK:	
1.	Sanjay Kumar & Pushp Lata, "Communication Skills", 2nd Edition, Oxford University Press, New Delhi, 2018.
REFERENCES:	
1.	Ashraf Rizvi, "Effective Technical Communication", 2nd Edition, McGraw-Hill India, 2017.
2.	S. P. Dhanavel, "English and Communication Skills for Students of Science and Engineering", Orient BlackSwan Publishers, Hyderabad, 2009.
3.	Jack C. Richards and Chuck Sandy, "Passages" Student's Book 1, 3rd Edition, Cambridge University Press, New York, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	use language effectively by acquiring vocabulary and syntax in context	Applying (K3)
CO2	listen and comprehend different spoken discourses from a variety of situations	Applying (K3)
CO3	speak confidently in different professional contexts and with peers	Creating (K6)
CO4	comprehend different genres of texts by adopting various reading strategies	Understanding (K2)
CO5	write legibly and flawlessly at varied professional contexts proficiently with appropriate choice of words and structures	Creating (K6)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						2			1	3	1	1
CO2									2	3		1
CO3									2	3		2
CO4						1				3	1	1
CO5										3		2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		37	30			33	100
CAT2		30	30			40	100
CAT3		33	34			33	
ESE		17	63			20	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22MAC11 - MATRICES AND ORDINARY DIFFERENTIAL EQUATIONS							
(Common to all Engineering and Technology branches)							
Programme & Branch	**All BE/BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1**	**BS**	**3**	**1***	**2***	**4**

Preamble	To provide the skills to the students for solving different real time problems by applying matrices and ordinary differential equations.

Unit – I	**Matrices:**	**9**
Introduction **–** Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors (without proof) – Cayley – Hamilton theorem (Statement and applications only) - Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Nature of Quadratic forms - Reduction of quadratic form to canonical form by orthogonal transformation – Applications of Eigen values and Eigen vectors: Stretching of an elastic membrane.		

Unit – II	**Ordinary Differential Equations:**	**9**
Introduction – Solutions of First order differential equations: Exact differential equations – Leibnitz's Linear Equation – Bernoulli's equation –Clairaut's equation - Applications: Law of natural growth and decay.		

Unit – III	**Ordinary Differential Equations of Higher Order:**	**9**
Linear differential equations of second and higher order with constant coefficients - Particular Integrals for the types: e^{ax} – $\cos ax$ / $\sin ax$ – x^n – $e^{ax}x^n$, $e^{ax}\sin bx$ and $e^{ax}\cos bx$ – $x^n \sin ax$ and $x^n \cos ax$ – Differential Equations with variable coefficients: Euler-Cauchy's equation – Legendre's equation.		

Unit – IV	**Applications of Ordinary Differential Equations:**	**9**
Method of variation of parameters – Simultaneous first order linear equations with constant coefficients – Applications of differential equations: Simple harmonic motion – Electric circuits (Differential equations and associated conditions need to be given).		

Unit – V	**Laplace Transform:**	**9**
Laplace Transform: Conditions for existence – Transform of elementary functions – Basic properties – Derivatives and integrals of transforms –Transforms of derivatives and integrals – Transform of unit step function – Transform of periodic functions. Inverse Laplace transform: Inverse Laplace transform of elementary functions – Partial fraction method – Convolution theorem (Statement only) – Applications: Solution of linear ODE of second order with constant coefficients.		

LIST OF EXPERIMENTS / EXERCISES:	
1.	Introduction to MATLAB
2.	Computation of eigen values and eigen vectors
3.	Plotting and visualizing single variable functions
4.	Solving first and second order ordinary differential equations
5.	Solution of Simultaneous first order ODEs
6.	Solving second order ODE by variation of parameters
7.	Determining Laplace and inverse Laplace transform of basic functions
8.	Solution of Second order ODE by employing Laplace transforms

Lecture:45, Tutorials and Practical:15, Total:60

TEXT BOOK:	
1.	Ramana B V, "Higher Engineering Mathematics", 1st Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018.

REFERENCES/ MANUAL / SOFTWARE:	
1.	Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2016.
2.	Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics For First Year B.E/B.Tech", Reprint Edition 2014, S.Chand and Co., New Delhi.
3.	Duraisamy C., Vengataasalam S., Arun Prakash K. and Suresh M., "Engineering Mathematics - I", 2nd Edition, Pearson India Education, New Delhi, 2018.
4.	Grewal B.S., "Higher Engineering Mathematics" 44thEdition, Khanna Publishers, New Delhi, 2018.
5.	MATLAB – Laboratory Manual

	COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	solve engineering problems which needs matrix computations.	Applying (K3)
CO2	identify the appropriate method for solving first order ordinary differential equations.	Applying (K3)
CO3	solve higher order linear differential equations with constant and variable coefficients.	Applying (K3)
CO4	apply the concept of ordinary differential equations for modeling and finding solutions to engineering problems.	Applying (K3)
CO5	apply Laplace Transform to find solutions of Linear Ordinary Differential Equations	Applying (K3)
CO6	understand the basics of MATLAB, solve ordinary differential equations and compute Laplace transforms using MATLAB.	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2											
CO2	3	3	2											
CO3	3	3	2											
CO4	3	3	2											
CO5	3	3	3											
CO6					3									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70	-	-	-	100
CAT2	10	20	70	-	-	-	100
CAT3	10	20	70	-	-	-	100
ESE	10	20	70	-	-	-	100

* ±3% may be varied (CAT 1,2,3 - 50 marks & ESE – 100 marks)

*Alternate week

22PHT11 - PHYSICS FOR CIVIL ENGINEERING

Programme & Branch	BE- Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	BS	3	0	0	3

Preamble	This course aims to impart knowledge on oscillations & waves, acoustics, ultrasonics, laser, fiber optics, smart materials and select materials characterization techniques. It also describes the applications of aforementioned topics in civil engineering.

Unit – I	**Oscillations and Waves:**	**9**

Periodic motion – Oscillations – Simple harmonic motion – Differential equation of simple harmonic motion – Forced oscillations – Damped oscillations – Application of simple harmonic motion in torsional pendulum, cantilever and LC circuit – Resonance – Waves – Equation of plane progressive wave – Types of progressive waves – Reflection and transmission of waves at a boundary (qualitative) – Energy transport of progressive waves.

Unit – II	**Acoustics and Ultrasonics:**	**9**

Classification of sound – Characteristics of sound – Reverberation and reverberation time – Growth and decay of sound – Sabine's formula for reverberation time – Determination of sound absorption coefficient – Factors affecting acoustics of buildings and the remedies – Ultrasonics – Properties of ultrasonic waves – Generation of ultrasonic waves – Magnetostrictive generator and Piezoelectric generator – Non-destructive testing – Flaw detection.

Unit – III	**Laser and Fiber optics:**	**9**

Stimulated absorption – Spontaneous emission – Stimulated emission – Einstein's coefficients and their relations – Population inversion – Pumping – CO_2 laser – Holography – Fiber optics – Numerical aperture and acceptance angle – Classification of optical fibers based on refractive index, modes and materials – Fiber optics communication system (qualitative) –Temperature and displacement sensors.

Unit – IV	**Smart Materials:**	**9**

Metallic glasses: Properties, preparation and applications – Shape memory alloys: Characteristics and applications – Nanostructure – Surface to volume ratio – Quantum confinement – Nanomaterials synthesis: Top-down and bottom-up approaches – Electron beam lithography – Physical vapour deposition – Carbon nanotubes: Structures, properties, synthesis by laser ablation method – Applications.

Unit – V	**Materials Characterization:**	**9**

Importance of materials characterization – X-ray diffraction (powder method) – Scanning electron microscope - Transmission electron microscope (qualitative) – Raman spectroscopy – Thermo gravimetric analysis.

	Total:45

TEXT BOOK:

1.	Avadhanulu M.N., Kshirsagar P.G. and Arun Murthy T.V.S., "A Textbook of Engineering Physics", 11th Edition, S. Chand & Company Pvt. Ltd., New Delhi, 2019. (Units I,II,III,IV)
2.	Sam Zhang, Lin Li and Ashok Kumar, "Materials Characterization Techniques", 1st Edition, CRC Press, Boca Raton, 2008. (Unit V)

REFERENCES:

1.	Hitendra K. Malik and A.K. Singh, "Engineering Physics", 2nd Edition McGraw-Hill Education , New Delhi, 2018
2.	Pandey B.K.and Chaturvedi S., "Engineering Physics" 2nd Edition, Cengage, New Delhi, 2022.
3.	Gaur R.K. and Gupta S.L., "Engineering Physics", 8th Edition, Dhanpat Rai and Sons, New Delhi, 2009.
4.	Tamilarasan K. and Prabu K., "Materials Science", 1st Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2019.

	COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	make use of the concepts of oscillatory and wave motion to comprehend the phenomena related to the propagation of elastic waves.	Applying (K3)
CO2	apply the concepts of growth and decay of sound energy in a hall to compute Sabine's formula and to recognize the requirements of acoustically good buildings and also to describe the production of ultrasonic wave and the testing materials by non-destructive method.	Applying (K3)
CO3	apply the concepts of stimulated emission of radiation to explain the working and the applications of laser in engineering and technology. To apply the principle of propagation of light through optical fiber to compute acceptance angle and numerical aperture and to comprehend the loss in optical fiber and also to explain fiber optic communication system and the working of fiber optic sensors.	Applying (K3)
CO4	utilize appropriate methods to prepare metallic glasses, shape memory alloys, nanomaterials and carbon nano tubes and also to comprehend their properties and applications.	Applying (K3)
CO5	apply the concepts of X-ray diffraction, matter waves, Raman effect and thermogram to describe the principle and working of select material characterization techniques.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2						2	2		2	2	
CO2	3	2	2						2	2		2	2	
CO3	3	2	2						2	2		2	2	
CO4	3	2	2						2	2		2	2	
CO5	3	2	2						2	2		2	2	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	50	40				100
CAT2	10	50	40				100
CAT3	20	50	30				100
ESE	10	55	35				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CET11 - CONSTRUCTION MATERIALS AND PRACTICES

Programme & Branch	B.E & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	PC	3	0	0	3

Preamble	This course imparts knowledge on the materials used for construction and the construction techniques implemented in construction industry.

Unit – I	Building Materials	9

Introduction and types of building materials – Properties – Physical & mechanical properties. Stones and Rocks: Classification of Rocks – Qualities of good stones – Uses. Bricks: Constituents - Qualities of good brick - Classification – Uses. Cement: Ingredients – Qualities of good cement - Types & Uses of cement.

Unit – II	Mortar, Concrete and Steel	9

Mortar: Types of Mortars – Properties –Uses – Selection of mortar. Concrete: Ingredients – Types of Concrete – Properties – Uses – Reinforced concrete. Steel: Steel sections- steel as a reinforcing material - Types of reinforcing steels.

Unit – III	Timber and Plastics	9

Timber: Characteristics of timber – Seasoning of timber – Properties and uses – Common forms of timber. Plastics: Advantages - Types - Thermoplastics and Thermosetting plastics –Uses.

Unit – IV	Substructure and Superstructure	9

Substructure: Objectives of foundation – Bearing capacity of soil – loads on foundation – requirements & types of foundation – Failure and remedial measures. Superstructure: Brick masonry- Types of bond - Stone Masonry - Classification of stone masonry – Comparison of brick and stone masonry.

Unit – V	Construction Practices	9

Structural elements - Beams – Columns – Lintels - Roofing - Flooring – types – selection of floorings - Damp proofing – causes and effect of dampness – materials and methods - Weather Proof Course – Materials and methods – Plastering – requirements – material and methods.

	Total:45

TEXT BOOK:

1.	Palanichamy M.S., "Basic Civil Engineering", 4th Edition, McGraw-Hill Education, New Delhi, 2020.

REFERENCES:

1.	Navaneethakrishnan P., "Basic of Civil and Mechanical Engineering", 1st Edition, McGraw-Hill Education, New Delhi, 2016
2.	Duggal S.K., "Building Materials", 5th Edition, New Age Publishers, 2021.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the role of bricks, stones, cement and rocks in construction	Understanding (K2)
CO2	infer the properties of concrete and steel as construction materials	Applying (K3)
CO3	identify the usage of plastics and other modern materials used in buildings	Understanding (K2)
CO4	classify and compare the types of foundations and masonry structures in buildings	Applying (K3)
CO5	interpret the various construction practices and techniques adopted in building construction	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					2	3					3	3	2
CO2	2					2						3	3	2
CO3	2					2	3					3	3	2
CO4	2					2						3	3	2
CO5	2					2	3					3	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	30				100
CAT2	30	40	30				100
CAT3	20	40	40				100
ESE	20	40	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CSC11 - PROBLEM SOLVING AND PROGRAMMING IN C

(Common to All Engineering and Technology branches except CSE, IT, CSD, AIDS & AIML)

Programme & Branch	All BE/BTech Engineering & Technology branches , except CSE, IT, CSD, AIDS & AIML	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	BS	3	0	2	4

Preamble	The course aims to provide exposure to problem-solving through programming. It introduces all the fundamental concepts of C Programming. This course provides adequate knowledge to solve problems using C

Unit – I	Introduction to C and Operators:	9

The structure of a C program – Compiling and executing C program – C Tokens – Character set in C – Keywords – identifiers- Basic data Types – Variables – constants – Input / Output statements – Operators

Unit – II	Control Statements and Arrays:	9

Decision-making and looping statements, Arrays: Declaring, initializing and accessing arrays – operations on arrays – Two-dimensional arrays and their operations.

Unit – III	Functions:	9

Functions: Introduction- Using functions, function declaration and definition – function call – return statement – passing parameters to functions: basic data types and arrays – storage classes – recursive functions

Unit – IV	Strings and Pointers:	9

Strings: Introduction – operations on strings: finding length, concatenation, comparing and copying – string and character manipulation functions, Arrays of strings. Pointers : declaring pointer variables – pointer expression and arithmetic, pointers and 1D arrays, pointers and strings

Unit – V	User-defined Data Types and File Handling:	9

User-defined data types: Structure: Introduction – nested structures– arrays of structure – structure and functions -unions – enumerated data type. File Handling : Introduction - opening and closing files – reading and writing data to files -Manipulating file position indicator : fseek(), ftell() and rewind()

LIST OF EXPERIMENTS / EXERCISES:

1.	Programs for demonstrating the use of different types of format Specifiers
2.	Programs for demonstrating the use of different types of operators like arithmetic, logical, relational, and ternary operators
3.	Programs for demonstrating the use of using decision making statements
4.	Programs for demonstrating the use of repetitive structures
5.	Programs for demonstrating one-dimensional arrays
6.	Programs for demonstrating two-dimensional arrays
7.	Programs to demonstrate modular programming concepts using functions
8.	Programs to demonstrate recursive functions.
9.	Programs to demonstrate strings (Using built-in and user-definedfunctions)
10.	Programs to illustrate the use of pointers
11.	Programs to illustrate the use of structures and unions
12.	Programs to implement file Handling

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Reema Thareja, "Programming in C ", 2nd Edition, Oxford University Press, New Delhi, 2018.

	REFERENCES/ MANUAL / SOFTWARE:
1.	Yashavant Kanetkar, "Let us C", 16th Edition, BPB Publications, 2018.
2.	Sumitabha Das, "Computer Fundamentals and C Programming", 1st Edition, McGraw Hill, 2018.
3.	Balagurusamy E., "Programming in ANSI C", 7th Edition, McGraw Hill Education, 2017.
4.	Behrouz A. Forouzan & Richard F.Gilberg, "Computer Science A Structured Programming Approach Using C", 3rd Edition, Cengage,2017.
5.	https://www.cprogramming.com/tutorial/c-tutorial.html

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	develop simple programs using input/output statements and operators	Applying (K3), Precision (S3)
CO2	identify the appropriate looping and control statements in C and develop applications using these statements	Applying (K3), Precision (S3)
CO3	develop simple C programs using the concepts of arrays and modular programming	Applying (K3), Precision (S3)
CO4	apply the concepts of pointers and develop C programs using strings and pointers	Applying (K3), Precision (S3)
CO5	make use of user-defined data types and file concepts to solve given problems	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1				1	1		1		
CO2	3	2	2	2	1				1	1		1		
CO3	3	2	2	2	1				1	1		1		
CO4	3	2	2	2	1				1	1		1		
CO5	3	2	2	2	1				1	1		1		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	30	60				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	30	60				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22MET11 - ENGINEERING DRAWING								
(Common to All Engineering and Technology Branches)								
Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit	
Prerequisites	Nil	1 / 2	ES	2	1	0	3	

Preamble	To impart knowledge on orthographic, isometric projections, sectional views and development of surfaces by solving different application oriented problems.	
Unit – I	**General Principles of Orthographic Projection:**	**6+3**
Importance of Graphics in Engineering Applications - Use of Drafting Instruments - BIS Conventions and Specifications - Size, Layout and Folding of Drawing Sheets - Lettering and Dimensioning - Projections of Points, Lines and Planes - General Principles of Orthographic Projection - First Angle Projection - Layout of Views - Projection of Points Located in all Quadrant and Straight Lines Located in the First Quadrant - Determination of True Lengths and True Inclinations and Location of Traces - Projection of Polygonal Surface and Circular Lamina Inclined to both Reference Planes.		
Unit – II	**Projections of Solid:**	**6+3**
Projections of Simple Solids Like Prisms, Pyramids, Cylinder and Cone when the Axis is inclined to One Reference Plane by Change of Position Method.		
Unit – III	**Sectioning of Solids:**	**6+3**
Sectioning of Solids - Prisms, Pyramids, Cylinder and Cone in Simple Vertical Position by Cutting Planes inclined to One Reference Plane and Perpendicular to the other - Obtaining True Shape of Section.		
Unit – IV	**Development of Surfaces:**	**6+3**
Development of Lateral Surfaces of Simple Solids Like Prisms, Pyramids, Cylinders and Cones - Development of Simple Truncated Solids Involving Prisms, Pyramids, Cylinders and Cones.		
Unit – V	**Isometric Projection and Introduction to AutoCAD:**	**6+3**
Principles of Isometric Projection - Isometric Scale - Isometric Projections of Simple and Truncated Solids Like Prisms, Pyramids, Cylinders and Cones - Conversion of Isometric Projection into Orthographic Projection - Introduction to AutoCAD.		

Lecture: 30, Tutorial:15, Total:45

TEXT BOOK:	
1.	Natarajan.K.V. "A Textbook of Engineering Graphics",35th Edition, Dhanalakshmi Publishers, Chennai, 2022,

REFERENCES:	
1.	Venugopal K. and Prabhu Raja V., "Engineering Graphics", 16th Edition, New Age International Publishers, Chennai, 2022.
2.	Basant Agrawal, Agrawal C.M., "Engineering Drawing", 3rd Edition, McGraw Hill Education, 2019.
3.	Parthasarathy N.S., Vela Murali. "Engineering Drawing", 1st Edition, Oxford University Press, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret international standards of drawings and sketch the projections of points, lines and planes	Applying (K3)
CO2	draw the projections of 3D primitive objects like prisms, pyramids, cylinders and cones	Applying (K3)
CO3	construct the various sectional views of solids like prisms, pyramids, cylinders and cones	Applying (K3)
CO4	develop the lateral surfaces of simple and truncated solids	Applying (K3)
CO5	sketch the isometric projections of simple and truncated solids and convert isometric drawing into orthographic projection	Applying (K3)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			2					3		2		
CO2	3	2	1		2					3		2		
CO3	3	2	1		2					3		2		
CO4	3	2	1		2					3		2		
CO5	3	2	1		2					3		2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	6	9	85				100
CAT2	6	9	85				100
CAT3	6	9	85				100
ESE	10	10	80				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22MEL11 - ENGINEERING PRACTICES LABORATORY							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**All BE/BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**1/ 2**	**ES**	**0**	**0**	**2**	**1**

Preamble		This course is designed to provide a hands-on experience in basic of mechanical and electrical engineering practices.

LIST OF EXPERIMENTS / EXERCISES:

	PART A – MECHANICAL ENGINEERING
1.	Prepare a Square / Rectangular / V-Shape Projection with its Counterpart for Mating and Perform the Drilling, Tapping, and Assembling Tasks from the given Square / Rectangular MS Plates using Modern Power Tools.
2.	Prepare T / L / Lap Joint from given Wooden Work Piece and Make a Box / Tray out of Plywood using Modern Power Tools.
3.	Perform the Thread Formation on a GI/PVC Pipe and Prepare a Water Line from the Overhead Tank that is Leak-Proof.
4.	Make a Butt / Lap / Tee Joint of MS Plate using Arc Welding Process and Welding Simulator.
5.	**Activity:** Prepare an Innovative Model with the Knowledge from Fitting / Carpentry / Plumbing / Welding Involving Modern Power Tools.
	PART B – ELECTRICAL AND ELECTRONICS ENGINEERING
6.	Wiring circuit for fluorescent lamp and Stair case wiring
7.	Wiring Circuit of Incandescent lamp using Impulse Relay
8.	Measurement of Earth Resistance
9.	Soldering of Simple Circuits and trouble shooting
10.	Implementation of half wave and full wave Rectifier using diodes
	Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Engineering Practices Laboratory Manual.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	plan the sequence of operations for effective completion of the planned models / innovative articles	Creating (K6) Manipulation (S2)
CO2	identify and use appropriate modern power tools and complete the exercises/models accurately	Applying (K3) Manipulation (S2)
CO3	perform house wiring and realize the importance of earthing	Applying (K3), Manipulation (S2)
CO4	soldering with simple electronics circuits	Applying (K3), Manipulation (S2)
CO5	trouble shoot the electrical and electronic circuits	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		3	1	3	1			3	3		3		
CO2	3		3	1	3				3	3		3		
CO3	3		3	2	1				2	2		3	3	2
CO4	3		2	1	1				2	3		3	3	2
CO5	3		3	2	1				2	2		3	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

22PHL11 - PHYSICS LABORATORY FOR CIVIL ENGINEERING							

Programme & Branch	BE - Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	BS	0	0	2	1

Preamble	This course aims to impart hands on training in the determination of parameters such as rigidity modulus, AC frequency, velocity of ultrasonic waves, compressibility of a liquid, particle size, wavelength of a laser, acceptance angle and numerical aperture of an optical fiber, specific resistance, thermal conductivity, thickness of a thin film, hall coefficient, Young's modulus and knowledge on the working of LCR circuit, and also to impart skills on writing coding / developing project / product related to societal requirement.

LIST OF EXPERIMENTS / EXERCISES:

1.	Determination of the rigidity modulus of a metallic wire using torsional pendulum / Studying the variation of current and voltage in a series LCR circuit.
2.	Determination of the frequency of alternating current using electrically vibrating tuning fork (Melde's apparatus).
3.	Determination of the velocity of ultrasonic waves in a liquid and the compressibility of the liquid using ultrasonic interferometer.
4.	Determination of the particle size of the given powder using laser.
5.	Determination of (i) the wavelength of a semiconductor laser and (ii) the acceptance angle and the numerical aperture of a given optical fiber.
6.	Determination of the specific resistance of a metallic wire using Carey-Foster's bridge.
7.	Determination of the thermal conductivity of a bad conductor using Lee's disc.
8.	Determination of the thickness of a thin film using air-wedge arrangement.
9.	Determination of the Hall coefficient of a material using Hall effect arrangement / Determination of the Young's modulus of the material of a given beam using uniform bending method.
10.	Writing coding for any one of the above experiments / developing a project / a product.
	Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Physics Laboratory Manual / Record, Department of Physics, 1st Edition, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	determine the rigidity modulus of a wire using the concepts of twisting couple or to study the variation of current in a series LCR circuit. To determine the velocity of ultrasound in a liquid and the AC frequency using electrically vibrating rod by means of formation of standing waves.	Applying (K3), Precision (S3)
CO2	determine the particle size of a powder material and the wavelength of a semiconductor laser using the concept of diffraction of light. To compute the acceptance angle and the numerical aperture of an optical fiber using the concepts of total internal reflection and divergence of light in air.	Applying (K3), Precision (S3)
CO3	determine the specific resistance of a conductor using the concept of Wheatstone bridge and the thermal conductivity of a material using the concept of heat conduction through materials. To determine the thickness of a thin film by means of interference of light and the Hall coefficient of a material using the concept of Hall effect or to determine the Young's modulus of a material using the concepts of elasticity and bending moment of a beam and also to write coding/ do project/ develop product.	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3					2	2		2	2	
CO2	3	2	2	3					2	2		2	2	
CO3	3	2	2	3					2	2		2	2	

22VEC11 - YOGA AND VALUES FOR HOLISTIC DEVELOPMENT

(Common to All Engineering and Technology Branches)

Programme & Branch	All B.E./B.Tech. Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1 / 2	HS	1	0	1	1

Preamble	Yoga or yogasanas are considered as art and science of healthy living by our ancient gurus. It is method to bring harmony of body and mind for general wellbeing. Yoga is considered as one of the greatest gifts to the world by Indians for healthy living. Students in particular are benefitted by learning yoga.

Unit – I	Introduction:		2

The Origins of Yoga – Definitions - Concepts - Aims and objectives of Yoga – Yoga is a Science and Art – Rules and Regulations of Asanas – Classifications of Yogasanas – Patanjali's Ashtanga Yoga – Pranayama – Mudras & Bandhas - Shatkarma (Cleansing Practice) - Streams of Yoga – Modern Trends in yoga.

Unit – II	Yoga and Mind:		2

The Nature of Mind - Five Elements and the Mind - Meditation and the Mind - Functions of the Mind - Role of Yoga in Psychological problems: Mood Disorders, Major Depressive Disorder, Cyclothymic Disorder.

Unit – III	Yoga and Values, Diet:		2

Human Values – Social Values – Role of Yoga in Personality Integration - Concepts of Natural Diet - Naturopathy Diet – Eliminative Diet – Soothing Diet – Constructive Diet.

Unit – IV	Asanas:		2

Prayer - Starting & Closing - Preparatory practices – Loosening Practices – Meaning, Definitions and Objectives of Asanas - Principles of Practicing Asanas. Asanas: Standing – Sitting – Prone – Supine – Suryanamaskar.

Unit – V	Pranayama and Meditation:		2

Breathing Practices for awareness - Definitions and Objectives of Pranayama - Principles of Practicing Pranayama. Pranayama: Nadi Shuddhi - Kapalabathi – Sitali – Sitkari – Bhranari – Ujjayi – Relaxation Techniques – Meditation.

Lecture: 10, Practical: 10, Total:20

TEXT BOOK:

1.	Swami satyananda saraswathi, "Asana pranayama mudra bandha", Bihar school of yoga, 4th Edition, 1969.
2.	Swami mukthi Bodhanandha, "Hatha yoga pradipika", Bihar school of yoga, 4th Edition, 1985.

REFERENCES:

1.	B.K.S. Iyenkar, "Yoga the path of holistic health", DK Limited, 2nd Edition, 1969.
2.	Selvarasu, "Kriya cleansing in yoga", Aruvi yoga, 3rd Edition, 2002.

COURSE OUTCOMES:		BT Mapped (Highest Level)
On completion of the course, the students will be able to		
CO1	realize the importance of yoga in physical health.	Applying (K3)
CO2	realize the importance of yoga in mental health.	Applying (K3)
CO3	realize the role of yoga in personality development and diet.	Applying (K3)
CO4	do the loosening practices, Asanas and realize its benefits.	Applying (K3)
CO5	do the practice of Pranayama, meditation and realize its benefits	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						3		2	1			
CO2						3		2				
CO3						3		3				
CO4						3		2	3			
CO5						3		3				

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	-	-	-	-	-	-	-
CAT2	-	-	-	-	-	-	-
CAT3	20	30	50	-	-	-	100
ESE	-	-	-	-	-	-	-

* ±3% may be varied (CAT3 – 100 marks)

22EGT21 - COMMUNICATION SKILLS - II							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**All B.E./B.Tech. Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Communication Skills I**	**2**	**HS**	**3**	**0**	**0**	**3**
Preamble	This course is designed to equip students with the necessary skills to listen, read, write and speak so as to develop their linguistic and communicative competencies.						
Unit – I	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**					**9**	
Grammar: Sentence Patterns **-** Simple, Compound & Complex sentences **- Vocabulary:** Portmanteau words **-** One word substitution **- Listening:** Speeches from company CEOs **-** TV debates **Speaking:** Just-a-minute talk **-** Group discussion **- Reading:** Reading for Gist **- Writing:** Job application letter with resume **–** Transcoding							
Unit – II	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**					**9**	
Grammar: Concord **- Vocabulary:** Phrasal verbs **-** Idioms & Phrases **- Listening:** Listening to celebrity talks **- Speaking:** Talking about celebrities **-** Practicing Pronunciation through web tools **- Reading:** Company correspondence, technical texts/working principles of a machine **- Writing:** Description: Person, Place**,** Process, Product and Picture							
Unit – III	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**					**9**	
Grammar: Discourse markers **-** Transitional words and phrases **- Vocabulary:** Commonly confused words **- Listening:** Listening to guest lectures **- Speaking:** Technical & Non-technical presentations **-** Workshop presentations **- Reading:** Reputed company profiles, Business Plans **- Writing:** a dream job/company **-** Letter to the Editor **–** Biography & Autobiography **-** Checklist							
Unit – IV	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**					**9**	
Grammar: Degrees of Comparison **-** Punctuations **–** Fragments & run-ons **- Vocabulary:** British & American **-** Spelling & words **- Listening:** Listening to global accents **-** listening to motivational speeches **- S**peaking: Narrating personal milestones **-** Sports commentaries **-** Movie Enactment **- Reading:** Narrative passages **- Writing:** E mail **-** Agenda & Minutes of Meeting **-** Special & Technical reports							
Unit – V	**Grammar, Vocabulary, Listening, Speaking, Reading & Writing**					**9**	
Grammar: Purpose and Function **-** If clause **-** Error detection **- Vocabulary:** Coding & Decoding **-** Alphabet test **- Listening:** Listening to sample HR Interviews **- Speaking:** Introduction to phonetics **-** Stress, rhythm & Intonation **–** Guided & unguided speeches/conversations **-** Giving feedback **–** Debate **- Reading:** Key Note speeches **-** Newspaper reports **-** short technical texts from journals **Writing:** Circulars **-** Critical Appreciation of a non-detailed text **-** Technical proposals							
						Total:45	

TEXT BOOK:	
1.	Sanjay Kumar & Pushp Lata, "Communication Skills", 2nd Edition, Oxford University Press, New Delhi, 2018.

REFERENCES:	
1.	Meenakshi Raman and Sangeeta Sharma. "Technical Communication- Principles and Practice". 4th Edition, Oxford University Press, New Delhi, 2022.
2.	Murphy Raymond, "English Grammar in Use", 5th Edition, Cambridge University Press, New York, 2019.
3.	Jack C. Richards and Chuck Sandy, "Passages" Student's Book 2, 3rd Edition, Cambridge University Press, New York, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	use functional grammar for improving communication skills	Applying (K3)
CO2	listen and comprehend different accents and infer implied meanings	Applying (K3)
CO3	speak clearly, initiate and sustain a discussion and negotiate using appropriate communicative strategies	Creating (K6)
CO4	read different genres of texts, infer implied meanings and critically analyze and evaluate them	Understanding (K2)
CO5	produce different types of narrative, descriptive expository texts and understand creative, critical, analytical and evaluative writing	Creating (K6)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						2			1	3	1	1
CO2									2	3		1
CO3									2	3		2
CO4						1				3	1	1
CO5										3		2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		37	30			33	100
CAT2		7	50			43	100
CAT3		17	50			33	100
ESE		15	45			40	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22MAC21 - MULTIVARIABLE CALCULUS AND COMPLEX ANALYSIS								
(Common to CIVIL, MECH, MTS, ECE, EEE, EIE & FT branches)								
Programme & Branch	B.E & Civil, Mech, MTS, ECE, EEE, EIE & FT branches	Sem.	Category	L	T	P	Credit	
Prerequisites	Nil	2	BS	3	1*	2*	4	

Preamble	To impart the knowledge of partial derivatives, evaluation of real and complex integrals, vector calculus and analytic functions to the students for solving the problems related to various engineering disciplines.

Unit – I	Functions of Several Variables:	9

Functions of two or more variables – Partial derivatives – Total differential – Taylor's series for functions of two variables – Applications: Maxima and minima – Constrained maxima and minima – Lagrange's multiplier method.

Unit – II	Multiple Integrals:	9

Double integration in cartesian coordinates – Change of order of integration – Application: Area between two curves – Triple integration in cartesian coordinates – Volume as triple integrals.

Unit – III	Vector Calculus:	9

Directional derivative – Gradient of a scalar point function – Divergence of a vector point function – Curl of a vector – Solenoidal and Irrotational vectors – Vector Integration: Introduction – Green's, Stoke's and Gauss divergence theorems (without proof) – Verification of the above theorems and evaluation of integrals using them.

Unit – IV	Analytic Functions:	9

Functions of a complex variable – Analytic functions – Necessary and sufficient conditions (excluding proof) – Cauchy–Riemann equations (Statement only) – Properties of analytic function (Statement only) – Harmonic function – Construction of analytic function – Applications: Fluid flow – Conformal mapping: $w = z + a$, az, $1/z$ – Bilinear transformation.

Unit – V	Complex Integration:	9

Introduction – Cauchy's theorem (without proof) – Cauchy's integral formula – Taylor's and Laurent series – Singularities – Classification – Cauchy's residue theorem (without proof) – Applications: Evaluation of definite integrals involving sine and cosine functions over the circular contour.

LIST OF EXPERIMENTS / EXERCISES:	
1.	Finding ordinary and partial derivatives
2.	Computing extreme values of function of two variables
3.	Evaluating double and triple integrals
4.	Finding the area between two curves
5.	Computing gradient, divergence and curl of point functions
6.	Applying Milne-Thomson method for constructing analytic function
7.	Determination of Mobius transformation for the given set of points
8.	Finding poles and residues of an analytic function

Lecture:45, Tutorials and Practical:15, Total:60

TEXT BOOK:	
1.	Ramana B V, "Higher Engineering Mathematics", 1st Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2018.

REFERENCES/ MANUAL / SOFTWARE:	
1.	Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2016.
2.	Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics For First Year B.E/B.Tech", Reprint Edition 2014, S.Chand and Co., New Delhi
3.	Duraisamy C., Vengataasalam S., Arun Prakash K. and Suresh M., "Engineering Mathematics - I", 2nd Edition, Pearson India Education, New Delhi, 2018.
4.	Grewal B.S, "Higher Engineering Mathematics" 44thEdition, Khanna Publishers, New Delhi, 2018.
5.	MATLAB – Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	compute the total derivatives and extreme values of multivariable functions.	Applying (K3)
CO2	evaluate multiple integrals and apply them to compute the area and volume of the regions.	Applying (K3)
CO3	apply the concepts of derivatives and line integrals of vector functions in engineering problems.	Applying (K3)
CO4	construct analytic functions and bilinear transformations and determine the image of given region under the given conformal mapping.	Applying (K3)
CO5	apply the techniques of complex integration to evaluate real and complex integrals over suitable closed curves.	Applying (K3)
CO6	demonstrate MATLAB programming to understand the concepts of functions of two variables, vector operators, multiple integrals and complex variables.	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2											
CO2	3	3	2											
CO3	3	3												
CO4	3	3												
CO5	3	3	3											
CO6					3									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	30	60	-	-	-	100
CAT2	10	30	60	-	-	-	100
CAT3	10	30	60	-	-	-	100
ESE	10	30	60	-	-	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

*Alternate week

22CYT21 – CHEMISTRY FOR CIVIL ENGINEERING							

Programme & Branch	B.E & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	BS	3	0	0	3

Preamble	This course aims to impart a sound chemistry knowledge on cement, polymeric, composite and engineering materials and also impart the fundamental knowledge of electrochemistry and control of corrosion of steel in concrete towards applications in civil engineering.

Unit – I	CEMENT AND SUSTAINABLE BUILDING MATERIALS	9

Introduction-types-constituents – functions- Bogue's compound- chemical reactions- hydration of cement- setting and hardening of cement –chemistry of 58evellin cement manufacturing- structural modification of clinker-clinker formation –$CaO-SiO_2$ system-lime saturation factor-silica-alumina ratio-sustainable building materials- green building concept in India – certification systems – Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED).

Unit – II	POLYMER AND COMPOSITE MATERIALS	9

Polymers: Introduction – terminology – structure and property relationship of polymers (mechanical, thermal) –rubbers (elastomers) – natural rubber- processing of latex- vulcanization of rubber – synthetic rubber- preparation, properties and applications of polyurethane-polymethyl methacrylate (PMMA) – conducting polymer–biodegradable polymer- synthesis, properties and applications of polylactic acid. **Composites:** Introduction-types- polymer composites – synthesis, properties and applications of 58evell fibre- fibre reinforced plastics (FRP) – properties and uses.

Unit – III	CHEMISTRY OF ENGINEERING MATERIALS	9

Refractory Bricks: Introduction –criteria of a good refractory material-classification (according to chemical nature and refractoriness)-properties-general method of manufacturing of refractories – causes for the failure of a refractory material. **Ceramics**: Introduction –components of ceramics – classification of ceramic materials –general methods of fabricating ceramic wares-applications of ceramics. **Abrasives**: Introduction-properties of abrasives – types of abrasives: i) natural abrasives – diamond, corundum and quartz ii) synthetic abrasives – silicon carbide, boron carbide – industrial applications of abrasives. **Adhesives**: Introduction-requisites of a good adhesive-advantages and disadvantages of adhesive bonding- adhesive action-classification of adhesives-industrial applications of adhesives.

Unit – IV	ELECTROCHEMISTRY AND CORROSION	9

Electrochemistry: Introduction – cells – types – representation of galvanic cell – electrode potential – Nernst equation (derivation of cell EMF) – Calculation of cell EMF from single electrode potential – reference electrode- construction, working and applications of standard hydrogen electrode – potentiometric titrations (redox) – conductometric titrations – mixture of weak and strong acid vs strong base. **Corrosion**: Introduction – chemical corrosion – Pilling-Bedworth rule – electrochemical corrosion and it's types – galvanic corrosion – differential aeration corrosion with examples – galvanic series – factors influencing rate of corrosion – measurement of corrosion (wt. loss method only).

Unit – V	CORROSION OF STEEL IN CONCRETE	9

Introduction- reinforced cement concrete- carbon emission and its impacts on environment – deterioration of concrete – corrosion mechanism in concrete – causes of corrosion: due to carbonation, chlorination and sulphonation – ettringite formation – delayed ettringite formation – corrosion assessment method: half cell potential measurement – preventive measures for corrosion of steel in concrete-corrosion control by inhibitors.

	Total:45

TEXT BOOK:

1.	Wiley Editorial Board, "Wiley Engineering Chemistry", 2nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019, for Unit-II, III, IV, V.
2.	Palanisamy P.N., Manikandan P., Geetha A., Manjula Rani K., Kowshalya V.N., "Chemistry for Civil Engineering", Pearson Education, New Delhi, Revised Edition 2019, for Unit- I, II, III, V.

REFERENCES:

1.	Jain and Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company, New Delhi, 2019.
2.	S. S. Dara, "A Text book of Engineering Chemistry", S. Chand & Co Ltd., New Delhi, 20th B.TECH. (BCL) Page 16 Edition, 2013.
3.	ArnonBentur, "Steel Corrosion in Concrete: Fundamentals and civil engineering practice: 1 (Modern Concrete Technology)", CRC Press, 1 edition (Reprint), 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the knowledge of cement chemistry and sustainable materials in construction	Applying (K3)
CO2	categorize and utilize the polymer and composite materials for various applications	Applying (K3)
CO3	make use of the chemical concepts in refractory bricks, ceramics, abrasive and adhesives	Applying (K3)
CO4	apply the principle of electrochemistry and corrosion for various applications	Applying (K3)
CO5	apply suitable corrosion control measures to prevent corrosion of steel in concrete	Applying (K3)

Mapping of Cos with POs and PSOs

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2		2	2			2		2		
CO2	3	2	2	2		2	2			2		2		
CO3	3	2	2	2		2	2			2		2		
CO4	3	2	2	2		2	2			2		2		
CO5	3	2	2	2		2	2			2		2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEC21 – SURVEYING AND GEOMATICS								
Programme & Branch	**B.E. & CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**	
Prerequisites	**Nil**	**2**	**PC**	**3**	**0**	**2**	**4**	

Preamble	This course is designed to impart knowledge on the principles of surveying and create awareness on the various methods of surveying, type of instruments and computations.	
Unit – I	**Chain and Compass Surveying:**	**9**
Definition – Principles – Classification – Plan and map – Scales – Ranging and chaining – Corrections – Prismatic compass – Surveyors compass – Bearing – Systems and conversions – True and magnetic bearing – Dip and declination – Local attraction – Adjustment of errors.		
Unit – II	**Levelling and Contouring:**	**9**
Level line – Horizontal line – Spirit level – Mean sea level – Sensitiveness – Bench marks – Levelling instruments – Types of 60evelling – Booking and reduction of levels – Curvature and refraction – Calculation of areas and volumes – Contouring – Characteristics and uses of contours – Calculation of earth work and reservoir capacity		
Unit – III	**Theodolite Surveying and Curve Setting:**	**9**
Theodolite survey – Omitted measurements – Curves –types – components and elements of simple curve – Setting out a simple curve by Rankine's method and two theodolite method – Transition curves – Functions and requirements.		
Unit – IV	**Tacheometric and Triangulation Surveying:**	**9**
Tacheometric systems – Tangential and stadia methods – Stadia systems – Determination of stadia constants – Anallatic lens – Triangulation – Corrections – Satellite station – Reduction to centre – Trigonometric Levelling – Single and reciprocal observations.		
Unit – V	**Digital Surveying:**	**9**
Introduction, aerial photogrammetry, terrestrial photogrammetry, stereoscopy, types of EDM instruments. Total station - Principles of remote sensing and its applications. Basics of GIS & GPS.		

LIST OF EXPERIMENTS / EXERCISES:	
1.	Levelling: Determination of elevation of given points
2.	Levelling: Determination of height difference between the points by conducting differential and reciprocal levelling
3.	Theodolite: Determination of distance and elevation by stadia method
4.	Theodolite: Determination of distance and elevation by tangential method
5.	Determination of distance and elevation of points by trigonometric levelling – same vertical plane method
6.	Determination of distance and elevation of points by trigonometric levelling – double vertical plane method
7.	Measurement of distance, elevation and area using total station
8.	Setting out works using advanced total station – foundation, column marking
9.	Contouring using advanced total station
10.	Co-ordinate marking with GPS

Lecture:45, Practical:30, Total:75

TEXT BOOK:	
1.	Punmia B.C., "Surveying I and II", 7th Edition, Laxmi Publications, Chennai, 2016.

REFERENCES/ MANUAL / SOFTWARE:	
1.	Subramanian R., "Surveying and Levelling", 2nd Edition, Oxford University Press, Noida, 2013.
2.	Laboratory Manual
3.	Experimental videos developed by faculty

	COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	carry out the chain and compass surveying	Applying (K3) Manipulation (S2)
CO2	compute the levels and to calculate the area and volume	Applying (K3), Manipulation (S2)
CO3	carry out the adjustments of closed traverse for errors and setting out the simple curves	Applying (K3), Manipulation (S2)
CO4	execute the tacheometric and triangulation Survey	Applying (K3), Manipulation (S2)
CO5	apply the principles, concepts and applications of digital surveying	Applying (K3), Manipulation (S2)

Mapping of Cos with POs and PSOs

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3		3				3		3	3	3
CO2	3	3	3	3		2			3	3		3	3	3
CO3	3	3	3	3		3			3	3		3	3	3
CO4	3	3	3	3		2			3	3		3	3	3
CO5	3	3	3	3	3	3			3	3		3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	30	70					100
CAT3	30	50	20				100
ESE	30	50	20				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CSC21 – FUNDAMENTALS OF DATA STRUCTURES

(Common to Civil, Mechanical, Automobile, Chemical Branches)

Programme & Branch	BE - Civil, Mechanical, Automobile & BTech – Chemical Engineering Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Programming in C	2	PC	3	0	2	4

Preamble	This course is indented to introduce the concept of elementary data structures and notion of algorithms to novice learner from cross disciplines in Engineering and Technology.

Unit – I	**List:**	**9**

Data Structures – Abstract Data Types (ADT) – List ADT and Array Implementation – Linked List- Singly Linked List- Insertion – Deletion – Copying Singly Linked List - Doubly Linked List- Insertion –Deletion.

Unit – II	**Stack and Queues:**	**9**

Stack ADT – Array and Linked List implementation of Stacks – Application: Balancing Parenthesis – Infix to Postfix – Postfix Expression Evaluation – Queue ADT – Array and Linked List implementation of Queues – Applications

Unit – III	**Trees:**	**9**

Trees- Preliminaries – Binary Trees –Binary Tree Traversals – The Search Tree ADT – Binary Search Trees– Operations : Find – FindMin – FindMax – Insertion – Deletion- Expression Tree

Unit – IV	**Graphs:**	**9**

Graphs – Definitions – Graph Traversals: Breadth First Search – Depth First Search – Shortest-Path Algorithms: Unweighted Shortest Paths – Dijkstra's Algorithm – Minimum Spanning Tree – Prim's Algorithm- Kruskal's Algorithm

Unit – V	**Sorting and Hashing:**	**9**

Sorting – Preliminaries – Insertion Sort – Quicksort – Merge sort – Hashing – General Idea – Hash Function – Separate Chaining – Open Addressing

LIST OF EXPERIMENTS / EXERCISES:

1.	Implementation of C programs using pointers
2.	Implementation of singly linked list and its operations
3.	Implementation of doubly linked list and its operations
4.	Implementation of Stack and its operations
5.	Implementation of Queue and its operations
6.	Implementation of Stack and Queue using Singly Linked List
7.	Evaluate the Post-fix Expression using Stack ADT
8.	Implementation of Binary Search Tree traversals
9.	Implementation of Insertion sort and Quick sort
10.	Implementation of hash function

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Weiss M. A., "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education Asia, New Delhi, 2016.

REFERENCES/ MANUAL / SOFTWARE:

1.	Horowitz Sahni, Andreson Freed, "Fundamentals of Data Structures in C", 2nd Edition, Universities Press, Hyderabad, 2011.
2.	Langsam Y.M., Augenstein J. and Tenenbaum A. M., "Data Structures using C and C++", 2nd Edition, Pearson Education, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply List ADT for solving the given problems	Applying (K3)
CO2	make use of arrays and linked lists to create Stack and Queue ADTs.	Applying (K3)
CO3	utilize Tree ADT to develop simple application	Applying (K3)
CO4	make use of Graph ADT for standard problems	Applying (K3)
CO5	illustrate the use of standard sorting and Hashing Techniques	Applying (K3)

Mapping of Cos with POs and PSOs

Cos/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	60	30				100
CAT2	5	35	60				100
CAT3	5	35	60				100
ESE	5	35	60				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CET21 - ENGINEERING MECHANICS							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Matrices and Ordinary Differential Equations	2	ES	3	0	0	3

Preamble	This course provides introduction to the basic concepts of forces, inertia, centroid and moments of area along with their effects on motion. It introduces the phenomenon of friction and its effects. It familiarizes students to cognitive learning in applied mechanics and develops problem-solving skills in both theoretical and engineering oriented problems.

Unit – I	**Statics of Particles**:	9

Introduction –Laws of Mechanics – Parallelogram and Triangular Law of forces – Principle of Transmissibility – Force system –Resolution of force –Free body diagram–Equilibrium of a particle in plane – Forces in space – Equilibrium of a particle in space.

Unit – II	**Statics of Rigid Bodies:**	9

Moments: Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar componentmoments – Varignon's theorem– Equivalent systems of forces – Single equivalent force. Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions.

Unit – III	**Properties of Surfaces and Solids:**	9

First moment of area and Centroid of sections — T section- I section- Angle section- Hollowsection from primary simpler sections — Second moment of plane areas — Parallel axis theorem and Perpendicular axis theorem – T section – I section- Angle section- Hollow section –Product of Inertia- Principal Moment of Inertia of planearea- Mass moment of inertia.

Unit – IV	**Friction:**	9

Surface Friction – Laws of dry friction – Angle of friction & Angle of repose – Sliding friction – Static and Kinetic friction– Ladder friction – Wedge friction – Belt friction. Rectilinear motion of particles.

Unit – V	**Dynamics of Particles & Kinematics of Rigid body:**	9

Dynamics of Particles: Newton's law, Work – Energy and Impulse – Momentum equations of particles — Impact of elastic bodies. Kinematics of Rigid body: Translation – Rotation about a fixed axis

	Total:45

TEXT BOOK:

1.	Dubey N.H., "Engineering Mechanics: Statics and Dynamics", 1st Edition, McGraw Hill Education, New Delhi, 2016.

REFERENCES:

1.	Ferdinand P. Beer., Russel Johnston E. Jr., David F. Mazure, Philip J. Cornwell, Brain P. Self., Sanjeev Sanghi, "Vector Mechanics for Engineers:Statics and Dynamics", 12th Edition, McGraw Hill Education, Chennai, 2019.
2.	Hibbeler R.C., "Engineering Mechanics", 14th Edition, Pearson Education, New Delhi, 2017.

	COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	represent the forces in vector components (both 2D and 3D) and apply equilibrium conditions	Applying (K3)
CO2	calculate the moment produced by various force systems and conclude the static equilibrium equationsfor rigid body system	Analyzing (K4)
CO3	compute the centroid, centre of gravity and moment of inertia of geometrical shapes and solidsrespectively	Analyzing (K4)
CO4	manipulate the effect of dry friction and its applications	Applying (K3)
CO5	apply the different principles to study the motion of a body and analyse their constitutive equations	Analyzing (K4)

Mapping of Cos with POs and PSOs														
Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2								3	3	3
CO2	3	3	2	2								3	3	3
CO3	3	3	2	2								3	3	3
CO4	3	3	2	2								3	3	3
CO5	3	3	2	2								3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	20	50			100
CAT2	10	20	20	50			100
CAT3	10	20	20	50			100
ESE	10	20	20	50			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEL21 - COMPUTER AIDED BUILDING DRAWING LABORATORY								
Programme& Branch	**B.E. & CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**	
Prerequisites	**Engineering Drawing**	**2**	**PC**	**0**	**0**	**2**	**1**	

Preamble	This course imparts knowledge about the preparation of plan, section & elevation of different types of buildings as per specification

LIST OF EXPERIMENTS / EXERCISES:

1.	Introduction to AutoCAD and basic drafting tools /commands
2.	Building Planning - NBC provisions & Bye-laws -Terminologies, Orientation, Ventilation & Lighting
3.	Preparation of key plan & site plan
4.	Introduction to Building Elements-Foundations, Super structure, Roof, Staircase, Doors and Windows
5.	Drawing the Plan, Elevation & Section of a residential Building with Load Bearing Wall
6.	Drafting a Single floor residential building - Plan, Section and Elevation
7.	Drafting a multi-Storied residential building with Dog legged staircase - Plan, Section and Elevation
8.	Drafting a School Building - Plan, Section and Elevation
9.	Drafting a Primary Health Center- Plan, Section and Elevation
10.	Drafting an Industrial building - Plan, Section and Elevation
11.	Drafting a commercial building (framed Structure) - Plan, Section and Elevation
12.	Preparation of approval plan for a Residential Building
	Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Reference manual for AutoCAD
2.	Sikka V.B., "A course in Civil Engineering Drawing", 4th Edition, S.K.Kataria and Sons, 2015.
3.	Bhavikatti, S.S and Chitawadagi, M.V., "Building Planning and Drawing", I.K. International Publishing House Pvt. Ltd. New Delhi,2019

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	plan buildings based on NBC specifications and building bye-laws	Applying(K3), Manipulation (S2)
CO2	prepare plan, section & elevation for different types of buildings	Analyzing (K4), Manipulation (S2)
CO3	prepare approval plan for buildings	Analyzing (K4), Manipulation (S2)

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2		3	3				3	3		3	3	3
CO2	3	2	2	3	3				3	3		3	3	3
CO3	3	3	3	3	3	3			3	3		3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

22CYL21 – CHEMISTRY LABORATORY FOR CIVIL ENGINEERING

Programme & Branch	B.E-Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	2	BS	0	0	2	1

Preamble	This course aims to impart the basic concepts of volumetric, conductometric, potentiometric, viscometry, spectrophotometric and pH metry experiments for the estimation of given samples and thereby, to improve the analytical skills. It also aims to impart the significance of Ca, Mg, Fe, Cl⁻, alkalinity & DO in water which is used for construction.

LIST OF EXPERIMENTS / EXERCISES:

1.	Complexometric analysis of calcium content in cement solution.
2.	Determination of molecular weight of a polymer / liquid by Ostwald viscometer.
3.	Electrometric method for determination of pH of soil using pH meter.
4.	Analysis and comparison of the strength of acids in the given mixture using conductivity meter.
5.	Potentiometric approach using a Pt electrode for the estimation of iron in the given sample.
6.	Spectrophotometric method for the determination of Iron in steel.
7.	Estimation of chloride ion in the given water sample using Argentometric method.
8.	Estimation of alkalinity of river and borewell water collected from different places.
9.	Determination of dissolved oxygen in the given wastewater sample.
10.	Assessment of the given water sample for the suitability of drinking / industrial purpose by estimating the calcium, magnesium and total hardness by EDTA method.
11.	Electroplating process (Demonstration).
12.	Prepare a report based on the water quality parameters and suggest the suitability of water for domestic / industrial use (Demonstration).

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Palanisamy P.N., Manikandan P., Geetha A. and Manjula Rani K., "Chemistry Laboratory Manual", 1ˢᵗ Edition, Rajaganapathy Publishers, Erode, 2022.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	estimate the amount of calcium, chloride and iron in the given solution.	Applying (K3), Precision (S3)
CO2	determine the amount of water quality parameter like hardness, alkalinity, dissolved oxygen for the given water sample and demonstrate the viscometer for the determination of molecular weight of a polymer.	Applying (K3), Precision (S3)
CO3	estimate the strength of acids using conductivity meter, the amount of iron using Pt electrode for the given solution and pH of soil using pH meter.	Applying (K3), Precision (S3)

Mapping of Cos with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3			3		2	2				
CO2	3	2	2	3			3		2	2				
CO3	3	2	2	3			3		2	2				

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

22ITC32 - INTRODUCTION TO PYTHON							
(Common to Civil, Mechanical, Chemical & Automobile Engineering branches)							
Programme & Branch	BE- Civil Engineering, Mechanical Engineering, Automobile Engineering & B.Tech – Chemical Engineering branches	Sem.	Category	L	T	P	Credit
Prerequisites	C Programming	3/4	ES	3	0	2	4
Preamble	This course deals with core python programming. It gives a comprehensive introduction to problem solving using python constructs and libraries.						
Unit – I	Introduction:						9
Problem solving strategies – program design tools – Types of errors – Testing and Debugging- Basics: Literals – variables and identifiers – data types – input operation – comments – reserved words – indentation – Operators and Expressions – Decision Control Statements: Introduction – conditional statement – iterative statements – Nested Loops – break, continue and pass statements – else in loops.							
Unit – II	Lists, Tuples and Dictionary:						9
Lists: Access, update, nested, cloning, operations, methods , comprehensions, looping – Tuple: Create, utility, access, update, delete, operations, assignments, returning multiple values, nested tuples, index and count method – Dictionary: Create, access, add and modify, delete, sort, looping, nested, built-in methods – list vs tuple vs dictionary.							
Unit – III	Strings and Regular Expressions:						9
Strings: Concatenation , append, multiply on strings – Immutable – formatting operator – Built-in string methods and functions – slice operation – functions – operators – comparing – iterating – string module – Regular Expressions – match, search, sub, findall and finditer functions – flag options.							
Unit – IV	Functions and Modules:						9
Functions: Introduction – definition – call – variable scope and lifetime – return statement – function arguments – lambda function – documentation strings – programming practices recursive function- Modules: Modules – packages – standard library methods – function redefinition.							
Unit – V	Object Orientation:						9
Class and Objects: Class and objects – class methods and self – constructor – class and object variables – destructor – public and private data member. NumPy : NumPy Arrays – Computation on NumPy Arrays. Matplotlib : Line plots – Scatter Plots							
LIST OF EXPERIMENTS / EXERCISES:							
1.	Programs using conditional and looping statements						
2.	Implementation of list and tuple operations						
3.	Implementation of dictionary operations						
4.	Perform various string operations						
5.	Use regular expressions for validating inputs						
6.	Demonstration of different types of functions and parameter passing						
7.	Develop programs using classes and objects						
8.	Perform computation on Numpy arrays						
9.	Draw different types of plots using Matplotlib						
					Lecture:45, Practical:30, Total:75		
TEXT BOOK:							
1.	Reema Thareja., "Python Programming using problem solving approach", 3rd impression, Oxford University Press., New Delhi, 2017.						
REFERENCES/ MANUAL / SOFTWARE:							
1.	Nageswara Rao, "Core Python Programming", 2nd Edition, DreamTech Press, New Delhi, 2018.						
2.	Jake Vander Plas, " Python Data Science Handbook Essential Tools for Working with Data", O'Reilly Publishers, 1st Edition, 2016.						

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	use basic Python constructs to build simple programs	Applying (K3), Precision (S3)
CO2	apply list, tuple, and dictionary to handle a variety of data.	Applying (K3), Precision (S3)
CO3	apply strings and regular expressions for searching and retrieval	Applying (K3), Precision (S3)
CO4	solve the problems using functions and modules.	Applying (K3), Precision (S3)
CO5	apply object-oriented concepts and perform basic data science operations using Python	Applying (K3), Precision (S3)

Mapping of Cos with POs and PSOs

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	15	75				100
CAT2	10	15	75				100
CAT3	10	15	75				100
ESE	10	15	75				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEC31 – CONCRETE TECHNOLOGY
(IS 456-2000 and IS10262-2019 code books are permitted)

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Construction Materials and Practices	3	PC	3	0	2	4

Preamble	This course imparts knowledge about the various ingredients and properties of materials used for concrete and mix design for concrete.	
Unit – I	**Ingredients of Concrete:**	**9**

Cement – ASTM classification of cement – Chemical composition – Heat of hydration – Field and laboratory tests for cement. Aggregates: - Coarse and Fine Aggregates – IS Specifications – Classification of aggregates- Importance of grading –Standard Grading Curve – Interfacial Transition Zone. Water: Quality of water for use in concrete – Use of sea water and its effects in concrete.

Unit – II	**Concrete Mix Design:**	**9**

Concrete Mix Proportioning – Methods – Statistical Quality Control of Concrete- IS concrete mix proportion guidelines for normal concrete and High Strength Concrete – Sampling and Acceptance Criteria.

Unit – III	**Fresh and Hardened Concrete Properties:**	**9**

Workability – Tests for workability of concrete – Determination of density, air content and temperature of fresh concrete – Segregation and Bleeding. Strength Properties of Hardened concrete – Elasticity – Creep, Shrinkage and temperature effects – Gain of strength with age – Stress and Strain characteristics of concrete- Non Destructive Tests for concrete.

Unit – IV	**Durability Properties of Concrete:**	**9**

Durability of concrete – Tests for durability – Strength and durability relationship – Factors affecting durability of concrete- Permeability- RCPT- Sorptivity – Alkali Aggregate Reaction – Chemical attack – Corrosion tests- Cracks in Concrete- Performance based durability design.

Unit – V	**Special Concretes:**	**9**

Light weight concrete – Foam concrete – Self compacting concrete – Vacuum concrete – Bacterial concrete – Fiber reinforced concrete – Ferrocement – HVFA concrete – SIFCON – Basalt fiber Concrete – Ready mix concrete – Reactive Powder Concrete– Polymer concrete – Geopolymer Concrete – Pumped concrete – Roller compacted concrete – Smart Concrete-Stamped concrete- Transparent concrete – Permeable concrete.

LIST OF EXPERIMENTS / EXERCISES:

1.	Specific gravity of Cement and Aggregates
2.	Fineness Modulus of Aggregates – Sieve Analysis
3.	Fineness and Soundness test on cement
4.	Consistency, Initial and Final setting time of cement
5.	Workability of fresh concrete –Slump Value, Compaction factor and Vee Bee Consistometer
6.	Compressive Strength of Concrete
7.	Split Tensile Strength of Concrete
8.	Flexural Strength of Concrete
9.	NDT on Concrete (Rebound Hammer and UPV test)
10.	Durability on Concrete – Permeability and RCPT (Demo only)

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Shetty M.S., "Concrete Technology Theory and Practice", 8th Edition, S.Chand& Company Ltd., New Delhi, 2019.

REFERENCES/ MANUAL / SOFTWARE:

1.	Neville A.M, "Concrete Technology", 27th Edition, Pearson India Education Services, 2020.
2.	Santhakumar A.R., "Concrete Technology", 2nd Edition, Oxford University Press India, 2021.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain and assess the properties of the ingredients of concrete	Understanding (K2), Manipulation (S2)
CO2	design mix proportions for concrete with and without admixtures	Creating (K6), Manipulation (S2)
CO3	determine the fresh and hardened properties of concrete	Applying (K3), Manipulation (S2)
CO4	explain and assess the durability performance of concrete	Applying (K3), Manipulation (S2)
CO5	infer the types of special concrete with its characteristics and applications	Applying (K3). Manipulation (S2)

Mapping of Cos with Pos and PSOs

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2			3		2			3	3		3	3	2
CO2	3	2	3			3						3	3	2
CO3	3	2	3	3		3			3	3		3	3	2
CO4	3	2	3	3	3	2			3	3		3	3	2
CO5	2			3		2	3		3	3		3	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50				20	100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	25			15	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CET31 - MECHANICS OF MATERIALS

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	**Engineering Mechanics**	3	PC	3	1	0	4

Preamble	This course imparts knowledge about stresses, strains, shear force, bending moment, slope and deflection in beams,concept of torsion in circular shaft and theory of columns.

Unit – I	**Stresses and Strain:**	**9+3**

Introduction – Types of loads – Stability - Stresses and strains – Stress and strain diagram for steel – Elastic limit - Hooke's law – Poisson's ratio – Elastic constants – Young's modulus – Shear modulus – Bulk modulus - Thermal stresses – Compound stresses - Factor of Safety -Deformation of simple and compound bars.

Unit – II	**Shear Force and Bending Moments in Beams:**	**9+3**

Types of beams – Types of supports and loads – Plane bending – Oblique bending – Bending moment and Shear force – Sign conventions - Point of contraflexure – Clockwise and anti-clockwise moments – Shear force and bending moment diagrams for concentrated load, uniformly distributed load, uniformly varying load and Couples.

Unit – III	**Stresses in Beams:**	**9+3**

Simple Bending - Bending stress – Assumptions – Theory of simple bending and bending equation – Complimentary shear – Load Carrying capacity -– Applications of bending equation - Shear stress distribution in beam.

Unit – IV	**Deflection of Beams and Torsion:**	**9+3**

Beam Deflection – Slope - Sign conventions - Double integration method –Macaulay's Method - Moment area method – Mohr's Theorems - Conjugate beam theorems - Conjugate beam method. Simple torsion – Torsional loads – Torsion equation for circular shafts and hollow circular shafts – Assumptions -Torsional rigidity -Power transmission — Modulus of rupture.

Unit – V	**Theory of column:**	**9+3**

Column and strut – Classification of columns - Slenderness ratio – Buckling load and factor - Effective length – Various end conditions - Euler'stheory, assumptions, formula and limitations - Rankine's formula – Crippling load and Safe load.

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:
1.	Rajput R.K., Strength of Materials, 7th Edition, S. Chand & Company Ltd, New Delhi, 2018.

REFERENCES:
1.	Subramanian R., Strength of Materials, 3nd Edition, Oxford University Press, 2016.
2.	Popov E P, Mechanics of Materials, 4th Edition, Prentice Hall of India, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	determine the various types of stresses and strain	Applying (K3)
CO2	draw the shear force and bending moment diagram for beams under various loading conditions	Applying (K3)
CO3	analyze the bending and shear stresses in beams	Analyzing (K4)
CO4	asses the slope and deflection in beams	Analyzing (K4)
CO5	analyze the torsional behavior and compute the critical load on columns	Analyzing (K4)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2									3	3	3
CO2	3	3	2									3	3	3
CO3	3	3	2									3	3	3
CO4	3	3	2									3	3	3
CO5	3	3	2									3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	20	50			100
CAT2	10	20	20	50			100
CAT3	10	20	20	50			100
ESE	10	20	20	50			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CET32 FLUID MECHANICS AND HYDRAULICS ENGINEERING							
Programme & Branch	**B.E. & CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Physics for Civil Engineering**	**3**	**PC**	**3**	**0**	**0**	**3**
Preamble	This course provides knowledge about fluid properties, fluid statics, kinematics and dynamics. It provides an understanding of flow through pipes and open channel. This course also enhances the knowledge on flow hydraulics.						
Unit – I	**Fluid Properties & Fluid Statics**						**9**
Properties of fluids – Types of fluids- Hydrostatic law – Pascal's law- Types and measurement of pressure – Hydrostatic pressure - Total pressure – Centre of pressure – Buoyancy – Meta centre – Equilibrium conditions.							
Unit – II	**Fluid kinematics:**						**9**
Classification and types of flow –flow lines and Path lines – Continuity equation – Velocity potential function and Stream function– Flow net – Euler's equation of motion – Bernoulli's equation and its applications							
Unit – III	**Flow through Pipes & Boundary Layer:**						**9**
Flow through Pipes- Pipes in series and parallel – Major and Minor losses in pipes -. Moody diagram. –. Boundary layer concept-Boundary layer thickness - Problems.							
Unit – IV	**Open Channel Flow:**						**9**
Types of flow- Specific energy and Critical flow – Chezy and Manning 's formula – Most economical sections (Rectangular and Trapezoidal)- Types of flow profiles -Problem on calculation of Length of Back water and draw down curve – Hydraulic Jumps – Surges.							
Unit – V	**Dimensional and Model Analysis:**						**9**
Dimensional analysis – Dimensional parameters – Rayleigh 's method and Buckingham 's Pi theorem -Model analysis - Similitude - Scale effect – Distorted and undistorted models.							
							Total:45

TEXT BOOK:

1.	Bansal R.K., "A Textbook of Fluid Mechanics and Hydraulic Machines", 10th Edition, Laxmi Publications, New Delhi, 2018.

REFERENCES:

1.	Modi P.M., and Seth S.M., "Hydraulics & Fluid Mechanics including Hydraulic Machines", 21st Edition, Standard Book House, New Delhi, 2017.
2.	Victor L. Streeter, Benjamin E. Wylie and Bedford K.W., "Fluid Mechanics", 9th Edition, McGraw-Hill, India, 2010.

			BT Mapped (Highest Level)
COURSE OUTCOMES: **On completion of the course, the students will be able to**			
CO1	predict the properties and characteristics of fluids		Applying (K3)
CO2	calculate the velocity and discharge of flow		Applying (K3)
CO3	calculate the characteristics of pipe flow		Applying (K3)
CO4	design the most economical channel sections		Applying (K3)
CO5	solve complex fluid problems		Applying (K4)

Mapping of Cos with Pos and PSOs

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				3	3	2				2	3	3
CO2	3	2				3	3	2				2	3	3
CO3	3	2				3	3	2				2	3	3
CO4	3	3	2			3	3	2				2	3	3
CO5	3	3				3	2	2				2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70				100
CAT2	10	30	60				100
CAT3	10	10	20	60			100
ESE	5	10	65	20			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CET33 - CONSTRUCTION ENGINEERING AND MANAGEMENT							
Programme & Branch	**B.E. & CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3**	**PC**	**3**	**0**	**0**	**3**

Preamble	This course imparts knowledge on Construction Engineering and Management principles necessary for execution of projects efficiently which deals with quality, cost control and safety aspects in construction industry.	
Unit – I	**Planning, Scheduling and Organizing:**	**9**
Planning for Construction projects - Objectives - Principles - Stages of planning, Scheduling - Methods - Project management through networks - CPM & PERT - Job lay-out - Work breakdown structure - Types of Construction organization.		
Unit – II	**Resource Management:**	**9**
Types of resources - Estimating resource requirements - Material management - Effective utilization of resources - Depreciation of construction equipment - Manpower planning - Resource levelling - Resource smoothing.		
Unit – III	**Quality Control:**	**9**
Quality control in construction-Importance - Elements - Quality control methods - ISO 9000 family of standards - Statistical methods - Sampling by attributes - Sampling by variables - Techniques and needs of QC.		
Unit – IV	**Schedule and Cost Control:**	**9**
Schedule variance - Cost variance - Cost and schedule relationship - Budgeted cost - Cost control in construction - Objectives - Cost control systems - Direct and indirect cost control - Time-cost trade off - Risk cost management.		
Unit – V	**Safety Management:**	**9**
Safety in construction projects - Importance of safety - Elements of safety programme - Jobsite safety assessment - Site accidents - Causes - Classification - Safety measures - Approaches to improve safety in construction - Safety codes and OSHA standards.		
		Total:45

TEXT BOOK:	
1.	Seetharaman. S, "Construction Engineering and Management", 5th Edition, Umesh Publishing, 2019

REFERENCES:	
1.	S.C. Sharma, S.V. Deodhar, "Construction Engineering and Management", 1st Edition, Khanna Publishing House, 2017.
2.	Garold D. Oberlender, "Project Management for Engineering and Construction", 3rd Edition, McGraw-Hill Education, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	articulate the importance of planning and scheduling in construction projects	Applying (K3)
CO2	estimate the resource requirement for construction projects	Applying (K3)
CO3	infer the various quality elements and its importance for construction materials	Understanding (K2)
CO4	prepare schedule and budgeted cost associated with construction activities	Applying(K3)
CO5	apply the safety codes and standards to improvise the safety culture at job site	Applying (K3)

Mapping of Cos with Pos and PSOs														
Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1			3				1	1		3	2
CO2	3	2	1			3					2	1	3	3
CO3	3	2	1			3					2	1	3	3
CO4	3	2	1			3					2	1	3	3
CO5	3	2	1			3					2	1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	35	45				100
CAT2	25	40	35				100
CAT3	25	40	35				100
ESE	20	40	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEL31 - STRENGTH OF MATERIALS LABORATORY

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	PC	0	0	2	1

Preamble	Engineering Mechanics

LIST OF EXPERIMENTS / EXERCISES:

1.	Tension test on metal specimens.
2.	Compression test on wooden specimen.
3.	Shear test on metal specimens
4.	Torsion test on metal specimen
5.	Impact tests on metal specimens
6.	Hardness tests on metal specimens
7.	Bending test -I –Verification of Maxwell's reciprocal theorem
8.	Bending test -II – Determination of young's modulus and flexural rigidity
9.	Test on open coil helical springs
10.	Test on closed coil helical springs
11.	Study on mechanical and electrical strain gauges
12.	Study on fatigue test
	Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Rajput, R.K., "Strength of Materials", 7th Edition, S Chand & Company Limited, New Delhi, 2018.
2.	Laboratory Manual
3.	Experimental Videos Developed by Faculty
4.	IS 8728-2015 (Part-1), IS883-1961, IS5242-1979, IS1598-1977, IS1757-1988, IS1499-1977, IS1586-2012, IS7906-2004 code books

COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	inspect the behavior of various materials under tension, compression, shear and torsion	Applying (K3) Manipulation (S2)
CO2	analyze the Impact strength and hardness strength of the material	Analyzing(K4) Manipulation (S2)
CO3	investigate strength of materials under stiffness and strain	Analyzing(K4) Manipulation (S2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	2				3	3		3	3	3
CO2	3	3	2	3	2				3	3		3	3	3
CO3	3	3	2	2	3				3	3		3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

22CEL32 - FLUID MECHANICS AND HYDRAULICS ENGINEERING LABORATORY

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Physics for Civil Engineering	3	PC	0	0	2	1

Preamble	This course helps the students to determine the various flow and the characteristics of various hydraulic machines

LIST OF EXPERIMENTS / EXERCISES:

1.	Determination of co-efficient of discharge through orifice and mouthpiece
2.	Determination of co-efficient of discharge of rectangular and triangular notches
3.	Determination of co-efficient of discharge of venturimeter through Bernoulli's equation
4.	Determination of co-efficient of discharge of orificemeter through Bernoulli's equation
5.	Impact of jet on vanes - Efficiency determination
6.	Determination of friction loss in pipes
7.	Determination of various types of minor losses in pipes
8.	Evaluation of the performance characteristics of Pelton turbine
9.	Evaluation of the performance characteristics of Francis turbine
10.	Evaluation of the performance characteristics of centrifugal pump
11.	Evaluation of the performance characteristics of reciprocating pump
12.	Evaluation of the performance characteristics of submersible pump

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual
2.	Bansal. R.K. "A Text Book of Fluid Mechanics and Hydraulics Engineering", 10th Edition, Laxmi Publications, New Delhi, 2019.
3.	Modi P.N. and Seth, S.M., "Hydraulics and Fluid Mechanics including Hydraulic Machines", Rajsons Publications Pvt. Ltd., 21st Edition, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	determine the rate of flow under different flow characteristics	Applying(K3) Manipulation (S2)
CO2	compute the major and minor losses in pipe flow	Applying (K3) Manipulation (S2)
CO3	determine the performance characteristic of pumps and turbines	Analyzing (K4) Manipulation (S2)

Mapping of Cos with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2		3			1			2	3	3
CO2	3	2	1	2		3			1			2	3	3
CO3	3	3	2	2		3			1			2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

22MNT31 - ENVIRONMENTAL SCIENCE								

<table>
<tr><td colspan="9" align="center">(Common to All Engineering and Technology Branches)</td></tr>
<tr><td>Programme & Branch</td><td>All B.E/B.Tech Branches</td><td>Sem.</td><td>Category</td><td>L</td><td>T</td><td>P</td><td colspan="2">Credit</td></tr>
<tr><td>Prerequisites</td><td>Nil</td><td>3 / 6</td><td>MC</td><td>2</td><td>0</td><td>0</td><td colspan="2">0</td></tr>
</table>

Preamble	This course provides an approach to understand the various natural resources, ecosystem, bio-diversity, pollution control & monitoring methods for sustainable life and also to provide knowledge and to create awareness for engineering students on biological sciences.	
Unit – I	**Environmental Studies and Natural Resources**	**5**

Introduction to Environmental Science – uses, over-exploitation and conservation of forest, water, mineral, food, energy and land resources–case studies

Unit – II	**Ecosystem and Biodiversity**	**5**

Ecosystems: concept and components of an ecosystem -structural and functional features – Functional attributes (Food chain and Food web only). Biodiversity: Introduction – Classification – Bio geographical classification of India- Values of biodiversity – Threats and Conservation of biodiversity - case studies.

Unit – III	**Environmental Pollution**	**5**

Environmental Pollution: Definition – causes, effects and control measures of: (a) Air pollution - Climate change, global warming, acid rain, ozone layer depletion (b)Water pollution (c) Soil pollution - Role of an individual in prevention of pollution - case studies.

Unit – IV	**Environmental Monitoring**	**5**

Sustainability -three pillars of sustainability- factors affecting environmental sustainability-approaches for sustainable development - Introduction to EIA - objectives of EIA - environment protection act – air (prevention and control of pollution) act – water (prevention and control of pollution) act.

Unit – V	**Introduction to Biological Science**	**5**

Functions of Carbohydrates, lipids, proteins and nucleic acids - Cells and its organelles - plasma membrane, mitochondria and nucleus- Heredity and DNA - organization of DNA in cells - Genes and chromosomes- Cell division -Types of cell division- mitosis & meiosis - Cell cycle and molecules that control cell cycle.

	Total:25

TEXT BOOK:

1.	Anubha Kaushik, and Kaushik C.P., "Environmental Science and Engineering", 6th Multicolour Edition, New Age International Pvt. Ltd., New Delhi, 2018, for Unit-I, II, III, IV.
2.	Rastogi.SC, "Cells and Molecular Biology", 2nd Edition, reprint, New Age International (P) Limited Publishers, New Delhi, 2008, for Unit-V.

REFERENCES:

1.	Palanisamy P.N., Manikandan P., Geetha A., Manjula Rani K., Kowshalya V.N., "Environmental Science", Pearson Education, New Delhi, Revised Edition 2019.
2.	Mukhtar Ahmad, "Text book of modern biochemistry", Volume I & II, Oxford & IBH Publishing Co. Pvt. LTD, Delhi, 1995.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	illustrate the various natural resources and role of individual for its conservation	Understanding (K2)
CO2	elaborate the features of ecosystem and biodiversity to find the need for conservation.	Understanding (K2)
CO3	manipulate the sources, effects and control methods of various environmental pollution.	Applying (K3)
CO4	make use of the knowledge of EIA and environmental legislation laws towards sustainability.	Applying (K3)
CO5	explain the functions of carbohydrates, lipids, proteins, nucleic acids, Cells and its organelles	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1					3							
CO2	2	1					3							
CO3	3	2	1				3							
CO4	3	2	1				3							
CO5	3	1												

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	NA						
ESE	NA						

* ±3% may be varied (CAT 1, 2 – 50 marks)

22EGL31 - COMMUNICATION SKILLS DEVELOPMENT LABORATORY							
(Common to All Engineering and Technology Branches)							
Programme & Branch	**All B.E./B.Tech Branches**		**Sem.**	**Category**	**L**	**T**	**P**	**Credit**

Programme & Branch	**All B.E./B.Tech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3 / 4**	**HS**	**0**	**0**	**2**	**1**

Preamble	This course is designed to impart necessary skills to listen, speak, read and write in order to obtain better professional communication skills.

LIST OF EXPERIMENTS / EXERCISES:

1.	Self Introduction & Mock Interview
2.	Job Application letter with Resume
3.	Presentation: A Technical topic / Project report & a Case study
4.	Situational Dialogues / Telephonic Conversations
5.	Group Discussion
6.	Reading Aloud
7.	Listening Comprehension
8.	Writing Company Profiles
9.	Preparing reviews of a book/product/movie
10.	Pronunciation Test

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Lab Manual
2.	Orell Digital Language Lab Software

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	enhance effective listening and reading skills	Understanding (K2), Imitation (S1)
CO2	acquire professional skills required for workplace/higher education	Applying (K3), Naturalization (S5)
CO3	use English language skills effectively in various situations	Applying (K3), Articulation (S4)

Mapping of Cos with POs and PSOs												
COs/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1									2	3		3
CO2									2	2		2
CO3									2	2		2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

22MAT41- NUMERICAL METHODS FOR ENGINEERS							
(Common to Civil, Mechanical, Mechatronics, Automobile and Food Technology Branches)							
Programme & Branch	BE - Civil, Mechanical, Mechatronics, Automobile and BTech - Food Technology Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	BS	3	1	0	4
Preamble	To impart knowledge in interpolation, numerical differentiation and integration. Also develop skills to apply numerical algorithms to identify roots of algebraic and transcendental equations and solve linear system of equations, ordinary and partial differential equations.						
Unit – I	Solution to Algebraic and Transcendental Equations:						9+3
Iteration method – Method of false position – Newton-Raphson method – Solution of linear system of equations – Direct methods: Gauss elimination method and Gauss – Jordan method – Iterative methods: Gauss Jacobi and Gauss – Seidel methods.							
Unit – II	Interpolation:						9+3
Interpolation with equal intervals: Newton's forward and backward difference formulae – Central difference interpolation formulae: Gauss forward and backward interpolation formulae – Interpolation with unequal intervals: Lagrange's interpolation formula – Newton's divided difference formula.							
Unit – III	Numerical Differentiation and Integration:						9+3
Differentiation using Newton's forward, backward and divided difference formulae – Numerical integration: Trapezoidal rule – Simpsons 1/3rd rule – Simpsons 3/8th rule – Double integrals using Trapezoidal and Simpson's rules.							
Unit – IV	Numerical Solution of First order Ordinary Differential Equations:						9+3
Single step methods: Taylor series method – Euler method – Modified Euler method – Fourth order Runge-Kutta method – Multi step methods: Milne's predictor corrector method – Adam's Bashforth method.							
Unit – V	Solutions of Boundary Value Problems in PDE:						9+3
Solution of one dimensional heat equation – Bender –Schmidt recurrence relation – Crank – Nicolson method – One dimensional wave equation – Solution of two dimensional Laplace equations – Solution of Poisson equation.							
						Lecture:45, Tutorial:15, Total:60	

TEXT BOOK:

1.	Veerarajan T, Ramachandran T., "Numerical Methods", 1st Edition, McGraw Hill Education, Chennai, 2019.

REFERENCES:

1.	Sankara Rao. K., "Numerical Methods for Scientists and Engineers", 3rd Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2007.
2.	Steven C. Chapra, Raymond P. Canale., "Numerical Methods for Engineers", 7th Edition, McGraw-Hill Education, 2014.
3.	Sastry, S.S, "Introductory Methods of Numerical Analysis", 5th Edition, PHI Learning Pvt. Ltd, 2015.
4.	Ramana B V, "Higher Engineering Mathematics", 1st Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply various numerical techniques to solve algebraic and transcendental equations.	Applying (K3)
CO2	perform interpolation on given data using standard numerical techniques.	Applying (K3)
CO3	understand the concepts of numerical differentiation and integration	Applying (K3)
CO4	compute the solution of first order ordinary differential equations by numerical techniques..	Applying (K3)
CO5	apply various numerical techniques for solving partial differential equations.	Applying (K3)

Mapping of Cos with POs and PSOs

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	2											
CO3	3	3	2											
CO4	3	2	1											
CO5	3	3	3											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	80	-	-	-	100
CAT2	10	10	80	-	-	-	100
CAT3	10	10	80	-	-	-	100
ESE	10	10	80	-	-	-	100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEC41 - GEOTECHNICAL ENGINEERING - I							
Programme & Branch	**B.E. & CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Construction Materials and Practices**	**4**	**PC**	**2**	**0**	**2**	**3**

Preamble	This course imparts basic knowledge on the index properties, engineering properties and classification of soil particles. This course also deals with the various concepts such as permeability, stress distribution, settlement, shear strength and slope stability	
Unit – I	**Soil Classification and Compaction:**	**6**
Formation of soil - Phase relationship – Index properties – Indian Standard Classification system – Compaction of Soils – Theory and Factors influencing compaction of Soils – Field Compaction methods.		
Unit – II	**Permeability and Effective Stress:**	**6**
Flow of water through soils - Darcy 's law – permeability – Factors affecting permeability – coefficient of permeability – Effective stress concepts in soils – quick sand conditions		
Unit – III	**Stress Distribution:**	**6**
Stress distribution in homogeneous and isotropic medium – Boussinesq's theory – Westergaard's theory – Use of New mark's influence chart – Pressure bulb		
Unit – IV	**Settlement:**	**6**
Components of settlement – Immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – Computation of rate of settlement.		
Unit – V	**Shear strength:**	**6**
Shear strength of cohesive and cohesion less soils – Different drainage conditions – Mohr-Coulomb failure theory – Measurement of shear strength - Direct shear test, Triaxial compression test, Unconfined compression test and Vane shear test -Factors influences shear strength of soil.		

LIST OF EXPERIMENTS / EXERCISES:

1.	Determination of specific gravity of soil
2.	Determination of grain size distribution using sieve analysis
3.	Determination of plasticity index of soil
4.	Determination of differential free swell index of cohesive soil
5.	Determination of field density by a. sand replacement method b. core cutter method
6.	Determination of moisture – density relationship using Standard Proctor Method
7.	Determination of relative density of cohesionless soil
8.	Determination of coefficient of permeability by constant head and falling head method
9.	Determination of shear parameters by direct shear test in cohesionless soil
10.	Determination of shear parameters by unconfined compression test in cohesive soil

Lecture:30, Practical:30, Total:60

TEXT BOOK:

1.	Arora K.R., "Soil Mechanics and Foundation Engineering", 7th Edition, Standard Publishers and Distributors, New Delhi, 2019.

REFERENCES/ MANUAL / SOFTWARE:

1.	Punmia B.C., Jain A.K. and Jain A.K., "Soil Mechanics and Foundations", 17th Edition, Laxmi Publications, New Delhi. 2017.
2.	Laboratory Manual.
3.	SP 36 - 1 (1987), Compendium of Indian Standards on Soil. Engineering.

	COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	determine the index properties of soil and solve problems related to three phase system	Applying (K3), Manipulation (S2)
CO2	determine permeability characteristics and solve the problems related to effective stress and seepage	Applying (K3), Manipulation (S2)
CO3	compute vertical stress distribution and settlement in soil	Applying (K3), Manipulation (S2)
CO4	calculate the shear strength parameters for various soil conditions	Applying (K3), Manipulation (S2)
CO5	analyze the stability of slopes	Analyzing (K4), Manipulation (S2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3		3			3	3		3	3	2
CO2	3	3	3	3		3			3	3		3	3	3
CO3	3	3	2	1		3						3	3	3
CO4	3	3	2	1		3			3	3		3	3	3
CO5	3	3	2	1		3			3	3		3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70				100
CAT2	10	30	60				100
CAT3	10	20	40	20			100
ESE	10	20	50	20			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEC42 – ENVIRONMENTAL ENGINEERING

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Chemistry for Civil Engineering	4	PC	2	0	2	3

Preamble	The course aims to impart knowledge on water and sewage occurrence, distribution, treatment and disposal techniques.	
Unit – I	**Water Supply, Source and Conveyance:**	**6**
Objectives and Factors influencing Public Water Supply systems – Sources of water – Population Forecasts – Water quality parameters and standards – Intake Structures – Laying, Jointing and Testing of pipelines – Pipe Appurtenances.		
Unit – II	**Principles of Treatment:**	**6**
Basic principles of water treatment – Unit processes and operations – Screens –Grit chamber – Design of sedimentation tanks – Design of Filters – Disinfection methods – Water Softening Methods.		
Unit – III	**Collection and Conveyance of Sewage:**	**6**
Sources and characteristics of wastewater – Quantity – Storm runoff estimation – Minimum and Maximum velocity – Laying, jointing and testing of sewers – Layout of Sewage treatment plant – Sewer appurtenances.		
Unit – IV	**Principles of Sewage Treatment:**	**6**
Basic principles of biological treatment – Principles and operation of Trickling filter– Activated sludge process and its Modifications – Aeration process and types – Oxidation Ditch – Waste stabilization ponds – Principles and Design of Septic tanks.		
Unit – V	**Sewage Disposal and Rural Sanitation:**	**6**
Objectives of sludge treatment – Properties of sludge –Sludge Digestion – Oxygen sag curve – Sanitary fixtures – One pipe and Two pipes systems – Rural sanitation system – Environmental Protection Acts.		

LIST OF EXPERIMENTS / EXERCISES:	
1.	Sampling and preservation methods of water and wastewater
2.	Determination of i) Ph and turbidity ii) Hardness
3.	Determination of Acidity & Alkalinity
4.	Determination of Chlorides
5.	Determination of Sulphates
6.	Determination of Optimum Coagulant Dosage
7.	Determination of dissolved oxygen
8.	Determination of Total Dissolved Solids and Suspended Solids
9.	Determination of B.O.D
10.	Determination of C.O.D

Lecture:30, Practical:30, Total:60

TEXT BOOK:	
1.	Garg S.K., "Environmental Engineering- Vol. I & II", 33rd & 39th Edition, Khanna Publishers, New Delhi, 2010 & 2019.

REFERENCES/ MANUAL / SOFTWARE:	
1.	Metcalf and Eddy, " Waste Water Engineering: Treatment and Reuse", 4th Edition, McGraw-Hill, New Delhi, 2017.
2.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	estimate the population, analyse the water demand and properties of water	Applying (K3), Manipulation (S2)
CO2	classify the water purification methods and analyse the oxygen demand	Applying (K3), Manipulation (S2)
CO3	calculate the quantity of waste water generated from various sources	Applying (K3), Manipulation (S2)
CO4	design the principal components of sewage treatment plant	Applying (K3), Manipulation (S2)
CO5	suggest appropriate sludge treatment methods and sanitary fixtures	Applying (K3), Manipulation (S2)

Mapping of Cos with POs and PSOs

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	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	2		3	3					3	3	3
CO4	3	3	3	3		3	3		3	3		3	3	3
CO5	3	3	2	2		3	3					3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	25	45				100
CAT2	20	40	40				100
CAT3	10	40	50				100
ESE	20	40	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CET41 – DESIGN OF RC ELEMENTS
(IS 456-2000 & SP16 code books are permitted)

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Mechanics of Materials and Concrete Technology	4	PC	3	1	0	4

Preamble	This course imparts knowledge on detailed design philosophies and the design of various structural elements like slabs, beams, columns and isolated footing

Unit – I	Fundamental Concepts:	9+3

Objective of structural design – Type of loads on structures and load combinations –Basic structural elements – Code of practices and Specifications – Cover requirements – Stress–strain curve for concrete in compression – Types and grades of reinforcement – Stress – strain curve for reinforcing steel. Concept of Working Stress Method (WSD), Ultimate Load Method (ULD) and Limit State Method (LSD) – Permissible stress – Characteristic strength and Characteristic load – Factor of safety and Partial safety factors

Unit – II	Limit State Design of Beams:	9+3

Types of beams – Design of singly and doubly reinforced rectangular and flanged beams for flexure, shear and combined bending, shear and torsion – Design requirement for bond and anchorage as per IS code

Unit – III	Limit State Design of Slabs and Staircase:	9+3

Types of slabs – Behaviour of one-way and two-way slabs – Design considerations – Design of one-way slab – cantilever, simply supported and continuous. Design of two-way slab – restrained, non-restrained and continuous. Types of staircases – Design of dog-legged staircase.

Unit – IV	Limit State Design of Columns:	9+3

Classification of columns – Unsupported and effective length of a column – Failure of columns – Design of short columns subjected to axial, uni-axial and bi-axial bending – Design of slender columns subjected to bi-axial bending.

Unit – V	Limit State Design of Footings:	9+3

Types of footings – Soil pressure under footings – Design considerations – Design of axially and eccentrically loaded square and rectangular isolated footings – Design principles of combined rectangular footings.

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Subramanian N., "Design of Reinforced Concrete Structures", 1st Edition, Oxford University Press, 2014

REFERENCES:

1.	Krishna Raju, N., "Design of Reinforced Concrete Structures", 4th Edition, CBS Publishers & Distributors, New Delhi,2018
2.	Unnikrishna Pillai S. and Devdas Menon, Reinforced Concrete Design, 4th Edition, Tata McGraw-Hill, New Delhi, 2021
3.	Varghese P.C., Limit State Design of Reinforced Concrete, 2nd Edition, Prentice Hall of India, New Delhi, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the basic concept of design philosophies	Understanding (K2)
CO2	design beams for flexure, shear & torsion	Applying (K3)
CO3	design different types of slabs and dog-legged staircase	Applying (K3)
CO4	categorize the column and apply the appropriate design procedure	Applying (K3)
CO5	design axially and eccentrically loaded isolated footing	Applying (K3)

Mapping of Cos with POs and PSOs

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			3				2		3	3	3
CO2	3	3	2			3				2		3	3	3
CO3	3	3	2			3				2		3	3	3
CO4	3	3	2			3				2		3	3	3
CO5	3	3	2			3				2		3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	10	20	70				100
CAT3	10	20	70				100
ESE	10	20	70				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CET42 - STRUCTURAL ANALYSIS							

Programme& Branch	**B.E. & Civil Engineering**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Mechanics of Materials**	4	PC	3	1	0	4

Preamble	This course offers the various methods for the analysis of determinate and indeterminate structures. It aims at the determination of end moments and constructing shear force and bending moment diagrams for the continuous beams and portal frames. It also involves the analysis of structures for moving loads.	
Unit – I	**Slope Deflection Method:**	**9+3**
Introduction to displacement method of analysis – Sign Conventions – Development of slope deflection equations – Analysis of continuous beams – Analysis of continuous beams with support settlement – Analysis of non-sway frames –Analysis of sway frames.		
Unit – II	**Moment Distribution Method:**	**9+3**
Introduction to moment distribution method – Stiffness factor – Carryover factor and distribution Factor –Analysis of continuous beams –Sinking of supports – Analysis of non-sway frames – Analysis of sway frames.		
Unit – III	**Flexibility Matrix Method:**	**9+3**
Introduction – Static and kinematic indeterminacy – Equilibrium and compatibility conditions – Primary structure– Element and global flexibility matrix – Applications – Analysis of indeterminate beams, frames and trusses (Redundancy restricted to two).		
Unit – IV	**Stiffness Matrix Method:**	**9+3**
Introduction to matrix methods of analysis – Displacement and force transformation matrices – Element and global stiffness matrix – Applications – Analysis of indeterminate beams – Analysis of portal frames – Analysis of trusses (Redundancy restricted to two).		
Unit – V	**Moving Loads and Influence Lines:**	**9+3**
Influence lines for reactions in statically determinate structures – Influence lines for member forces in pin-jointed frames – Influence lines for shear force and bending moment in beam sections – Muller Breslau's principle –Influence lines for continuous beams (2-degree redundant structures)		
	Lecture:45, Tutorial:15, Total:60	

TEXT BOOK:	
1.	Devdas Menon, Structural Analysis, 2nd Edition, Narosa Publishing House, New Delhi, 2018.

REFERENCES:	
1.	Hibbeler, R.C, Structural Analysis, 10th Edition, Pearson India, Bengaluru, 2018.
2.	Punmia.B.C, Ashok K.Jain, ArunK.Jain, Theory of Structures, 13th Edition, Laxmi Publications, New Delhi, 2017
3.	Bhavaikatti, S.S, "Structural Analysis – Volume 1 & Volume 2", 5th Edition, Vikas Publishing Pvt Ltd., New Delhi, 2021.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	evaluate shear force and bending moment for beams and rigid frames using slope defection method	Analyzing (K4)
CO2	determine the bending moment of beams and rigid frames using moment distribution method	Analyzing (K4)
CO3	determine the bending moment using flexibility matrix methods	Analyzing (K4)
CO4	determine the bending moment using stiffness matrix method	Analyzing (K4)
CO5	analyse the beams subjected to moving loads	Analyzing (K4)

Mapping of Cos with POs and PSOs

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			2						3	3	3
CO2	3	3	2			2						3	3	3
CO3	3	3	2			2						3	3	3
CO4	3	3	2			2						3	3	3
CO5	3	3	2			2						3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	30	50			100
CAT2	10	10	30	50			100
CAT3	10	10	30	50			100
ESE	10	10	30	50			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEL41 - COMPUTER AIDED BUILDING INFORMATION MODELLING LABORATORY							

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Aided Building Drawing Laboratory	4	PC	0	0	2	1

Preamble	This course facilitates efficient design, documentation, better coordination, simulation and visualization of a building through modelling process.

LIST OF EXPERIMENTS / EXERCISES:

1.	Modeling of Building Components – Walls, Doors, windows
2.	Modeling of Building Components – Floor, Roof, Staircase
3.	Modeling of Building Components – Beam, Column & Foundation
4.	Create Plan, Section and elevation of a single storey Residential building
5.	Create Plan, Section and elevation of a multi storey Residential building
6.	Create Plan, Section and elevation of an Industrial building
7.	Create walkthrough for a simple residential building
8.	Documentation and quantity take off for a building
9.	Detailing and bar bending schedule of beam
10.	Detailing and bar bending schedule of column
11.	Detailing and bar bending schedule of slab
12.	Detailing and bar bending schedule of staircase
	Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Revit Architecture Software
2.	MS project Software
3.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the BIM concept civil projects	Applying (K3), Manipulation (S2)
CO2	visualize and document of building components	Applying (K3), Manipulation (S2)
CO3	take quantity of various material used in the building	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	3				3	3	3	3	3	3
CO2	3	2	3	3	3				3	3	3	3	3	3
CO3	3	2	3	3	3				3	3	3	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

22CEL42 - COMPUTER AIDED STRUCTURAL DESIGN LABORATORY – I (IS 456:2000, IS 3370:2009, SP 16, IS 800:2007, SP 06, IS 875 and SP 38 are permitted)							

Programme & Branch	**B.E. & CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Mechanics of Materials**	**4**	**PC**	**0**	**0**	**2**	**1**

Preamble	This course gives knowledge about how to analyze and design the various components of the different types of the structure using ETABS software

LIST OF EXPERIMENTS / EXERCISES:

1.	Introduction & Modelling of different types of elements
2.	Load and load combinations
3.	Analysis and design of beams
4.	Analysis of single storied frame
5.	Design of single storied frame structural elements
6.	Analysis of multi- storied frame
7.	Design of multi- storied frame structural elements (Design of slabs & beams)
8.	Design of multi- storied frame structural elements (Design of columns & footings)
9.	Analysis of plane truss
10.	Analysis of space truss
	Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	ETABS Software
2.	Lab Manual
3.	S.N.Sinha, Reinforced Concrete Design, Tata Mcgraw Hill Education, 4th Edition, 2018

COURSE OUTCOMES: **On completion of the course, the students will be able to**		**BT Mapped (Highest Level)**
CO1	analyze the different types of structures	Analyzing (K4), Manipulation (S2)
CO2	analyze and design of reinforced concrete elements	Analyzing (K4), Manipulation (S2)
CO3	analyze the steel structures	Analyzing (K4), Manipulation (S2)

Mapping of COs with POs and PSOs														
COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2	3	3	2			3	3		3	3	3
CO2	3	3	2	3	3	2			3	3		3	3	3
CO3	3	3	2	3	3	2			3	3		3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

22GCL41 - PROFESSIONAL SKILLS TRAINING - I							
(Common to All BE/ BTech Engineering and Technology branches)							
Programme & Branch	**All BE/ BTech Engineering and Technology branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**4**	EC	0	0	80	2

Preamble	This subject is to enhance the employability skills and to develop career competency	
Unit – I	**Soft Skills – I :**	**20**

Soft skills and its importance: Pleasure and pains of transition from an academic environment to work environment-Need for change- Fear, stress and competition in the professional world-Importance of positive attitude- Self motivation and continuous knowledge up gradation-Self-confidence. Professional grooming and practices: Basics of corporate culture-Key pillars of business Etiquette- Basics of etiquette-Introductions and greetings-Rules of the handshake, earning respect, business manners-Telephone etiquette- Body Language.

Unit – II	**Quantitative Aptitude and Logical Reasoning – I:**	**30**

Problem solving level I: Number System-LCM &HCF-Divisibility test-Surds and indices-Logarithms- Ratio-proportions and Variation-Partnership-Time speed and distance-Data interpretation-data representation. Logical reasoning: Family tree-Deductions-Logical connectives-Binary logic Linear arrangements- Circular and complex arrangement

Unit – III	**Grammar, Vocabulary, Listening, Speaking, Reading and Writing:**	**30**

Grammar: Parts of speech - Tenses - Articles and Prepositions - Vocabulary: Synonyms & Antonyms - Analogies - Syllogism - Spelling test - Cloze test - Concord - Spotting Errors - Listening: Listening to TED talks, ESL & ESOL Videos - Podcasts - Speaking : Mock Interviews - Personality traits - Better pronunciation -   Extempore talk - Reading: Reading with stress, pauses, slurs and fillers - Soft skills - Writing: Job application letter & resume - Video resume – Different types of writing - Jumbled sentences - Professional   e-mail writing - Business letters - One page essay - Report writing - Editing & proofreading – Writing skills for IELTS

	Total:45

TEXT BOOK:

1.	R.S. Aggarwal, "Quantitative Aptitude", 7th Edition, S. Chand Publication, 2022.
2.	R.S. Aggarwal, "A Modern Approach to Logical Reasoning", S. Chand Publication, 2022 edition.
3.	Edgar Thorpe and Showick Thorpe, "Objective English for Competitive Examination", 6th Edition, Pearson India Education Services Pvt Ltd, 2017.

REFERENCES:

1.	Stephen Bailey, "Academic Writing: A practical guide for students", Routledge, New York, 2011.
2.	Meenakshi Raman and Sangeeta Sharma. "Technical Communication- Principles and Practice". 4th Edition, Oxford University Press, New Delhi, 2022.

	COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	develop the soft skills of learners to support them work efficiently in an organization as an individualand as a team	Applying (K3), Precision (S3)
CO2	solve real time problems using numerical ability and logical reasoning	Applying (K3), Precision (S3)
CO3	apply English language skills for various academic and professional purposes	Applying (K3), Precision (S3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				3	3		3		3	2		
CO2	3	2				3	3		3		3	2		
CO3		2					3	3		3	3	3	2	

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2		50	50				100
CAT3		50	50				100
Assessment Test		50	50				100

* ±3% may be varied (CAT 1,2,3 - 50 marks & Assessment Test – 100 marks)

22CEC51 TRANSPORTATION ENGINEERING
(IRC: 37-2012 & IRC: 58-2002 permitted)

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PC	2	0	2	3

Preamble	To impart knowledge about the history of highway development, planning, design, construction and maintenance of pavement & Traffic characteristics and controls.	

Unit – I	Transportation Infrastructure:	6

Highway development in India - Classification of roads - Road patterns, Highway alignment and engineering surveys; Highway materials - Soil, Aggregates & Bitumen - Desirable properties and quality control tests**.**

Unit – II	Geometric Design:	6

Cross-sectional elements – Camber - Sight distances, Design of horizontal alignment - Horizontal curves, Super elevation, Widening of curves, Transition curves, Set-back distance - Design of vertical alignment - Gradients, grade compensation, vertical curves

Unit – III	Highway Pavements:	6

Design factors for flexible and rigid pavements - Design of flexible pavement using IRC: 37-2012 - Stresses, Design of joints, dowel bar, tie bar - Design of rigid pavements using IRC: 58-2015 - Construction Procedure and 0Distresses in flexible and rigid pavements - Drainage and Pavement Maintenance

Unit – IV	Traffic Characteristics:	6

Microscopic and macroscopic parameters of traffic flow, Fundamental relationships; Traffic studies on flow, speed, travel time, delay and O-D study, PCU, peak hour factor, parking study, accident study and analysis

Unit – V	Traffic Control:	6

Conflicts at intersection, Types of intersections - At-grade intersection, Grade separated intersections and channelization, Rotary intersection; Traffic signs - Road markings - Traffic control aids - Street furniture, Control devices, Signal design by Webster's method. Signal coordination; Highway capacity and level of service.

LIST OF EXPERIMENTS / EXERCISES:

1.	Water absorption and specific gravity test on aggregates and bitumen
2.	Gradation of coarse aggregates
3.	Aggregate impact value test and crushing value test
4.	Attrition and abrasion test on aggregates
5.	Flakiness and elongation test on aggregates
6.	Penetration and specific gravity test on bitumen
7.	Viscosity on bitumen and stripping test on bituminous mixes
8.	Softening point test on bitumen
9.	Ductility test on bitumen
10.	Marshall stability of bituminous mixes
11	Skid resistance test
12	CBR test on sub-grade soil

	Lecture:30, Practical:30, Total:60

TEXT BOOK:

1.	Khanna S.K. and Justo C.E.G., Highway Engineering, 10th Revised Edition, Nemchand & Bros, 2018.

REFERENCES/ MANUAL / SOFTWARE:

1.	kadiyali L.R., Traffic Engineering and Transport Planning, 7th Edition, Khanna Publications, 2013.
2.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Infer the knowledge of highway planning and testing of materials	Understanding (K2) Manipulation (S2)
CO2	analyze the geometric design elements of highway	Applying (K3) Manipulation (S2)
CO3	apply the design procedure of flexible and rigid pavement	Applying (K3) Manipulation (S2)
CO4	analyze the characteristics of traffic and accident data	Applying (K3) Manipulation (S2)
CO5	design traffic signals and elaborate intersections with traffic control	Applying (K3) Manipulation (S2)

Mapping of Cos with Pos and PSOs

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	3	3				3							3	3
CO3	3	2				3							3	3
CO4	3	3				3							3	3
CO5	3	2				3							3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	50				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	30	60				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CET51 - GEOTECHNICAL ENGINEERING-II
(IS 6403-1981 code is permitted)

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	GEOTECHNICAL ENGINEERING I	5	PC	3	0	0	3

Preamble	This course facilitates the students to understand the behaviour of foundations for engineering structures and to gain knowledge of the design methods that can be applied to practical problems

Unit – I	Soil Exploration and Foundation Systems:	9

Scope and objectives - Depth and spacing of bore holes – Methods of exploration – Type of soil samples – Sampling methods — Penetration tests (SPT, SCPT and DCPT) – Data interpretation - Selection of foundation based on soil condition- Bore log report.

Unit – II	Bearing Capacity:	9

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

Unit – III	Shallow Foundation	9

Design of isolated and spread footing – design principles of combined rectangular and trapezoidal footing – design aspects of strap footings and mat foundation –contact pressure under footings.

Unit – IV	Pile Foundation:	9

Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering news and Hileys) –Negative skin friction –Group capacity by different methods (Feld's rule and block failure criterion) –Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles.

Unit – V	Earth Pressure and Slope Stability:	9

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesionless and cohesive soil – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann Graphical method – Types of slope failure - Stability number - Method of slices - Slope protection measures.

	Total:45

TEXT BOOK:

1.	Arora K. R "Soil Mechanics and Foundation Engineering",7th edition Standard Publishers, New Delhi, 2020.

REFERENCES:

1.	Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributers Ltd., New Delhi, 2018
2.	Das, B.M. "Principles of Foundation Engineering" 8th edition, Cengage India Private Limited, Noida Uttar Pradesh, 2017.

	COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	explain the process of site investigation and select geotechnical design parameters and type of foundation	Understanding (K2)
CO2	determine bearing capacity and settlement of shallow foundations	Applying (K3)
CO3	design combined footings and raft foundations, its component or process as per the needs and specifications	Applying (K3)
CO4	calculate the load carrying capacity and settlement of pile foundation	Applying (K3)
CO5	estimate the pressures on the earth retaining structures	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				2				1		2	3	3
CO2	3	2	2			3						2	3	3
CO3	3	2	2			3						2	3	3
CO4	3	2	2			3						2	3	3
CO5	3	3	2			3						2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	20	60				100
CAT2	20	20	60				100
CAT3	20	20	60				100
ESE	10	30	60				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CET52 - WATER RESOURCES AND IRRIGATION ENGINEERING							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	PC	3	0	0	3

Preamble	This course aims to expose civil engineering students to a clear knowledge of Water Resources, Irrigation Engineering concepts, and National Water Policy. Further, they will impart the required knowledge on Reservoir management and Irrigation management practices.

Unit – I	Water Resources:	9

Need for water resources – water resources of Tamil Nadu and India– planning of water resources – assessment of water requirement for drinking and irrigation purposes   – reservoirs   – single and multipurpose reservoir – multi-objective –storage capacity of reservoirs – reservoir operation strategies – design flood level – levees and flood walls.

Unit – II	Water Resource Management:	9

Financial aspects of water resources planning – National Water Policy – consumptive and non – consumptive water use – water quality – scope and aims of the master plan – idea of the basin as a unit for development – water budget – conjunctive use of surface and groundwater.

Unit – III	Irrigation Engineering:	9

Need – advantages and disadvantages – connection between duty, delta, and base period   – causes affecting duty– problems – irrigation efficiencies – problems – seasonal crops of India – crop water requirement – evaluation of consumptive use of water.

Unit – IV	Canal Irrigation:	9

Types of impounding structures: Gravity dam – diversion headworks – canal drop – cross drainage works – head regulators – cross regulators – canal outlets – types of canals   – alignment of canals – river training works – Kennedy's and Lacey's Regime theory (Only theory).

Unit – V	Irrigation Methods and Management:	9

Types of irrigation – lift irrigation – tank irrigation – well irrigation – irrigation methods: surface and sub – surface and micro irrigation – merits and demerits – irrigation scheduling – water distribution – soil-plant relationship – moisture content at field capacity – participatory irrigation management with a case study – on farm development works– participatory irrigation management – rainwater harvesting structures– case study.

	Total:45

TEXT BOOK:

1.	Asawa G.L., "Irrigation and Water Resources Engineering", 2nd Edition, New Age International Publishers, New Delhi, 2008.

REFERENCES:

1.	Garg S.K., "Water Resources Engineering Vol. II Irrigation Engineering & Hydraulic Structures", 34th Edition, Khanna Publishers, New Delhi, 2016.
2.	Michel A.M, "Irrigation Theory and Practice", 2nd Edition, Vikas Publishing House Pvt. Ltd., Noida, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the components of water storage structures along with its functions	Understanding (K2)
CO2	infer the importance of water resource management	Understanding (K2)
CO3	compute the delta, duty relationship and irrigation efficiency	Applying (K3)
CO4	identify the types of canal irrigation and analyze the functions of diversion head works	Applying (K3)
CO5	apply participatory irrigation management and infer the types of irrigation methods	Applying (K3)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2			3						2	3	3
CO2	2	1				3							3	2
CO3	3	2	2			3						2	3	3
CO4	3	2	2			3						2	3	3
CO5	3	2	2			3						2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	20	50	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CET53 - DESIGN OF STEEL STRUCTURES
IS 800:2007, IS 875 (Part-3) and SP 06 are permitted

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Mechanics of Materials and Structural Analysis	5	PC	3	1	0	4

Preamble	This course offers the limit state design of structural steel members subjected to compressive, tensile and bending loads, including connection design along with the design of structural systems like roof trusses as per provisions of current code (IS 800 - 2007) of practice. It aims at determination of safe as well as economical steel section for various structures.

Unit – I	Introduction and Design of Connections:	9+3

Introduction to limit state method of design - Properties of steel sections- Stress strain behaviour - Partial safety factor - Design of welded connections — Weld symbols - Design of fillet and butt welds –Design of bolted connections - Efficiency of joints – High strength friction grip bolts.

Unit – II	Tension Members:	9+3

Types of sections – Gross area and net area – Design of connections in tension members – Design of tension splice – Concept of shear lag – Use of lug angles

Unit – III	Compression members:	9+3

Types of compression members – Theory of columns – Buckling classification - Slenderness ratio – Design of simple compression member - Design of built-up compression members – Design of angle struts - Design procedure of braced columns.

Unit – IV	Beams:	9+3

Classification of cross sections - Simple and builtup sections – Calculation of plastic modulus of section – Flexural strength of beams - Design considerations – Behaviour of web under shear - Failure modes –Design of laterally supported beams – Lateral torsional buckling – Design of laterally unsupported beams.

Unit – V	Trusses:	9+3

Introduction – Types of trusses – Components of truss – Loads – Wind load calculation – Design of truss elements – Design of purlins

Lecture: 45, Tutorial: 15, Total:60

TEXT BOOK:

1.	Subramanian N., "Design of Steel Structures Limit States Method", 2nd Edition, Oxford University Press, New Delhi, 2015.

REFERENCES:

1.	Duggal S., "Design of Steel Structures", 3rd Edition, McGraw Hill Education, 2019.
2.	Bhavikatti S.S., "Design of Steel Structures", 5th Edition, I.K. International Publishing House Pvt. Ltd., New Delhi, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	discriminate the various connection methods	Analyzing (K4)
CO2	analyse and design the various profiles of tension members	Analyzing (K4)
CO3	analyse and design compression members	Analyzing (K4)
CO4	discriminate and design the flexural members	Analyzing (K4)
CO5	examine and design the roof truss	Analyzing (K4)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			3				1		2	3	3
CO2	3	3	2			3					1	2	3	3
CO3	3	3	2			3				1		2	3	3
CO4	3	3	2			3				1		2	3	3
CO5	3	3	2			3				1		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	40	40			100
CAT2	10	10	40	40			100
CAT3	10	10	40	40			100
ESE	10	10	40	40			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEL51 - COMPUTER AIDED STRUCTURAL DESIGN LABORATORY-II
(Use of IS 456:2000, IS 3370:2009, SP 16, SP 34, IS 800:2007, IS1893-2002, IS13920-2016, Steel Tables, IS 875 and SP 38 code books are permitted)

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Structural Analysis, Design of RC elements & Design of steel structures	5	PC	0	0	2	1

Preamble	This course gives knowledge about how to design and detailing the various components of the different types of the structure using STAAD Pro software

LIST OF EXPERIMENTS / EXERCISES:

1.	Analysis and design of continuous beam with various loading
2.	Analysis of single storey RCC building
3.	Design of single- storey RCC building elements
4.	Analysis of multi- storey RCC building
5.	Design of multi- storey RCC building elements
6.	Wind load analysis of RCC buildings
7.	Earthquake analysis of RCC structure
8.	Analysis and design of shear wall
9.	Analysis and design of RCC rectangular elevated water tank
10.	Analysis and design of an industrial building (Steel Structure)
11.	Analysis and design of transmission line tower
12.	Mini Project
	Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	STAAD. Pro V8i
2.	Lab Manual
3.	Punmia B.C., Jain, Ashok Kumar and Jain, Arun Kumar, Comprehensive Design of Steel Structures, 2 nd Edition, Laxmi Publications Pvt. Ltd., 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	analyze the RCC structures for various loading	Analyzing (K4), Manipulation (S2)
CO2	analyze and design the RCC elements as per IS code	Analyzing (K4), Manipulation (S2)
CO3	analyze and design the steel structures	Analyzing (K4), Manipulation (S2)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3		3		1	1			2	3	3
CO2	3	3	2	3		3		1	1			2	3	3
CO3	3	3	2	3		3		1	1			2	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

22CEL52 - COMPUTATIONAL LABORATORY FOR CONSTRUCTION MANAGEMENT								

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	PC	0	0	2	1

Preamble	To impart knowledge about modelling software in construction

LIST OF EXPERIMENTS / EXERCISES:

1.	Introduction to Project Management tools for construction Projects
2.	Assigning Calendars to Project and its Activities
3.	Prepare Network diagram for a Construction Project using CPM
4.	Prepare Network diagram for a Construction Project using PERT
5.	Assigning and Allocation of Resources
6.	Levelling and smoothing of allocated resources
7.	Cost analysis of a Construction Project
8.	Tracking of a Construction Project (Include the application of BIM in construction Management)
9.	3D and 4D applications of BIM in Construction Projects
10.	Management of Multiple projects in Construction
	Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Carl S Chattfield and Timothy D Johnson, "Microsoft Project 2016 Step by Step", 1st Edition, Pearson Publication, 2016.
2.	Laboratory Manual
3.	Microsoft Project

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	prepare network diagram for a Construction project using CPM & PERT	Applying (K3), Manipulation (S2)
CO2	allocate and smoothening of resources in construction projects	Applying (K3), Manipulation (S2)
CO3	apply the BIM dimensions in Construction Projects	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	3	1	3			1	2		2	3	3
CO2	3	3	2	3	2	3			1	2		2	3	3
CO3	3	3	2	3	2	3			1	2		2	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

22CET61 - ESTIMATION AND QUANTITY SURVEYING
(PWD Schedule of rates are permitted)

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	PC	3	0	0	3

Preamble	To perform estimation and rate analysis for the various civil structures.	
Unit – I	**Estimation of Buildings:**	**9**

Types of estimates - Units of measurements - Methods of estimates - Load bearing and framed structures - Calculation of quantities of various items for residential building with flat roof and pitched roof - Steel requirement and bar bending schedule – Types of arches - Calculation of brick work in arches.

Unit – II	**Estimation of other Structures and Specifications:**	**9**

Septic tank - soak pit - staircase - bituminous and cement concrete roads – retaining walls – culverts –Estimation of Irrigation works - Specifications – sources – Detailed and general specifications – Measurement book.

Unit – III	**Analysis of Rates:**	**9**

Rate for material and labour - Rate analysis for Stone masonry, Brick masonry, concreting, plastering, painting and Tiles laying, PWD Schedule of rates – Market rates.

Unit – IV	**Valuation:**	**9**

Definitions – Various types of valuations – Valuation methods – Necessity– Capitalized value – Factors affecting the value of plot and building - Depreciation - Valuation of residential building – Escalation – Calculation of standard rent – Mortgage – Lease – Measurement Book – BOT & EPC.

Unit – V	**Tenders and Report Preparation:**	**9**

Tenders – e Tendering - Contracts – Types of contracts – Arbitration and legal requirements- Principles for report preparation – Report on estimate of residential building – Culvert – Roads – Water supply and sanitary installations.

	Total:45

TEXT BOOK:

1.	Dutta B.N., "Estimating and Costing in Civil Engineering", 28th Edition, UBS Publishers & Distributors Pvt. Ltd., Chennai, 2016.

REFERENCES:

1.	Upadhyay A.K., "Civil Estimating & Costing: Including Quality Surveying, Tendering and Valuation", S K Kataria and Sons, New Delhi, 2013.
2.	Kohli D.D., & Kohli R.C., "A Textbook of Estimating and Costing (Civil)", 13th Edition, S Chand Publishing, New Delhi, 2013.

	COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	compute quantities of various items for load bearing and framed structures		Applying (K3)
CO2	calculate the quantities of various items for other structures		Applying (K3)
CO3	analyse the rates for various items of works		Analyzing (K4)
CO4	carry out valuation of plots and buildings		Applying (K3)
CO5	prepare tenders, contract documents and reports as per norms		Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3			2			2	3	2
CO2	3	2	1			3	2	1	2		2	3	3	2
CO3	3	3	2			3			2			2	3	2
CO4	3	3	1			3	2		2		2	2	3	2
CO5	3	3	1			3		1	2		2	2	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50				100
CAT2	10	20	40	20			100
CAT3	10	30	60				100
ESE	10	20	50	20			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CET62 - PRE-ENGINEERED BUILDINGS							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Design of steel structures	6	PC	3	0	0	3

Preamble	This course offers the design of pre-engineered buildings as per limit state method. It aims at determination of safe as well as economical steel section for various industrial and framed structures

Unit – I	Basics of Metal Building Systems	9

Introduction to metal building systems – Origin - Advantages and disadvantages – Industry groups – MBMA – AISI – MBCEA – NAIMA – MCA – NRCA – LGSI – CCFSS – Structural loads – Loads and load combinations – Structural behavior – Structural system selection criteria.

Unit – II	Primary Framing	9

Available systems – Tapered beams – Single span rigid frame – Multi span rigid frame –Single span and continuous trusses – Framing systems - Lean to framing – Role of frame bracing – End wall framing

Unit – III	Secondary Framing	9

Girts and Purlins – Types of purlins for metal building systems - Design of cold-formed framing – Cold-formed steel purlins - Purlin bracings – Cold-formed steel grits – Hot rolled steel girts - Eave struts

Unit – IV	Metal roofing and Wall Materials9	9

ypes of metal roofs – Seam configurations – Through fastened Roofing – Structural standing-seam roof – Insulated structural panels – Architectural metal roofing – Panel finishes – Site-formed metal panels - Wind uplift ratings of metal roofs – Roofing selection and construction.
Wall Materials - Metal panels – Hard walls – Single-Wythe Masonry – Brick veneer walls – Combination walls – Concrete Materials – selection of wall system

Unit – V	Foundation for Metal Building Systems	9

Soil investigation program – Difference between conventional foundation and foundation for metal building system – Estimation of column reaction –Methods of resisting lateral reactions – Anchor bolt and base plates – Design of slabs on grade

	Total:45

TEXT BOOK:

1.	Alexander Newman, "Metal Building Systems", 3rd Edition, McGraw Hill, 2014.

REFERENCES:

1.	Subramanian N., "Design of Steel Structures Limit States Method", 2ndEdition, Oxford University Press, New Delhi, 2016.
2.	Bhavikatti S.S., "Design of Steel Structures", 5th Edition, I.K. International Publishing House Pvt. Ltd., New Delhi, 2017.
3.	Duggal S., "Design of Steel Structures", 3rd Edition, McGraw Hill Education, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the components of metal building system	Understanding (K2)
CO2	discuss the primary framing system	Understanding (K2)
CO3	discuss secondary framing system	Understanding (K2)
CO4	explain the metal roofing and wall materials for PEB structures	Understanding (K2)
CO5	select a suitable foundation for a PEB structure	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1										3	3
CO2	3	2	1										3	3
CO3	3	2	1										3	3
CO4	3	2	1										3	3
CO5	3	2	1										3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	20	30	30			100
CAT2	20	20	30	30			100
CAT3	20	20	30	30			100
ESE	20	20	30	30			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEL61 - STRUCTURAL ENGINEERING LABORATORY								

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	PC	0	0	2	1

Preamble	This course demonstrates the test methods to study the behaviour of concrete with different proportions of ingredients and behaviour of beams under different loaded and environment conditions.

LIST OF EXPERIMENTS / EXERCISES:

1.	Determine the workability of Self-Compacting Concrete
2.	Determine the effect of water/cement ratio on workability and strength of concrete
3.	Determine the effect of fine aggregate-coarse aggregate ratio on strength of concrete
4.	Determine the stress - strain relationship for concrete
5.	Determine the correlation between cube strength& cylinder strength
6.	Determine the rate of corrosion of steel in concrete
7.	Determine the behaviour of steel beam under flexure
8.	Determine the behaviour of reinforced concrete beam under flexure
9.	Study on behaviour of beams under shear
10.	Study on behaviour of under reinforced and over reinforced beams

Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	determine the fresh and hardened properties of concrete	Applying (K3), Manipulation (S2)
CO2	relate the strength parameters of concrete	Analyzing (K4), Manipulation (S2)
CO3	analyse the behaviour of beams under flexure and shear	Analyzing (K4), Manipulation (S2)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	3	1	3		1	1			2	3	3
CO2	3	2	1	3	1	3		1	1			2	3	3
CO3	3	3	2	3	2	3		1	1			2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

22CEL62 - COMPUTER AIDED STRUCTURAL DETAILING LABORATORY
(Use of IS 456:2000, SP 16, SP 34, IS 800:2007, and SP 38 code books are permitted)

Programme& Branch	**B.E. & CIVIL ENGINEERING**	Sem.	Category	L	T	P	Credit
Prerequisites	**Design of RC elements & Design of Steel Structures**	**6**	**PC**	**0**	**0**	**2**	**1**

Preamble	This course gives knowledge about how to be detailing the various components of the structure using Tekla Structures software

LIST OF EXPERIMENTS / EXERCISES:

1.	Detailing of one-way slab
2.	Detailing of two-way slab
3.	Detailing of beams & columns
4.	Detailing of isolated footing
5.	Detailing of steel beam to beam connection
6.	Detailing of steel beam to column connection
7.	Detailing of steel column base
8.	Detailing of steel seated connection
9.	Detailing of steel truss connection
10.	Detailing of pre-engineered building
	Total:30

REFERENCES/ MANUAL /SOFTWARE:

1.	Tekla structures software
2.	Lab Manual
3.	Krishna Raju N., Structural Design and Drawing - Reinforced Concrete and Steel, 4th Edition, University Press (India) Ltd., Hyderabad, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	carry out the detailing for flexural members	Analyzing (K4), Manipulation (S2)
CO2	carry out detailing for column and footings	Analyzing (K4), Manipulation (S2)
CO3	Carry out detailing for various steel connections and pre-engineered building	Analyzing (K4), Manipulation (S2)

Mapping of COs with POs and PSOs													
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3		3		1	1			2	3	3
CO2	3	3	2	3		3		1	1			2	3	3
CO3	3	3	2	3		3		1	1			2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

22CEP61 – PROJECT WORK - I

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	EC	-	-	8	4

<table>
<tr><td colspan="2"></td><td align="right">Total:120</td></tr>
<tr><td colspan="2">COURSE OUTCOMES:
On completion of the course, the students will be able to</td><td>BT Mapped (Highest Level)</td></tr>
<tr><td>CO1</td><td>prepare plan, section and elevation of a civil engineering structure as per NBC</td><td>Creating (K6)</td></tr>
<tr><td>CO2</td><td>analysing the structure in accordance with relevant IS codes</td><td>Analyzing (K4)</td></tr>
<tr><td>CO3</td><td>design the structure in accordance with relevant IS codes</td><td>Applying (K3)</td></tr>
<tr><td>CO4</td><td>calculate quantity and rate for the civil engineering structure as per PWD schedule of rates</td><td>Applying (K3)</td></tr>
<tr><td>CO5</td><td>prepare and present the project report</td><td>Applying (K3)</td></tr>
</table>

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	1	3	2	3	3	3	3	3	3	3
CO2	2	2	2	2		3		1	1	3	2	3	3	3
CO3	2	2	2	2	1	3		3	3	3	3	3	3	3
CO4	2	2	2	3	3	3	3	3	3	3	3	3	3	3
CO5	2	2	2	2	2	3		1	1	2	2	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

22GCT31- UNIVERSAL HUMAN VALUES							
(Common to All Engineering and Technology Branches)							
Programme& Branch	**All BE/BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**3/6**	**BS**	**2**	**0**	**0**	**2**
Preamble	To make the student to know what they 'really want to be' in their life and profession, understand the meaning of happiness and prosperity for a human being. Also to facilitate the students to understanding of harmony at all the levels of human living, and live accordingly						
Unit – I	**Introduction:**						**6**
Need and Basic Guidelines of Value Education – Content and Process of Value Education – Self Exploration – purpose of self-Exploration – Content and Process of Self exploration – Natural Acceptance – Realization and Understanding – Basic Human Aspirations – Continuous Happiness and Prosperity – Exploring Happiness and Prosperity – Basic Requirement for Fulfillment of Human Aspirations – Relationships – Physical Facilities – Right Understanding.							
Unit – II	**Harmony in the Self and Body:**						**6**
Human Being and Body – Understanding Myself as Co–existence of Self ('I') and Body, Needs of the Self and Body, Activities in the Self and Body, Self ('I') as the Conscious Entity, the Body as the Material Entity – Exercise – Body as an Instrument– Harmony in the Self ('I) – Understanding Myself – Harmony with Body.							
Unit – III	**Harmony in the Family and Society:**						**6**
Harmony in the Family – Justice – Feelings (Values) in Human Relationships – Relationship from Family to Society – Identification of Human Goal – Five dimensions of Human Endeavour.							
Unit – IV	**Harmony in Nature and Existence:**						**6**
Order of Nature – Interconnectedness – Understanding the Four order – Innateness – Natural Characteristic – Basic Activity – Conformance – Introduction to Space – Co–existence of units of Space – Limited and unlimited – Active and No–activity – Existence is Co–existence.							
Unit – V	**Implications of the above Holistic Understanding of Harmony on Professional Ethics:**						**6**
Values in different dimensions of Human Living – Definitiveness of Ethical Human Conduct –Implications of Value based Living – Identification of Comprehensive Human Goal – Humanistic Education – Universal Human Order – Competence and Issues in Professional Ethics.							
							Total:30

TEXT BOOK:

1.	Gaur R.R., Sangal R., Bagaria G.P., "A Foundation Course in Human Values and Professional Ethics", 1st edition, Excell Books Pvt. Ltd., New Delhi, 2016.

REFERENCES:

1.	Ivan Illich, "Energy & Equity", The Trinity Press, USA, 1974.
2.	Schumacher E.F., "Small is Beautiful: a study of economics as if people mattered", Britain, 1973.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	restate the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society	Applying (K3)
CO2	distinguish between the Self and the Body, understand the meaning of Harmony in the Self, the Co–existence of Self and Body	Applying (K3)
CO3	infer the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human–human relationships and explore their role in ensuring a harmonious society	Applying (K3)
CO4	transform themselves to co-exist with nature by realising interconnectedness and four order of nature	Applying (K3)
CO5	distinguish between ethical and unethical practices, and extend ethical and moral practices for a better living	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	75					100
CAT2	25	75					100
ESE	NA						100

* ±3% may be varied (CAT 1&2 – 60 marks & ESE – 100 marks)

22GCT71 - ENGINEERING ECONOMICS AND MANAGEMENT							
(Common to All BE/BTech branches)							
Programme & Branch	All BE/BTech branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	HS	3	0	0	3

Preamble	The aim of the course is to create fundamental knowledge on management by introducing concepts like economics, national income, marketing, operations management, accounting principles etc.

Unit – I	Micro Economics	9

Economics – Basics Concepts and Principles – Demand and Supply – Law of demand and Supply – Determinants – Market Equilibrium – Circular Flow of Economic Activities and Income.

Unit – II	Macro Economics, Business Ownership and Management concepts	9

National Income and its Measurement Techniques. Inflation - Causes of Inflation – Controlling Inflation – Business Cycle - Forms of Business – Ownership Types. Management concepts: Taylor and Fayol's Principles – Functions of Management - Managerial Skills - Levels of Management - Roles of Manager.

Unit – III	Marketing Management	9

Marketing - Core Concepts of Marketing - Four P's of Marketing - New Product Development – Intellectual Property Rights (IPR), Product Life Cycle - Pricing Strategies and Decisions.

Unit – IV	Operations Management	9

Operations Management - Resources - Types of Production System - Site Selection, Plant Layout, Steps in Production Planning and Control - Inventory - EOQ Determination.

Unit – V	Financial Management	9

Accounting Principles – Financial Statements and its Uses – Depreciation - Straight Line and Diminishing Balance Method – Break Even Analysis – Capital Budgeting - Significance –Traditional and Discounted Cash Flow Methods.

	Total:45

TEXT BOOK:

1.	Compiled by Department of Management Studies, Kongu Engineering College, "Economics and Management for Engineers", 1st Edition, McGraw Hill Education, Noida, 2013.

REFERENCES:

1.	Geetika, Piyali Ghosh and Purba Roy Choudhury, "Managerial Economics", 3rd Edition, McGraw-Hill, New Delhi, 2018.
2.	William J. Stevenson, "Operations Management", 14th Edition, McGraw-Hill Education, 2021.
3.	William G. Nickels, James M. McHugh, Susan M. McHugh, "Understanding Business", 12th Edition, McGraw-Hill Education, New York, 2019.

	COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	identify market equilibrium and interpret national income calculations and inflation issues	Applying (K3)
CO2	choose a suitable business ownership for their enterprise and illustrate managerial functions	Applying (K3)
CO3	infer marketing management decisions	Understanding (K2)
CO4	apply appropriate operation management concept in business situations	Applying (K3)
CO5	interpret financial and accounting statements and evaluate new proposals	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	2			3		2	2	2	3	2		
CO2		1	2			2	2	2	2	2	3	2		
CO3	1	2	1			2		2	2	2	3	2		
CO4	1	2	1			2		2	2	2	3	2		
CO5	2	2				2		2	2	2	3	2		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100
* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)							

22CEP71 – PROJECT WORK - II PHASE - I

Programme & Branch	B.E. & CIVIL ENGINEERING		Sem.	Category	L	T	P	Credit
Prerequisites	Nil		7	EC	0	0	10	5

Total:150

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the problem and formulate a problem statement	Applying (K3)
CO2	summarize the literature review	Understanding (K2)
CO3	develop a suitable methodology	Applying (K3)
CO4	carry out experimental and/or theoretical work as per the specified methodology / design and prepare detailed drawing for various structural components using computer software	Creating (K6)
CO5	prepare and present the project report	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	1	3	2	3	3	3	3	3	3	3
CO2	2	2	2	2		3		1	1	3	2	3	3	3
CO3	2	2	2	2	1	3		3	3	3	3	3	3	3
CO4	2	2	2	3	3	3	3	3	3	3	3	3	3	3
CO5	2	2	2	2	2	3		1	1	2	2	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

22CEP81 – PROJECT WORK - II PHASE - II						

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	EC	0	0	8	4

Total:120

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the problem and formulate a problem statement	Applying (K3)
CO2	summarize the literature review	Understanding (K2)
CO3	develop a suitable methodology	Applying (K3)
CO4	carry out experimental and/or theoretical work as per the specified methodology / design and prepare detailed drawing for various structural components using computer software	Creating (K6)
CO5	prepare and present the project report	Applying (K3)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	1	3	2	3	3	3	3	3	3	3
CO2	2	2	2	2		3		1	1	3	2	3	3	3
CO3	2	2	2	2	1	3		3	3	3	3	3	3	3
CO4	2	2	2	3	3	3	3	3	3	3	3	3	3	3
CO5	2	2	2	2	2	3		1	1	2	2	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

22CEE01 - DESIGN OF PRESTRESSED CONCRETE STRUCTURES

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	DESIGN OF RC ELEMENTS	5	PE	3	0	0	3

Preamble	This course gives knowledge on the prestressing principles and the methods of prestressing for real time applications.

Unit – I	Introduction:	9

Concepts of prestressing – Requirements for high strength steel and concrete – Partial prestressing – Moderate prestressing – Bonded and unbounded prestressing - Terminology – Degree of prestressing - Materials for prestressed concrete – Pre-tensioning systems – Post-tensioning systems – Tensioning devices - Analysis of prestress and bending stresses – Effect of end eccentricity – Resultant stress distribution – Durability-Types of failure in prestress concrete members.

Unit – II	Loss of Prestress and Deflection of Prestressed Concrete Beams:	9

Losses of prestress – Types of losses - Deflections of prestressed concrete members – Factors influencing deflection – Mohr's theorem - Factors influencing deflections – Short-term deflections of uncracked members – Prediction of long time deflections - Flexural strength of prestressed concrete sections – eccentricity.

Unit – III	Design of Prestressed Concrete Elements:	9

Design of sections for flexure – Critical combinations - Design of sections for axial tension- Design of sections for compression and bending – Design of prestressed sections for shear and torsion – Anchorage zone - Guyon's theorem - Concept of magnel's method - Assembly of prestressing and reinforcing steel.

Unit – IV	Design of Composite Prestressed Concrete Elements:	9

Composite structures – Advantages - Types of composite structures – Design procedure - Propped construction - Unpropped construction - Design of shear connector – Shrinkage stresses – Stresses due to differential shrinkage – Design of shear connector – Estimation of ultimate shearing force – Calculation of horizontal shear stress.

Unit – V	Design of Circular Elements, Mast and Sleepers	9

Circular prestressing –applications - Types of pre-stressed concrete pipes - IS Codal provisions – Design of cylindrical pre-stressed concrete tanks -Design of pre-stressed pretensioned mast - Design of pre-stressed concrete sleepers.

	Total:45

TEXT BOOK:

1.	Krishna Raju, "Prestressed Concrete", 6th Edition, Tata McGraw Hill Publishing Co, India, 2018

REFERENCES:

1.	Praveen Nagarajan, "Prestressed Concrete", 1st Edition, Dorling Kindersley (I) Pvt. Ltd., 2013.
2.	N.Rajagopalan, "Prestressed Concrete", 2nd Edition, Narosa Book Distributors, 2010

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Concepts of prestressing and methods	Applying (K3)
CO2	Calculate Prestressed Concrete BeamsLoss of Prestress and Deflection	Applying (K4)
CO3	design the prestressed concrete structural elements	Applying (K4)
CO4	design the shear connectors	Applying (K4)
CO5	design the prestressed circular tanks and concrete poles	Applying (K4)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			3				1		2	3	3
CO2	3	3	2			3				1		2	3	3
CO3	3	3	2			3				1		2	3	3
CO4	3	3	2			3				1		2	3	3
CO5	3	3	2			3				1		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	14	28	48			100
CAT2	10	14	36	40			100
CAT3	14	14	36	36			100
ESE	14	18	38	30			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE02 - OPERATIONS RESEARCH							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Construction Engineering and Management	5	PE	3	0	0	3

Preamble	This course imparts knowledge on operation research, optimality analysis, production and financial management to carry over the project with a wise decision making principles.

Unit – I	Operations Research	9

Introduction to operations research - Linear programming - Non linear programming - Introduction and types - Graphical method - Simplex methods.

Unit – II	Optimality Analysis	9

Sensitivity analysis- Optimality analysis- Duality and post optimality analysis - Transportation problem - Assignment problems.

Unit – III	Production Management	9

Inventory control - EOQ - Quantity discounts - Safety stock - Replacement theory -PERT and CPM - Quality control.

Unit – IV	Financial Management	9

Working capital management - Compound interest and present value methods - Discounted cash flow techniques - Capital Budgeting

Unit – V	Decision Theory and Managerial Economics	9

Decision theory - Decision rules - Decision making under conditions of certainty, risk and uncertainty - Decision trees - Utility theory.

Total:45

TEXT BOOK:

1.	Vohra, N.D. "Quantitative Techniques in Management", 6th Edition, Tata McGraw-Hill Company Ltd, New Delhi, 2022

REFERENCES:

1.	Sehroeder, R.G. "Operations Management", McGraw-Hill, New York, 2018.
2.	Levin, R.I, Rubin, D.S. and Stinson, J. "Quantitative Approaches to Management". McGraw-Hill Book Co., New York, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the operation research principles for solving linear programming	Applying(K3)
CO2	assign right people at right time to right job	Applying(K3)
CO3	maintain economy in ordering materials	Applying(K3)
CO4	apply cash flow techniques for better financial management	Applying(K3)
CO5	implement the decision theory and principles for taking wise decisions	Applying(K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2				2							3	2
CO2	2	2				2							3	2
CO3	2	2				2							3	2
CO4	3	2	1			3						2	3	3
CO5	3	2	1			3						2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	80				100
CAT2	10	10	80				100
CAT3	10	10	80				100
ESE	10	10	80				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE03 - SOLID AND HAZARDOUS WASTE MANAGEMENT							
Programme& Branch	**B.E. & CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Environmental Engineering**	**5**	**PE**	3	0	0	3

Preamble	This course helps to interpret the nature and characteristics of solid and hazardous wastes for providing appropriate treatment facilities.

Unit – I	**Solid Waste and Its Perspectives**	**9**
Sources – Types – Composition – Properties – Characteristics – Quantities – Generation rates – Types of sampling – Elements of Integrated waste management– Legislative measures – Source reduction of wastes– Participatory waste management.		
Unit – II	**On-Site and Off-Site Processing:**	**9**
Importance of onsite and offsite handling– storage methods – Effect of storage methods atsite and offsite – materials used for containers – Waste segregation and storage – Offsite processing techniques and equipment – Types of composting – Incineration – Pyrolysis – Case studies.		
Unit – III	**Collection and Transfer:**	**9**
Collection services – Classification of container systems – Types of collection vehicles – Analysis of collection system – Collection routes – Guidelines – Transfer station –Site selection – Types – Manpower requirement.		
Unit – IV	**Hazardous Wastes:**	**9**
Sources and impacts – Classification – Labelling and handling– Selection and design of storage facilities – Physical, chemical and Biological treatment technologies – treatment of biomedical wastes– Federal and State Legislations – International treaties and their significance.		
Unit – V	**Disposal of Solid and Hazardous Wastes:**	**9**
Design configurations and site selection of sanitary landfills – Merits and Demerits – Classification – Leachate Control Methods – Principles and design of hazardous waste landfills – Bioremediation processes – Monitoring of Disposal Sites – Case Studies.		
		Total:45

TEXT BOOK:	
1.	G.Tchobanoglous, Frank Kreith, "Hand Book of Solid Waste Management", 2nd Edition, McGrawHill, Inc., 2002.

REFERENCES:	
1.	Freeman, H. M., "Standard Handbook of Hazardous Waste Treatment and Disposal", 2nd Edition, McGraw-Hill, Inc., 1997.
2.	"Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe the sources, types and characteristics of solid waste	Understanding (K2)
CO2	illustrate on-site and offsite processing methods	Understanding (K2)
CO3	elucidate the collection and conveyance approaches available in solid waste sector	Applying (K3)
CO4	interpret the causes and effects of hazardous wastes with treatment techniques	Applying (K3)
CO5	recommend appropriate disposal method for solid and hazardous wastes	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3									3	2
CO2	3	2	2	2									3	3
CO3	3	3	3	3									3	3
CO4	3	3	3	3									3	3
CO5	3	3	3	3									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	35	40	25				100
CAT2	25	45	30				100
CAT3	25	45	30				100
ESE	25	40	35				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE04 - RAILWAY, AIRPORT AND HARBOR ENGINEERING							

Programme& Branch	**B.E. & CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**5**	**PE**	3	0	0	3

Preamble	To impart knowledge about the planning & geometric design of Railway, Airport and Harbour engineering	
Unit – I	**Railway Planning:**	**9**
Role of Indian Railways in National development – Conventional and modern methods – Obligatory points – Track Stress, Coning of wheels, Creep in rails, Defects in rails – Geometric design of railway tracks – Points and Crossings – Turnouts – Working principle – Signalling, Interlocking and Track circuiting.		
Unit – II	**Railway Infrastructure, Construction and Maintenance:**	**9**
Earthwork – Stabilization of track on poor soil – Track drainage – Calculation of Materials required for track laying – Constructionand maintenance of tracks –Modern methods of construction & maintenance – Railway stations and yards – Passenger amenities –Modern Transit facilities – Railway Track – Transfer station – Structures – Bridges – Tunnels – Planning and Design aspects.		
Unit – III	**Airport Planning:**	**9**
Air transport characteristics – Airport classification – ICAO - Airport planning – Site selection – Typical Airport Layouts, Casestudies – Parking and circulation area		
Unit – IV	**Airport Design:**	**9**
Runway design – Orientation, Wind rose diagram, Problems on basic and actual length – Geometric design – Elements of taxiway design – Airport zones – Passenger facilities and services – Runway and taxiway markings.		
Unit – V	**Harbour Engineering:**	**9**
Harbour, Port, Satellite port, Docks, Waves and Tides – Planning and design of harbours – Harbour layout and terminal facilities– Coastal structures – Piers, Break waters, Wharves, Jetties, Quays, Spring fenders, Dolphins and floating landing Stage –Inland water transport – Wave action on Coastal structures and Coastal protection Works – Coastal Regulation Zone.		
		Total:45

TEXT BOOK:	
1.	Subramanian K.P., "Railways, Airports and Harbour Engineering", 1st Edition, Scitech Publications (India) Pvt. Ltd., Chennai,2018.

REFERENCES:	
1.	Saxena Subhash C. & Satyapal Arora, "A Course in Railway Engineering", 7th Edition, Dhanpat Rai Publications Pvt. Ltd., NewDelhi, 2017
2.	Khanna S.K., Arora M.G.& Jain S.S., "Airport Planning and Design", 6th Edition, Nem Chand & Bros, Roorkee, 2017.

	COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	explain the concepts of railway planning and the components and functions	Understanding (K2)
CO2	infer the modern facilities of the railway infrastructure and explain the material requirement, construction and maintenance works	Understanding (K2)
CO3	report the suitable criteria in planning and site selection of airport planning and design	Applying (K3)
CO4	analyze and design the elements for orientation of runway and passenger facility system	Applying (K3)
CO5	demonstrate the various features in harbour and port, their construction, coastal protection works and coastal regulations to be adopted	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3							3	3
CO2	2	1				3							3	3
CO3	3	2	1			3							3	3
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3							3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	20	60	20				100
CAT3	20	60	20				100
ESE	20	60	20				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE05 - GROUND IMPROVEMENT TECHNIQUES							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Geotechnical Engineering I & II	5	PE	3	0	0	3

Preamble	Course consists of various problems associated with soil deposits and different techniques used to improve the characteristics of problematic soil as well as design techniques required to implement ground improvement methods

Unit – I	Problematic Soil and Improvement Techniques:	9

Role of ground improvement in foundation engineering – Methods of ground improvement – Geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions.

Unit – II	Dewatering:	9

Dewatering Techniques - Well points – Vacuum and electro-osmotic methods – Seepage analysis for two-dimensional flow for fully and partially penetrated slots in homogeneous deposits – Design for simple cases.

Unit – III	In-situ Treatment of Cohesionless and Cohesive Soils:	9

In-situ densification of cohesionless soils - Dynamic compaction –Vibro-flotation, Sand compaction piles and deep compaction - Consolidation of cohesionless soils - Preloading with sand drains and fabric drains - Stabilization of soft clay ground using stone columns and lime piles-Installation techniques –Relative merits of above methods and their limitations.

Unit – IV	Earth Reinforcement:	9

Concept of reinforcement – Types of reinforcement material – Soil nailing - Reinforced earth wall – Mechanism – Simple design - Applications of reinforced earth - Functions of geotextiles in filtration, drainage, separation, road works and containment applications

Unit – V	Grouting Techniques:	9

Types of grouts – Grouting equipment and machinery – Injection methods – Grout monitoring – Stabilization with cement, lime and chemicals – Stabilization of expansive soil

	Total:45

TEXT BOOK:

1.	Purushothama Raj. P, "Ground Improvement Techniques", 3rd Edition, Laxmi Publications (P) Ltd, 2023

REFERENCES:

1.	Koerner, R.M. "Construction and Geotechnical Methods in Foundation Engineering", 2nd Edition McGraw Hill, 1994.
2.	Das, B.M., "Principles of Foundation Engineering" 8th edition, Cengage learning, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the geotechnical problems in various soil deposits	Applying (K3)
CO2	design and select suitable technique of dewatering	Applying (K3)
CO3	suggest suitable in-situ treatment for cohesive and cohesionless soils	Applying (K3)
CO4	recommend different soil reinforcement materials based on their application	Applying (K3)
CO5	select different types of grouting methods and stabilization techniques	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3						1	3	3
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	30	60				100
CAT2	10	30	60				100
CAT3	20	40	40				100
ESE	10	30	60				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE06 - REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	**5**	**PE**	3	0	0	3

Preamble	This course gives the knowledge on the remote sensing and its working principles. It also describes the image processing techniques using GIS for real time applications which motivates towards innovations in the relevant fields.

Unit – I	**Fundamentals of Remote Sensing:**	**9**

Definition – Components of remote sensing – EMR Spectrum – EMR interactions with atmosphere – EMR interactions and Spectral signature curves of Earth surface features – Platforms and Sensors-Types of satellites and their characteristics – Sensor types– Resolution concepts- Photogrammetry – Scale.

Unit – II	**Geographical Information System:**	**9**

Definition and Components of GIS – GIS Data Types – Non spatial data: Field and statistical data, Spatial data: Maps and Map projection methods, Aerial photographs and satellite data – Vector and Raster data types – Merits and demerits.

Unit – III	**Digital Image processing**	**9**

Digital Image – Characteristics – Image preprocessing techniques – Image enhancement techniques – Classification methods – Database concepts – Data structures: Run length encoding, Block encoding, Chain encoding and Quad tree, Topology – Data storage formats: BIL, BSQ and BIP, Topology – Data compression techniques – File formats- Image interpretation: Visual interpretation keys and techniques.

Unit – IV	**Data Analysis and Modelling:**	**9**

Data retrieval-Querying – Raster data analysis: Spatial analysis – Reclassification – Vector data analysis: Overlay, Buffer and Network analysis – Modelling surfaces: TIN, DTM, DEM, Slope model: Slope, Aspect, Hill shades – Modelling networks-Types of data products

Unit – V	**Applications of Remote sensing and GIS:**	**9**

LiDAR and Microwave remote sensing with its applications, Basics of hyper spectral Remote sensing – Concepts of Online GIS and Mobile GIS – Fields of applications and case studies: LIS and cadastral mapping – Urban and municipal applications – Forest resources management – Watershed management- Natural disaster management.

	Total:45

TEXT BOOK:	
1.	Remote Sensing and Image Interpretation, 6th edition– students edition, Lillisand and Kiefer, Chipman, Willey Publications,7thEditionFebruary 2015.

REFERENCES:	
1.	Remote sensing and Geographical Information Systems, 4th Edition, M. Anji Reddy, B S Publications, 2019.
2.	Kang-Tsung Chang, " Introduction to Geographic Information Systems", 2nd Edition, McGraw Hill Publishing, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the earth features in an satellite imagery and the sensor properties for various applications of remote sensing	Applying (K3)
CO2	recommend suitable GIS elements for storing and analyzing different remote sensing datasets	Applying (K3)
CO3	modify suitable GIS database for different remote sensing imageries using preprocessing techniques	Applying (K3)
CO4	relate the raster and vector data analyses on different remote sensing images	Applying (K3)
CO5	compute the fields of applications of remote sensing and GIS with the recent advancement techniques	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3		1	1	1			2	3
CO2	3	2	1			3		1	1	1			2	3
CO3	3	2	1			3		1	1	1			2	3
CO4	3	2	1			3	2	1	1				2	3
CO5	3	2	1			3	2						3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	30				100
CAT2	30	40	30				100
CAT3	30	40	30				100
ESE	30	40	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE07 - ADVANCED STRUCTURAL ANALYSIS							
Programme& Branch	**B.E. & CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Structural Analysis**	**6**	**PE**	3	0	0	3

Preamble	This course offers the various plastic and elastic methods of analysis for structures. It also aims at analysis of special structures like suspension cables, space structures, arches and shells.	
Unit – I	**Plastic Analysis of Structures:**	**9**
Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Plastic analysis of indeterminate beams and portal frames – Upper and lower bound theorems.		
Unit – II	**Force methods of Analysis:**	**9**
Introduction – Choice of redundants – Method of consistent deformation – Applications – Statically indeterminate beams – Pin jointed plane frames – Statically indeterminate rigid jointed plane frames – System with elastic supports – Three moment equation.		
Unit – III	**Flexibility Matrix Method:**	**9**
Introduction – Static and kinematic indeterminacy – Equilibrium and compatability conditions – Primary structure – Element and global flexibility matrix – Applications – Analysis of indeterminate beams, frames and trusses (Redundancy restricted to two).		
Unit – IV	**Suspension Cables and Arches:**	**9**
Suspension Cables –Components - Analysis of suspension cables – Analysis of stiffening girders - Arches as structural forms – Arch structures – Arch action – Types of arches – Parabolic and circular arches – Analysis of three hinged and two hinged arches – Settlement and temperature effects.		
Unit – V	**Shells:**	**9**
Introduction – Classification of shells – Structural action – Membrane theory – Analysis of spherical domes – Analysis of cylindrical shells – Introduction to folded plates.		
		Total:45

TEXT BOOK:

1.	Devdas Menon, Structural Analysis, 3rd Edition, Narosa Publishing House, New Delhi, 2023

REFERENCES:

1.	Hibbeler, R.C, Structural Analysis, 10th Edition, Pearson India, Bengaluru, 2023
2.	Punmia.B.C, Ashok K.Jain, ArunK.Jain, Theory of Structures, 12th Edition, Laxmi Publications, New Delhi, 2023

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	determine the plastic moment capacity of structures	Analyzing (K4)
CO2	analyse the structural elements using force method	Analyzing (K4)
CO3	determine the bending moment using flexibility matrix method	Analyzing (K4)
CO4	determine the forces acting in cable structures and analyse the behaviour of various types of arches	Analyzing (K4)
CO5	analyse the behaviour of dome and shell structures	Analyzing (K4)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			2				1		2	3	3
CO2	3	3	2			2				1		2	3	3
CO3	3	3	2			2				1		2	3	3
CO4	3	3	2			2				1		2	3	3
CO5	3	3	2			2				1		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	15	65			100
CAT2	10	10	15	65			100
CAT3	10	10	15	65			100
ESE	10	10	15	65			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE08 - CONTRACT MANAGEMENT							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	PE	3	0	0	3

Preamble	Create awareness on contracts for construction industry, impart knowledge on tender preparation, tendering process, arbitration procedure and laws, Intellectual property requirements and Labour Regulations.

Unit – I	Construction Contracts:	9

Indian contract Act – Need – Provisions - Scope for modifications / improvement - Contract specifications - Types of contract documents used in construction - Contract procurement - Selecting a contractor - Introduction to BOT and BOOT projects - EPC contracts.

Unit – II	Tenders:	9

Tender request for proposals - Bids & Proposals - Bid evaluation - Contract conditions & specifications - Critical /Red flag conditions - Contract award & Notice to proceed - Variations & changes in contracts - Differing site conditions - Cost escalation - Delays, Suspensions & Terminations - Wrong practices in contracting (Bid shopping, Bid fixing, Cartels).

Unit – III	Arbitration:	9

Arbitration and litigation procedure - preparation, settlement, evidence - Comparison of actions and laws - Agreements ,subject matter violations - Appointment of arbitrators - Conditions of arbitrations - Powers and duties of arbitrator - Enforcement of award – costs - Arbitration and conciliation act 1996 - Case studies.

Unit – IV	Law relating to Intellectual property:	9

Introduction – meaning of intellectual property - main forms of IP- Copyright - Trademarks, patents and designs, secrets - Law relating to Copyright in India - Meaning of copyright – Ownership of copyrights and assignment - Criteria of infringement - Piracy in internet – Remedies and procedures in India - Law relating to patents under Patents Act - Process of obtaining patent – Application, examination, opposition and sealing of patents.

Unit – V	Laws Applicable to Construction Activity:	9

Industrial disputes act - Workmen's compensation act - Employer's liability act - Payment of wages act - Contract labour act - Minimum wages act - Inter-state migrant workmen act - BOCW Act - other acts introduced time to time.

	Total:45

TEXT BOOK:

1.	Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India", 4th Edition, M.M.Tripathi Pvt. Ltd., Bombay, 2000.

REFERENCES:

1.	Joseph T. Bockrath, "Contracts and the Legal Environment for Engineers and Architects", 7th Edition, McGraw-Hill, New York, 2010.
2.	Jimmie Hinze, "Construction Contracts", 3rd Edition, McGraw-Hill, New York, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	design contract documents including standard and international norms.	Applying (K3)
CO2	infer about the procedures of bidding and accepting of tenders.	Understanding (K2)
CO3	summarize the duties and powers of arbitrators.	Understanding (K2)
CO4	sort out the different types of property rights and patents	Understanding (K2)
CO5	apply the laws related to labour legislation in construction industry	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					2					2	2	2	2
CO2		2				2		2			2	2	2	2
CO3											2		2	2
CO4		2									2	2	2	2
CO5	2					2			3	3	2	2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	70	15				100
CAT2	50	50	-				100
CAT3	15	65	20				100
ESE	45	45	10				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE09 - ENVIRONMENTAL IMPACT ASSESSMENT

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Environmental Engineering	6	PE	3	0	0	3

Preamble	This course imparts knowledge on EIA and to identify the impact of environmental attributes for sustainable development.

Unit – I	Introduction:	9

Definition – Concept of environment - Hierarchy in EIA-Initial environmental examination (IEE)- Environmental impact statement (EIS) – Environmental impact analysis – Significant environmental impacts – Stages of environmental impact analysis – Environmental impacts and stages of development - Need for EIA studies-Advantages and limitation of EIA.

Unit – II	Measurement of Environmental Impacts	9

Measurement of physical environmental variables – Measuring social variables – Measuring of economic variables – Environmental indices – Various environmental impact assessment methods - Terms of Reference (ToR) - RIA Matrix.

Unit – III	Assessment and Mitigation Measures	9

Definition and concepts – Water quality indicators and standards – Water impact factors – Water quality impact analysis – Mitigation measures – Aesthetic environmental impacts – Framework for visual impact assessment - Mitigation Measures and monitoring – Public participation in EIA.

Unit – IV	Legislation:	9

The environmental protection Act-The water act- The Air (Prevention & Control of pollution Act)-EIA notification 1994 and 2006 -Wild life Act- Case studies and preparation of environmental impact assessment statement for various Industries.

Unit – V	Sectoral Analysis of Environmental Impacts	9

Introduction – Rural sector – Urban sector – Energy sector – Industrial sector – Transportation sector – Case study and impacts on the environment by various sectors.

	Total:45

TEXT BOOK:

1.	Barthwal R.R., "Environmental Impact Assessment", 2nd Edition, New Age International Publishers, New Delhi, 2019.

REFERENCES:

1.	Charles H. Eccleston., "Environmental Impact Assessment: A Guide to Best professional practices", 1st Edition, CRC Press., United States, 2017
2.	Y.Anjaneyulu and ValliManikam, "Environmental Impact Assessment Methodologies", 2nd Edition, B.S Publications., Hyderabad, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	summarize the concept of EIA framework.	Understanding (K2)
CO2	suggest the methodologies and measure the variables in EIA.	Understanding (K2)
CO3	interpret the importance of public participation in EIA studies.	Applying (K3)
CO4	discuss the key steps involved in the EIA legislations.	Understanding (K2)
CO5	illustrate the various sectorial analysis in EIA.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3	3					2	3	2
CO2	2	1				3	3					2	3	2
CO3	3	2	1	3		3	3					3	3	3
CO4	3	2				3	3	2				3	3	3
CO5	3	1				3	3					2	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				100
CAT2	30	50	20				100
CAT3	30	50	20				100
ESE	30	50	20				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE10 - TRAFFIC ENGINEERING AND MANAGEMENT

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Transportation Engineering	6	PE	3	0	0	3

Preamble	This course imparts knowledge on traffic engineering, safety and management concepts on rural and urban highways.	
Unit – I	**Fundamentals of Traffic Engineering:**	9

Scope – Elements – Road characteristics – Road user characteristics – PIEV theory – Vehicle characteristics - IRC standards - Design speed, volume – Performance characteristics – Fundamentals of traffic Flow – Urban traffic problems in India

Unit – II	**Traffic Surveys and Level of Service:**	9

Speed, journey time and delay surveys – Vehicle volume survey including non-motorized transports – Origin destination survey– Parking survey – Accident analyses – Statistical applications and traffic forecasting – Level of service – Highway capacity – Capacity of urban and rural roads - PCU concept – Traffic flow theory

Unit – III	**Traffic Design and Visual Aids:**	9

Design of at-grade intersections – Principles of design – Channelization - Design of rotaries – Traffic signals – Design of signal setting – Signal co-ordination – Roundabouts - Grade separated intersections – Geometric elements for divided and access controlled highways and expressways

Unit – IV	**Traffic Safety and Environment:**	9

Road furniture - Street lighting -Traffic signs & markings – Networking pedestrian facilities & cycle tracks – Traffic regulation and control – Traffic Safety – Principles and practices – Road safety audit – Traffic and environment hazards – Air and noise pollution, causes, abatement measures

Unit – V	**Traffic Management:**	9

Traffic system management (TSM) with IRC standards – Traffic regulatory measures-Travel demand management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods- Coordination among different agencies – Intelligent transport System for traffic management, enforcement and education – Car pooling

	Total:45

TEXT BOOK:

1.	Kadiyali.L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 9th Edition,2016

REFERENCES:

1.	Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of Highway Engineering and Traffic Analysis", Wiley India Pvt. Ltd., New Delhi,2 nd Edition, 2011
2.	Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 3 rd Edition,2010

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer the fundamental concepts of road user characteristics	Understanding (K2)
CO2	select a suitable survey for traffic parameters and highway capacity	Applying (K3)
CO3	develop channels, intersections, signals, roundabouts and parking arrangements	Applying (K3)
CO4	explain traffic signs, markings for road safety and environmental impacts.	Understanding (K2)
CO5	Implement the traffic planning and management systems	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2						1	3	2
CO2	3	2	1			3						2	3	3
CO3	3	2	1			3						2	3	3
CO4	3	1				2						1	3	2
CO5	3	2	1			3					3	2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	50	30				100
CAT3	20	60	20				100
ESE	10	60	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE11 - ENVIRONMENTAL GEO-TECHNOLOGY							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Geotechnical Engineering - I	6	PE	3	0	0	3

Preamble	To develop an understanding of the geotechnical aspects in the disposal of waste materials and the remediation of environmentally contaminated sites.	
Unit – I	**Fundamentals of Geo-environmental Engineering:**	**9**

Scope of geo-environmental engineering - Multiphase behaviour of soil – Role of soil in geo-environmental applications – Importance of soil physics, soil chemistry, hydrogeology, biological process – Sources and type of ground contamination - Impact of ground contamination on geo-environment - case histories on geo-environmental problems.

Unit – II	**Contaminant transport and Site characterisation:**	**9**

Transport of contaminant in subsurface – Advection, diffusion, dispersion – Chemical process –Biological process, sorption, desorption, precipitation, dissolution, oxidation, complexation, ion exchange, volatization, biodegradation – characterization of contaminated sites– Soil and rock data – Hydrological and chemical data – Analysis and evaluation – Risk assessment – Case studies

Unit – III	**Waste Containment System:**	**9**

Insitu containment – vertical and horizontal barrier – surface cover – ground water pumping system on subsurface drain – soilremediation – soil vapour extraction, soil waste stabilization, solidification of soils, electrokinetic remediation, soil heating, vitrification,bio remediation, phyto remediation – ground water remediation – Insitu flushing, permeable reacting barrier, Insitu air sparging - case studies.

Unit – IV	**Landfills:**	**9**

Source and characteristics of waste - Site selection for landfills – Components of landfills – Liner system – Soil, geomembrane, geosynthetic clay, geocomposite liner system – leachate collection –final cover design – monitoring landfill.

Unit – V	**Remediation of Contaminated soils:**	**9**

Rational approach to evaluate and remediate contaminated sites – Monitored natural attenuation – Ex-situ and in-situ remediation – Solidification, Bio-remediation, incineration, soil washing, electro kinetics, soil heating, vitrification, bio-venting – Ground water remediation – Pump and treat, air sparging, reactive well –Case studies.

	Total:45

TEXT BOOK:	
1.	Hsai-Yang Fang and Ronald C. Chaney., "Introduction to Environmental Geo-technology", 2nd Edition, CRC Press., USA, 2016.

REFERENCES:	
1.	Sharma H.D. and Reddy K.R., "Geo-environmental Engineering: Site Remediation, Waste Containment, and Emerging WasteManagement Technologies", 1st Edition, John Wiley & Sons, USA, 2004.
2.	Reddi L.N. and Inyang, H. I., "Geo-environmental Engineering, Principles and Applications", 1st Edition, CRC Press, 2020

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	discuss the importance, applications and case histories of geo-environmental engineering	Understanding (K2)
CO2	Identify the various methods of generation of wastes and asses the waste characterization	Understanding (K2)
CO3	select suitable treatment techniques based on waste containment system	Applying (K3)
CO4	design engineered land fill systems	Applying (K3)
CO5	choose suitable remediation techniques based on type of pollutant	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3							3	2
CO2	2	1				3							3	2
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	2	1				3							3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	50	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE12 - ENGINEERING GEOLOGY							

Programme& Branch	**B.E. & CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**6**	**PE**	3	0	0	3

Preamble	This course imparts knowledge on geological process, classification, morphology of rocks and the importance of the study of geology for civil engineering practices with regard to the selection of appropriate site for their projects like dams, tunnels, buildings etc.,	
Unit – I	**Geomorphology:**	**9**

Internal structure of the earth – Weathering of Rocks- scale of weathering – soils - Geological work of rivers - Wind — Groundwater – Hydrologic cycle – Origin and occurrence - Vertical distributions and types of aquifers- relevance to civil engineering.

Unit – II	**Mineralogy:**	**9**

Elementary knowledge on symmetry elements of crystallographic systems (normal class) – Physical properties of minerals – Study of the rock forming minerals: Quartz family – Feldspar family – Mica minerals: Muscovite and Biotite – Augite – Calcite - Fundamentals of ore mineral formation.

Unit – III	**Petrology:**	**9**

Rock cycle – Classification and distinction of rocks - Igneous rocks: granite, syenite, basalt and dolerite - Sedimentary rocks: Conglomerate, breccia, sandstone, shale and limestone - Metamorphic rocks: Gneiss, schist, quartzite, slate and marble

Unit – IV	**Structural features of rocks & investigations:**	**9**

Attitude of beds: dip, strike, stratification and out crops – Folds - Faults and Joints - Causes and types – Bearing on engineering construction – Unconformities- Electrical and seismic methods – Geotechnical considerations for Dams and reservoirs - Tunnels – Road cuts - Landslides- Causes of Landslides.

Unit – V	**Fundamental concepts of geo-tectonic:**	**9**

Plate tonics and continental drift – Earthquake- Causes –Seismic zones of India -dynamic evolution of continental and oceanic crust- Tectonic framework of India.

	Total:45

TEXT BOOK:	
1.	Duggal S.K., Pandey H.K., Rawal N., "Engineering Geology", 1st Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2017

REFERENCES:	
1.	SubinoyGangopadhyay, "Engineering Geology", 1st Edition, Oxford University Press India, 2012.
2.	Marland P. Billings, "Structural Geology", 3rd Edition, Pearson Education India, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Classify the different earth surface process	Understanding (K2)
CO2	Identify the minerals with reference to their properties	Understanding (K2)
CO3	distinguish the different types of rocks and their formation	Understanding(K2)
CO4	identify the geological structures of rocks and suggest suitable site investigation methods	Applying (K3)
CO5	summarize the concepts of geo-tectonic movements	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	2	1				2							3	2
CO3	3	3	2			3						2	3	3
CO4	3	2	1			3						1	3	3
CO5	2	1				2							3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	10	30	30				100
CAT3	20	40	40				100
ESE	10	30	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE13 - ADVANCED STEEL DESIGN								
(IS 800:2007, Steel Tables, IS 875 (Part-3), IS 801: 1975, IS811:1987, IS 6533:1989 (Part 1 & Part 2), IS 9178:1979 (Part 1 & Part 2) and SP 06 are permitted)								
Programme& Branch	B.E. & CIVIL ENGINEERING		Sem.	Category	L	T	P	Credit
Prerequisites	Design of Steel Structures		7	PE	3	0	0	3

Preamble	This course offers the design of steel structures as per limit state method. It aims at determination of safe as well as economical steel section for various industrial and framed structures like chimneys, silos, plate girders and gantry girders. Design of light gauge construction and introduction to pre engineered buildings are also discussed.	
Unit – I	**Industrial buildings:**	**9**
Roof trusses - Roof and side coverings – Wind load calculation - Design of purlins – Design of truss under gravity load and wind load - Introduction to design of steel structures for fire loads.		
Unit – II	**Design of chimneys and Silos:**	**9**
Introduction – Forces acting on chimneys– Types – Load calculation - Design of Self supporting chimneys - Pressure on side walls of silos - Design of single cell circular silos.		
Unit – III	**Light Gauge Steel Structures and Pre-Engineered Buildings:**	**9**
Introduction to cold formed steel - Advantages of cold formed steel sections - Types of cross sections - Local buckling - Design of compression members - Design of beams - General concept of pre-engineered buildings - Simple portal frame design concepts.		
Unit – IV	**Plate Girder:**	**9**
Introduction - Difference between beam and plate girder – Types of plate girders – Post buckling behavior of web plate – Proportioning of the web plate and flanges – Design of welded plate girder.		
Unit – V	**Gantry girder:**	**9**
Introduction - Load consideration - Max load effects - Determination of maximum bending moment and shear force due to crane wheel load - Longitudinal effect of wheel load - Design of gantry girder**.**		
		Total:45

TEXT BOOK:

1.	Duggal S.K., "Design of Steel Structures",3rd Edition, McGraw Hill Education, 2019.

REFERENCES:

1.	Subramanian N., "Design of Steel Structures Limit States Method",2nd Edition, Oxford University Press, New Delhi, 2015.
2.	Bhavikatti S.S., "Design of Steel Structures", 5th Edition, I.K. International Publishing House Pvt. Ltd., New Delhi, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	analyze and design various components of industrial building	Analyzing (K4)
CO2	evaluate and design the forces of chimney and silo	Analyzing (K4)
CO3	design the cold formed members and study about pre engineered buildings	Analyzing (K4)
CO4	analyze and design weldedplate girders	Analyzing (K4)
CO5	determine the design forces over a gantry girder and design the member	Analyzing (K4)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2			3				1		2	3	3
CO2	3	3	2			3				1		2	3	3
CO3	3	3	2			3				1		2	3	3
CO4	3	3	2			3				1		2	3	3
CO5	3	3	2			3				1		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	20	60			100
CAT2	10	10	20	60			100
CAT3	10	10	20	60			100
ESE	10	10	20	60			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE14 - ARCHITECTURE AND TOWN PLANNING

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	PE	3	0	0	3

Preamble	This course imparts knowledge on building standards, zone regulation, design of architectural elements in buildings and surveys related to site analysis.

Unit – I	Architectural Space Standards:	9

Introduction to architectural design-Aesthetics-concepts of space, form and function-Factors and concepts related to building design - Climate, Site characteristics, land form, visual elements, behavioural factors, space utilization.

Unit – II	Town Planning & Surveys:	9

Evolution of planning- Objects of planning- Planning Legislation and Legal Framework - Town planning in ancient India-Types of survey - Uses of survey - Methods adopted to collect data - Advance techniques in planning - Regional Survey-Concepts of smart cities.

Unit – III	Zoning:	9

Principles of zoning- Advantages and importance of zoning- Economy of zoning- Housing- Slum - Parks and Playgrounds- Industries-Public buildings-Urban roads and Traffic Management.

Unit – IV	Climate and Environmental Responsive Design:	9

Man and environment interaction with climatic factors– Characteristics of climate - Types – Design adopted for different climatic conditions – Passive and active energy controls – Green building concept

Unit – V	Building Bye-laws:	9

Objects - Importance - Functions of local authority- Anthropometrics- Building rules and regulations- Set back - Light plane - Floor space Index- Off-street parking - Fire protection- Development and building Permit.

Total:45

TEXT BOOK:

1.	Rangwala. S., "Town Planning", 32nd Edition, Charotar Publishers, 2023.

REFERENCES:

1.	Hiraskar. G. K., "Fundamentals of Town Planning", 17th Edition, Dhanpat Rai Publications, 2017.
2.	Francis D. K. Ching., "Architecture: Form, Space & Order", 4th Edition, John Wiley & Sons, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Identify and design architectural elements in buildings by considering space standards	Understanding(K2)
CO2	Identify the standards required for town planning	Understanding(K2)
CO3	Classify the zoning along with required standards	Understanding(K2)
CO4	Apply green building concepts in the planning of buildings	Applying(K3)
CO5	Prepare building plans as per standards and zoning regulations	Applying(K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	2	1				2							3	2
CO3	2	1				2							3	2
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	40	40				100
CAT3	15	35	50				100
ESE	20	30	50				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE15 - AIR AND NOISE POLLUTION CONTROL ENGINEERING							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Environmental Science	7	PE	3	0	0	3

Preamble	To realize the importance of Air and Noise pollution measurement and its control strategies for maintaining environmental quality standards.

Unit – I	Sources and Effects of Air Pollutants:	9

Classification of air pollutants - Sources of air pollution - Effects of air pollution on human beings, materials, vegetation, and animals - Global warming - Ozone layer depletion - Basic Principles of sampling-Source and ambient sampling - Analysis of pollutants - Basic principles of CO_2 sequestration.

Unit – II	Dispersion of Pollutants:	9

Elements of atmosphere - Meteorological factors - Wind rose diagram - Lapse rate - Atmospheric stability and turbulence - Plume rise - Effective stack height - Dispersion of pollutants - Dispersion models –Applications.

Unit – III	Air Pollution Control:	9

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

Unit – IV	Noise Pollution:	9

Sources, measurements, effects and occupational hazards of noise pollution- Assessment - Control methods - Noise Exposure Index - Prevention - Noise measurement strategies - Case Studies.

Unit – V	Noise and Air Quality Management:	9

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

	Total:45

TEXT BOOK:

1.	Rao M and Rao H.V.N., "Air Pollution Control", 1st edition 2017, McGraw Hill, New Delhi.

REFERENCES:

1.	Howard Peavy, Donald Rowe, George Tchobanoglous, "Environmental Engineering", 1st edition 2017, McGraw Hill, New Delhi.
2.	Lawrence K.Wang, Norman C.Pereira, Yung-Tse Hung, "Advanced Air and Noise Pollution Control", 2nd edition 2010, Humana Press, United States.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the sources and impacts of air pollutants	Applying (K3)
CO2	elucidate about the dissolution of pollutants and plume behaviour	Applying (K3)
CO3	interpret appropriate air pollution control methods	Understanding(K2)
CO4	paraphrase significant noise pollution control methods	Applying (K3)
CO5	enumerate air and noise quality standards	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2		2							2	2
CO2	3	2	3	2		2							2	2
CO3	3	3	2	3		2							3	2
CO4	3	3	2	2		2							3	2
CO5	3	2	2	2		2							2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	25	55	20				100
CAT3	15	60	25				100
ESE	15	55	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE16 - URBAN TRANSPORTATION PLANNING

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Transportation Engineering	7	PE	3	0	0	3

Preamble	This course imparts knowledge on the principles of urban transportation planning and its component	
Unit – I	**Urban Transportation Planning Process & Concepts:**	**9**
Role of transportation – Transportation problems – Urban travel characteristics – Evolution of transportation planning process - Concept of travel demand – Demand function - Independent variables – Travel attributes – Assumptions in demand estimation - Sequential, recursive and simultaneous processes.		
Unit – II	**Transportation Survey and Analysis:**	**9**
Definition of study area – Zoning – Types and sources of data – Road side interviews – Home interview surveys – Expansion factors – Accuracy check – Trip generation models - Zonal models – Category analysis – Household models – Trip attractions of work centers - Trip distribution models – Growth factor models – Uniform factor method – Average factor method – Disadvantage of growth factor method – Case studies**.**		
Unit – III	**Design and Mode Split Analysis:**	**9**
Standards and guidelines – Transport policies – Mode choice behaviour, completing modes, mode split curves, probabilistic models – Route split analysis – Elements of transportation networks, coding – Minimum path trees, all-or-nothing assignment.		
Unit – IV	**Urban Goods Movement:**	
Importance and characteristics of urban goods movement - Problems of urban goods movement - Goods traffic management in urban area - Urban Goods Movement planning process - Goods movement forecasting		
Unit – V	**Innovations in Urban Transportation:**	**9**
Need for innovative approaches–Classification of urban transportation innovations–Bus rapid transit (BRT)–Bus route rationalization– Geographic Information System (GIS)–Intelligent Transportation System (ITS)–Track Guided Bus–Duo Bus		
		Total:45

TEXT BOOK:	
1.	Khisty, C. J. and Iall, B. K., "Transportation Engineering - An Introduction", 3rd Edition, Pearson, India, 2017.

REFERENCES:	
1.	Papacostas, C S, and Prevedouros. P. D, "Transportation Engineering and Planning", 3 rd Edition,2009, Prentice Hall.
2.	Hutchinson B. G., "Principles of Urban Transportation System Planning", 1 st Edition 1974 ,McGraw Hill.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain urban transport planning and its concepts	Understanding (K2)
CO2	apply the transportation survey, trip attraction, generation and distribution	Applying(K3)
CO3	summarize the modal choice and the transportation network	Understanding(K2)
CO4	apply the characteristics, problems and management of urban goods movement	Applying(K3)
CO5	explain the advancement in urban transportation	Understanding(K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1			2						1	3	2
CO2	3	2	1			3						1	3	3
CO3	2	1	1			2						1	3	2
CO4	3	2	1			3						1	3	3
CO5	2	1	1			2						1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	60	20				100
CAT3	20	60	20				100
ESE	20	50	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE17 - ROCK MECHANICS							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	7	PE	3	0	0	3

Preamble	To impart knowledge on fundamentals of rock mechanics and its applications in solving problems associated with rock slopes and underground openings.	
Unit – I	**Classification and index properties of rocks:**	**9**

Introduction – Scope of rock mechanics- Geological classification –Index properties of rock systems – Classification of rock masses for engineering purpose- Rock mass rating and Q System-Strength and modulus from classifications, Classification based on strength and modulus and strength and fracture strain, Geoengineering classification.

Unit – II	**Rock strength and failure criteria:**	**9**

Modes of rock failures – Strength of rock –Laboratory measurement of shear, tensile and compressive strength – Stress-strain behaviour of rock under hydrostatic compression and deviator loading – Mohr-Coulomb failure criteria.

Unit – III	**Initial stresses and their measurements:**	**9**

Estimation of initial stresses in rocks –Influence of joints and their orientation in distribution of stresses – Measurement of in-situ stresses – Hydraulic fracturing –Flat jack method – Over coring method

Unit – IV	**Application of rock mechanics in engineering:**	**9**

Simple engineering application – Underground openings –Rock slopes – Bolting – Anchoring -Foundations and mining subsidence - Improvement of slope stability and protection.

Unit – V	**Rock stabilization:**	**9**

Rock support and rock reinforcement -Methods of excavation of tunnels - Control and maintenance- Tunnel ventilation - Grouting in rocks-Rock bolting-Rock anchor

	Total:45

TEXT BOOK:	
1.	Ramamurthy T. 'Engineering in Rocks for Slopes Foundations and Tunnels', 3rd Edition, PHI Learning Pvt. Ltd, 2014.

REFERENCES:	
1.	Debasis&VermaAbhiram Kumar, "Fundamentals and Applications of Rock Mechanics" 1st Edition, PHI Learning Pvt. Ltd, 2016.
2.	Nagaratnam Sivakugan, Sanjay Kumar Shukla and Braja M. Das, 'Rock Mechanics An Introduction', 1st edition CRC press,, India, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	classify the rocks and explain the index properties of rock systems	Understanding (K2)
CO2	Interpret the modes of rock failure and the stress-strain characteristics	Applying (K3)
CO3	calculate the stresses in rocks	Applying (K3)
CO4	apply the methods to improve the stability of rocks	Applying (K3)
CO5	apply suitable method for rock stabilization	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	3	2	1			3						1	3	3
CO3	2	1	1			2						1	3	3
CO4	3	2	1			3						1	3	3
CO5	2	1	1			2						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				100
CAT2	10	40	50				100
CAT3	20	40	40				100
ESE	10	40	50				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE18 - FINITE ELEMENT METHODS							

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Engineering Mechanics, Strength of Materials & Structural Analysis	7	PE	3	0	0	3

Preamble	This course deals with understand the basics of the Finite Element Technique, and to cover the analysis methodologies for 1-D, 2-D and 3-D Structural Engineering problems.

Unit – I	INTRODUCTION:	9

Introduction - Basic concepts of Finite Element Analysis - Introduction to elasticity- Steps in finite element analysis - Finite element formulation Techniques - Virtual work and variational principle -Galerkin method - Finite element method: Displacement Approach - Stiffness matrix and boundary conditions.

Unit – II	ELEMENT PROPERTIES:	9

Natural coordinates - Triangular elements-Rectangular elements - Lagrange and serendipity elements - Solid elements - Isoparametric formulation - Stiffness matrix of Isoparametric elements -Numerical Integration

Unit – III	ONE DIMENSIONAL PROBLEMS:	9

Discretization of domain -Coordinate types, shape function using natural coordinates and generalized coordinates-Stiffness matrix of a1-D bar and beam element-Stiffness matrix and finite element equation for a two nodded Truss element- Basic equations of heattransfer - Shape function and thermal stiffness matrix for 1-D heat conduction.

Unit – IV	TWO AND THREE DIMENSIONAL SOLIDS:	9

Constant strain triangle - Linear strain triangle - Rectangular elements- Numerical evaluation of element stiffness - Computation of Stresses, Geometric Nonlinearity and static Condensation -Axisymmetric element - Finite element formulation of axisymmetric Element - Finite element formulation for 3 Dimensional elements- Problems

Unit – V	ANALYSIS OF FRAMED STRUCTURES:	9

Stiffness of Truss Members-Analysis of Truss-Stiffness of Beam Members-Finite Element Analysis of Continuous Beam-Plane Frame Analysis-Analysis of Grid and Space Frame

	Total:45

TEXT BOOK:	
1.	Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2017

REFERENCES:	
1.	Moaveni, S., "Finite Element Analysis Theory and Application with ANSYS", 5th Edition Prentice Hall Inc., 2019.
2.	David Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw Hill Publishing Company Limited, New Delhi, 2017

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain basic concept of Finite Element Method	Applying (K3)
CO2	form the shape function and stiffness matrix for 1D &2D elements	Applying (K3)
CO3	solve one dimensional problems	Applying (K3)
CO4	apply FEM concept in two and three dimensional solid element	Applying (K3)
CO5	analyse the beam, truss, plane frame & space frame	Analyse (K4)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	3	2	1			3						1	3	3
CO3	2	1	1			2						1	3	3
CO4	3	2	1			3						1	3	3
CO5	2	1				2							3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	20	40	40				100
CAT3	20	20	20	40			100
ESE	20	30	30	20			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22GEE02 TOTAL QUALITY MANAGEMENT

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	7	PE	3	0	0	3

Preamble	This course deals with quality concepts and Total Quality Management (TQM) principles focusing on process quality for customer perspective. It also deals with the basic and modern quality management tools including ISO standards

Unit – I	Quality Concepts and Principles	9

Definition of Quality - Dimensions of Quality - Quality Planning - Quality Assurance and Control - Quality Costs with Case Studies - Elements / Principles of TQM - Historical Review – Leadership – Qualities / Habits - Quality Council - Quality Statements, Strategic Planning – Importance - Case Studies - Deming Philosophy - Barriers to TQM Implementation – Cases with TQM Success and Failures.

Unit – II	TQM-Principles and Strategies	9

Customer Satisfaction - Customer Perception of Quality - Customer Complaints - Customer Retention, Employee Involvement – Motivation - Empowerment - Teams - Recognition and Reward - Performance Appraisal, Continuous Process Improvement - Juran'sTrilogy - PDSA Cycle - 5S - Kaizen, Supplier Partnership - Partnering - Sourcing - Supplier Selection - Supplier Rating - Relationship Development,   Performance Measures – Purpose – Methods - Cases.

Unit – III	Control Charts for Process Control	9

Basic Seven Tools of Quality and its Role in Quality Control, Statistical Fundamentals - Measures of Central Tendency and Dispersion, Population and Sample - Normal Curve - Control Charts for Variables and Attributes - Process Capability - Case Study - Introduction to Six Sigma.

Unit – IV	TQM-Modern Tools	9

New Seven Tools of Quality, Benchmarking - Need - Types and Process, Quality Function Deployment - House of Quality (HOQ) Construction - Case Studies, Introduction to Taguchi's Robust Design - Quality Loss Function - Design of Experiments (DOE), TotalProductive Maintenance (TPM) - Uptime Enhancement, Failure Mode and Effect Analysis (FMEA) - Risk Priority Number (RPN) – Process - Case Studies.

Unit – V	Quality Systems	9

Need for ISO 9000 and Other Quality Systems - ISO 9000: 2015 Quality System – Elements - Implementation of Quality System - Documentation - Quality Auditing, Introduction to ISO 14000 - IATF 16949 - TL 9000-IEC 17025 - ISO 18000 - ISO 20000 - ISO 22000 - ISO21001. Process of Implementing ISO - Barriers in ISO Implementation.

	Total:45

TEXT BOOK:

1.	Besterfield Dale H., Besterfield Carol, Besterfield Glen H., Besterfield Mary, Urdhwareshe Hemant, UrdhwaresheRashmi. "Total Quality Management", 5th Edition, Pearson Education, Noida, 2018.

REFERENCES:

1.	Subburaj Ramasamy, "Total Quality Management", McGraw Hill Education, New Delhi, 2017.
2.	James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, Cengage Learning, 2012.
3.	David Goetsch & Stanley Davis, "Quality Management for Organizational Excellence: Introduction to Total Quality", 8th Edition, Pearson, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	demonstrate the evolution of TQM principles	Understanding (K2)
CO2	illustrate the principles and strategies of TQM	Understanding (K2)
CO3	use control charts and identify process capability of a process	Applying (K3)
CO4	apply various quality tools and techniques in both manufacturing and service industry	Applying (K3)
CO5	choose appropriate quality standards and implement them in the respective industry	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2				1						1		3
CO2	2	2				1						1		3
CO3	2	2				1						1		3
CO4	2	2				1						1		3
CO5	1	1				1						1		3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	45	30				100
CAT2	20	40	40				100
CAT3	25	45	30				100
ESE	20	40	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE19 - EARTHQUAKE ENGINEERING AND DESIGN
(IS: 13920:2016, IS 4326:1993, IS: 1893: 2002, IS: 13828: 1993, IS13935:2009 code books are permitted)

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	7	PE	3	0	0	3

Preamble	This course imparts knowledge on earthquake-resistant design of structures in the field of engineering wherein many exciting developments are possible.

Unit – I	Basics & Causes of Earthquake:	9

Cross section of earth interior - Seismology- Plate tectonics- Faults -Seismic waves- Consequences of earthquake - Earthquake parameters - Magnitude & intensity scales - Seismic zones of India - Characteristics of ground motion and attenuation - Earthquake recording instruments - Seismograph - Seismogram - Causes of earthquakes and its effect on built structures – Damages caused during past earthquakes.

Unit – II	Basics of Earthquake Vibrations of Buildings:	9

Static load v/s Dynamic load - Force control and displacement control - Simplified single degree of freedom system - Modelling of buildings - Natural frequency and resonance - Responses of buildings to different types of vibrations like free and forced - Damped and Undamped vibration - Response of building to earthquake ground motion -Introduction to multi degree of freedom systems - Mode shapes only

Unit – III	Earthquake Resistant Design of Structures:	9

Planning considerations and Architectural concepts - Earthquake resistant design of RCC buildings – Evaluation of Earthquake forces – Material properties – Guidelines for Earthquake resistant design – lateral load analysis – Capacity based design and Detailing – Rigid frames – Shear walls.

Unit – IV	Response Spectrum and Ductile Detailing:	9

Response of structure subjected to Random vibrations - Seismic coefficient method and Dynamic analysis - Ductile detailing of reinforced concrete beams, Columns and shear wall - Design procedure on ductile detailing - Design concepts of non-structural members.

Unit – V	Vibration Control Techniques:	9

Vibration control – Tuned mass dampers – Principles and application, Basic concepts of seismic base Isolation – Various systems. Case studies of important structures.

	Total:45

TEXT BOOK:

1.	Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", 2ndEdition, PHI Learning Private Ltd, New Delhi, 2019.

REFERENCES:

1.	Ray W Clough & Joseph Penzien., "Dynamics of Structures",2ndEdition, CBS Publishers & Distributors Pvt. Ltd, New Delhi, 2019
2.	Anil K. Chopra, "Dynamics of Structures", 5th Edition, Pearson Education, 2020

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain various elements of seismology with some case studies	Understanding (K2)
CO2	interpret the causes and effects of vibration under earthquakes	Applying (K3)
CO3	design the earthquake resistant RCC structures	Understanding (K2)
CO4	interpret response spectrum presented in various formats	Applying (K3)
CO5	explain the concept of vibrational control techniques	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				2							3	2
CO2	3	2	2			3						2	3	3
CO3	3	2	2			2						2	3	3
CO4	3	2				2							3	2
CO5	3	2				2							3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	75					100
CAT2	30	40	30				100
CAT3	30	60	10				100
ESE	30	50	20				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE20 - SUSTAINABLE ENGINEERING							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	PE	3	0	0	3

Preamble	This course imparts knowledge on sustainable construction methods incorporating site and climatic zone-specific sustainability features	
Unit – I	**Introduction to Sustainable Engineering:**	**9**

Definitions of Sustainability - Need for Sustainability-Concept of sustainable development-three pillar basic model - Egg of sustainability model. Attkisson's Pyramid Model-Prism Model-Principles of sustainable development-Threats for sustainability.

Unit – II	**Environmental issues:**	**9**

Global, Regional and local environmental issues- Natural resources and their pollution- Air-water- solid waste - Zero Waste Concept - 3R Concept- Waste to Energy Technology - Climate Change and Global Warming - Ozone Layer Depletion – Resource Degradation-Carbon Footprint.

Unit – III	**Tools for Sustainability:**	**9**

Environmental Management System (EMS)- Concept of IS0 14000 - Life Cycle Assessment (LCA)- Basic Concepts- EIA Process in India - Environmental Auditing- Case Studies.

Unit – IV	**Sustainable habitat:**	**9**

Introduction- Necessity - Concept of Green Building-Principles of Green Building-Green Building Certification and Rating-Sustainable Cities - Sustainable Transport-Sustainable Pavements-Case Studies.

Unit – V	**Sustainable industrialization and urbanization:**	**9**

Need-Pollution Prevention-Industrial Ecology-Green Business-Green Technology-Green Construction-Green Energy-Green Transportation

	Total:45

TEXT BOOK:

1.	R.L.Rag, "Introduction to sustainable engineering",1st Edition, PHI Learning Pvt. Ltd, New Delhi,2016

REFERENCES:

1.	Mohamed Salama, "Principles of Sustainable Project Management", 1st Edition, Goodfellow Publishers Ltd, Oxford,2018
2.	Rogers Peter P, "An Introduction to Sustainable Development", 1st Edition, Glen Educational Foundation Inc, USA,2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the concept of sustainability for future	Understanding (K2)
CO2	predict the local and global environmental issues to overcome the challenges in implementing sustainability	Applying (K3)
CO3	identify sustainable tools for construction	Understanding (K2)
CO4	apply green building practices in a building	Applying (K3)
CO5	illustrate sustainable industrialization and urbanization process	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1			2							3	2
CO2	3	2	1			3						1	3	3
CO3	2	1	1			2							3	2
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	70	20				100
CAT2	10	20	70				100
CAT3	10	30	60				100
ESE	10	40	50				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE21 - INDUSTRIAL WASTE MANAGEMENT

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Environmental Engineering	7	PE	3	0	0	3

Preamble	This course imparts knowledge on the significance of industrial waste water and solid waste treatment techniques for ensuring environmental sustainability.

Unit – I	Introduction:	9

Industrial scenario in India -Uses of water by industry-Sources, characteristics and types of industrial waste water-Industrial waste water and environmental impacts-Industrial waste survey-Industrial Wastewater generation rates- Population Equivalent-Toxicity of Industrial effluents and Bioassay tests.

Unit – II	Industrial Pollution Prevention:	9

Importance of prevention techniques - Significance of control measures - Benefits and Barriers - Source reduction techniques - Waste audit - Recycle, reuse and byproduct recovery – Applications.

Unit – III	Pollution from Major Industries:	9

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, dairy, sugar, paper, distilleries, steel plants, refineries, fertilizer, thermal power plants – Waste water reclamation concepts.

Unit – IV	Waste Treatment Methods:	9

Equalization – Neutralization – Oil separation – Flotation – Precipitation – Heavy metal removal – Adsorption – Sequential batch reactor (SBR) – Handling and treatment of Solid waste.

Unit – V	Waste water Reuse and Residual Management:	9

Zero effluent discharge Systems-Residue management - Quality requirements for waste water reuse and industrial reuse-Disposal on water and land- Quantification and characterization of sludge - Location, needs and flow sheet of operational sequences in CETPs.

	Total:45

TEXT BOOK:	
1.	Rao M.N. and Datta A.K., "Wastewater Treatment", 3rd Edition, Oxford - IBH Publication, New Delhi, 2017.

REFERENCES:	
1.	Stanley N Barton "Industrial Waste: Management, Assessment & Environmental Issues (Waste and Waste Management)", 1st Edition, Nova science publishers Inc, New Delhi, 2016.
2.	G N Pandey, "Environmental Engineering", 1st Edition, McGraw Hill Education, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	discuss the sources and effects of industrial contaminants	Understanding (K2)
CO2	illustrate rigid preventive measures to overcome environmental pollution	Understanding (K2)
CO3	identify the causes and effects of pollution from various industries	Applying (K3)
CO4	explain appropriate industrial waste treatment methods	Understanding (K2)
CO5	recommend effective residue management technique	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2			3							3	2
CO2	3	3	3			3							3	3
CO3	3	3	2			3							3	3
CO4	3	2	3			3							3	3
CO5	3	3	3			3							3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	50	30				100
CAT3	10	50	40				100
ESE	30	50	20				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE22 - PUBLIC TRANSPORTATION SYSTEMS							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Transportation Engineering	7	PE	3	0	0	3

Preamble	To impart knowledge on public transportation systems and planning	
Unit – I	**Introduction**:	**9**
Modes of public transport and comparison - Public transport travel characteristics - Prioritization of public transport -Technology of bus, rail, rapid transit systems – Transit classification – Right of way – Transit system performance – Transit capacity – Quality of service.		
Unit – II	**Rail Transit System:**	**9**
Rail transport – Types of rail transit - Sub-urban commuter rail - rapid rail transit – Light rail transit – Monorail system – Growth of rail based transit systems – Rail transit system development in Indian cities.		
Unit – III	**Rail Transit Planning:**	**9**
Transit system operations – Para-Transit systems – Street transit systems – Rapid transit systems – Estimation of transit demand - Route development – Properties of routing stop location and stopping policy – Schedule.		
Unit – IV	**Bus Transit Management:**	**9**
Bus transport –Characteristics – Types of buses –Bus transit management – Estimation of the required fleet strength – Bus route planning - Expansion/Curtailment of services – Performance indicators – Fleet management – Methods of financing.		
Unit – V	**Coordination of Public Transport& Parking:**	**9**
Need for coordination – Selection of transit mode – Public transport financing – Transit fare structures – Transit marketing – Inter modal transfer – Parking problems – Impact of parking – Parking space requirements – Parking standards.		
		Total:45

TEXT BOOK:

1.	L. R. Kadiyali, "Traffic Engineering and Transport Planning", Khanna Publishers, 9th Edition, 2018

REFERENCES:

1.	G.V.Rao "Principles of Transportation and Highway Engineering" Tata McGraw-Hill Publishing Co. Ltd, 5th Edition,2012
2.	P.Chakroborty& A. Das, Principles of Transportation Engineering , 6th Edition Prentice Hall India Learning Private Limited, 2nd Edition 2003

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	summarize different modes of public transport and its characteristics	Understanding (K2)
CO2	explain the types of rail transit system and its development in India	Understanding (K2)
CO3	illustrate rail transit planning system, routing and scheduling	Applying (K3)
CO4	infer the transit management techniques and finance	Understanding (K2)
CO5	interpret the coordination of public transport system and financing	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3				2							3	2
CO2	2	3				2							3	2
CO3	3	2	1			3						1	3	3
CO4	2	2				3							3	2
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	60	20				100
CAT3	20	60	20				100
ESE	20	60	20				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE23 - SITE INVESTIGATION AND SOIL EXPLORATION

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem	Category	L	T	P	Credit
Prerequisite	Geotechnical Engineering I & II	7	PE	3	0	0	3

Preamble	This course enhances the knowledge on the preparation of soil exploration report based on laboratory, field exploration and testing techniques.

Unit - I	Planning of exploration and geophysical methods:	9

Site investigation –Scope and objectives – activities involved in site investigation – Preliminary desk studies-Subsurface exploration – General considerations – Objectives – Planning an exploration programme – Location – Spacing and depth of borings –Soil Profile – Bore logs – Data Presentation – Soil investigation and exploration reports - Geophysical investigation – Multichannel analysis of surface waves (MASW)

Unit - II	Exploration Techniques:	9

Open pits and trenches - Different methods of boring and drilling – Stabilization of bore holes – Cleaning of bore hole – Geophysical exploration and interpretation – non-displacement and displacement methods – Drilling in difficult subsoil conditions.

Unit - III	Soil Sampling:	9

Sampling Techniques – quality of samples – factors influencing sample quality - disturbed and undisturbed soil sampling advanced sampling techniques, offshore sampling, shallow penetration samplers, preservation and handling of samples.

Unit - IV	Field Testing in Soil Exploration:	9

Field tests – Importance of field tests in soil exploration – Penetration testing – Standard Penetration Test – Static Cone Penetration Test – Dynamic cone penetration test – Plate load test – Field Vane shear test – Pressure meter testing – Data interpretation – Cyclic plate load test – Block vibration test – Field Permeability test.

Unit - V	Instrumentation:	9

Instrumentation in soil engineering, strain gauges, resistance and inductance type, load cells, earth pressure cells, settlement and heave gauges, pore pressure measurements -slope indicators, sensing units - case studies.

	Total:45

TEXT BOOK:

1.	Clayton C.R, Matthews M.C, Simons N.E, "Site Investigation", 2nd edition, Trans Tech Publications Ltd, 1995.

REFERENCES:

1.	Hanna T.H, "Field Instrumentation in Geotechnical Engineering", 2nd Edition, Trans Tech Publications Ltd, 1985.
2.	Brahma S.P, " Foundation Engineering", 5th Edition., Tata McGraw-Hill Publishing Company, New Delhi, 1993.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the importance, features and stages of geotechnical investigation	Understanding (K2)
CO2	select suitable exploration technique based on type of subsoil	Applying (K3)
CO3	choose appropriate soil and rock samplers for testing	Applying (K3)
CO4	outline in-situ testing of soil and rock	Understanding (K2)
CO5	Explain the geotechnical instrumentation	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2			2						1	3	2
CO2	3	2	2			3						1	3	3
CO3	3	2	2			3						1	3	3
CO4	2	1	2			2						1	3	2
CO5	2	1	2			2						1	3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50				100
CAT2	10	40	50				100
CAT3	30	70					100
ESE	10	50	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE24 - GREEN BUILDING							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	PE	3	0	0	3

Preamble	To impart knowledge on eco-friendly building concepts and building certification systems as per Indian and International Standards	
Unit – I	Green Building Concept and Introduction to IGBC:	9
Definition of green buildings and sustainable development- Green Project Management - Green Building Opportunities and Benefits- Introduction to IGBC - Eco-friendly materials - Certification systems.		
Unit - II	Introduction to Green Rating Systems:	9
History of green rating systems - LEED, GRIHA, BREEAM, IGBC - Need and use of green rating systems - Structure of the rating systems - Selection of the appropriate rating system, ZEB- ZEB-ZCB ratings.		
Unit - III	Alternative Construction Materials & Construction Methods:	9
Building and Material Reuse - Salvaged Materials and its Content - Manufactured Materials - Recycled Content – Eco Block - Volatile Organic Compounds (VOC's), Natural Non-Petroleum Based Materials - Alternative Construction Methods - Handling of construction waste materials -Waste Management and Recycling.		
Unit - IV	Performance Testing:	9
Cost and Performance Comparisons and Benchmarking - Building Modelling & Energy Analysis - Cost Benefit Analysis - Blower Door - Duct Tightness - Thermal Imagery - Moisture Testing - Commissioning, Metering, Monitoring -Weatherization - Air Sealing - Moisture Control - Energy Retrofits and Green Remodels.		
Unit - V	Future of Building Rating Systems:	9
Utility of Solar energy in buildings concepts - Energy modelling and energy auditing in green building ratings - Consultancy scope and services for green rating systems - Codes and Certification Programs - Green Rating Registration - Green Remodel Ratings - International Green Construction Codes and ratings.		
		Total:45

TEXT BOOK:

1.	Linda Reeder, "Guide to green building rating systems ", John Wiley & Sons,3rd Edition 2010.

REFERENCES:

1.	Dru Meadows," Preparing a Building Service Life Plan for Green Buildings", McGraw-Hill Publications,1st Edition,2014.
2.	Abe Kruger, "Green Building: Principles and Practices in Residential Construction", Cengage learning India Pvt Ltd, 1st Edition, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	summarize the concepts of green building	Understanding (K2)
CO2	interpret the existing green building rating systems	Understanding (K5)
CO3	identify alternate construction materials and methods	Understanding (K2)
CO4	rate the green building materials	Evaluating (K5)
CO5	re-frame the codes for certification of green construction.	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					2	2				1	2	2	2
CO2	1					1	2				1	2	2	2
CO3	2					3	3				2	2	2	2
CO4	2					1	2				1	2	2	2
CO5	1				3	3	2				1	2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50	-		-		100
CAT2	20	70	-		10		100
CAT3	17	33	33		17		100
ESE	11	39	39		11		100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22GEE01 - FUNDAMENTALS OF RESEARCH							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	7	PE	3	0	0	3

Preamble	This course familiarizes the fundamental concepts/techniques adopted in research, problem formulation and also disseminate the process involved in collection, consolidation of published literature and rewriting them in a presentable form using latest tools.

Unit – I	Introduction to Research	9

Introduction to Research: Types and Process of Research - Outcomes of Research - Sources of Research Problem - Characteristics of a Good Research Problem - Errors in Selecting a Research Problem - Importance of Keywords.

Unit – II	Literature Review	9

Literature Review: Literature Collection - Methods - Analysis - Citation Study - Gap Analysis - Problem Formulation Techniques.

Unit – III	Research Methodology	9

Research Methodology: Appropriate Choice of Algorithms/Methodologies/Methods – Data Collection – Primary Data Analysis – Experimental Methods and Result Analysis - Investigation of Solutions for Research Problem - Interpretation - Research Limitations.

Unit – IV	Journals and Papers	9

Journals and Papers: Journals in Science/Engineering - Indexing and Impact factor of Journals. Plagiarism and Research Ethics. Types of Research Papers - Original Article/Review Paper/Short Communication/Case Study.

Unit – V	Reports and Presentations	9

How to Write a Report - Language and Style - Format of Project Report - Title Page - Abstract - Table of Contents - Headings and Sub-Headings - Footnotes - Tables and Figures - Appendix - Bibliography etc - Different Reference Formats. Presentation using PPTs. Research Tools.

	Total:45

TEXT BOOK:

1.	Walliman, Nicholas. "Research Methods: The basics". 2nd edition, Routledge, 2017., for Units I, II, III, IV & V

REFERENCES:

1.	Mishra, S.B. and Alok, S. "Handbook of research methodology" Educreation Publishing, 2017
2.	Kumar, Ranjit. "Research Methodology: A step-by-step guide for beginners". SAGE Publications Limited, 2019.
3.	Nayak, J.K. and Singh, P. "Fundamentals of Research Methodology Problems and Prospects". SSDN Publishers & Distributors, 2021.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	list the various stages in research and categorize the quality of journals	Applying (K3)
CO2	formulate a research problem from published literature/journal papers	Evaluating (K5)
CO3	write, present a journal paper/ project report in proper format	Creating (K6)
CO4	select suitable journal and submit a research paper	Applying (K3)
CO5	compile a research report and the presentation	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	1	1	3	3	1	1	3	3	3
CO2	3	3	3	3	2	1	1	3	3	3	3	3	3	3
CO3	3	3	3	3	3	1	1	3	3	3	1	3	3	3
CO4	3	2	1	1	2	1	1	3	2	1	1	3	3	3
CO5	3	3	2	2	3	1	1	3	3	3	1	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1		40	50	10			100
CAT2		30	50	10	10		100
CAT3		20	30	30	10	10	100
ESE		40	40	10	10		100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE25 - DESIGN OF PREFABRICATED STRUCTURES							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Design of RC Elements	7	PE	3	0	0	3

Preamble	This course enhances the knowledge among the students to understand the principles, components and design of various prefabricated structural elements.

Unit - I	Design Principles:	9

Introduction to prefabrication - Need for prefabrication – General principles – Comparison with monolithic construction -Types of prefabrication - Site and plant prefabrication - Economy of prefabrication - Modular coordination - Standardization – Materials – Systems – Production – Transportation – Erection.

Unit - II	Prefabricated Components and Joints:	9

Planning for components of prefabricated structures, Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls, Disuniting of structures - Joints – Joints for different structural connections, Effective sealing of joints for water proofing, Provisions for non-structural fastenings, Expansion joints in precast construction.

Unit - III	Production and Fabrication:	9

Production technology – Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening. Hoisting technology – equipment for hoisting and erection, techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.

Unit - IV	Design of Prefabricated Beams:	9

Prefabricated load carrying members – Types of beams – Design of simple rectangular beams and I-beams, handling and erection stresses, elimination of erection stresses – beams, columns, symmetric frames

Unit - V	Design of Prefabricated Elements:	9

Types of Slabs - Construction of roof and floor slabs - Design of hollow core slab - Columns – Construction and design principles of column.

	Total:45

TEXT BOOK:

1.	Ramachandra Murthy D.S., "Design and Construction of Precast Concrete Structures", 1st Edition, Dipti Press OPC Private Limited, Chennai; 2017.

REFERENCES:

1.	Kim S. Elliott, "Precast Concrete Structures", 2nd Edition, CRC Press, United States, 2017.
2.	"PCI Design Hand Book", 6th Edition, Precast / Prestressed Concrete Institute, ACI, Chicago, 2004.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the principles, manufacturing and erection of prefabricated components	Understanding (K2)
CO2	illustrate the production, erection and loading process	Understanding (K2)
CO3	summarize the behaviour of the components of prefabricated structures and different joints	Understanding (K2)
CO4	apply the design procedure to prefabricated beams	Applying (K3)
CO5	apply the design procedure to the prefabricated slab and column	Applying (K3)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	2	1				2							3	2
CO3	2	1				2							3	2
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	30	70					100
CAT3	30	30	40				100
ESE	25	40	35				100
* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)							

22CEE26 - CONSTRUCTION EQUIPMENT AND MANAGEMENT

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Construction Engineering & Management	7	PE	3	0	0	3

Preamble	To impart knowledge in selection strategies of various equipment based on the requirement of the project at optimum cost and time.

Unit – I	Equipment Management:	9

Identification – Factors in Selection of Equipment - Planning Equipment Utilization–Renting Strategies – Capital cost – Investment Alternatives – Elements of Operating and Owning – Bidding Costs – Replacement Decisions – Rent and Lease Considerations – Safety Management

Unit – II	Earthwork Equipment:	9

Tractors - Motor Graders - Scrapers - Front end Loaders - Earth movers -Equipment for Dredging and Trenching- Tunnelling methods and equipments - Compaction Equipment - Diaphragm wall equipment - Pile Driving Equipment - Drilling and Blasting

Unit – III	Equipments for Screening and Transporting:	9

Forklifts and related equipment - Portable Material Bins –Material handling cranes - Conveyors - Aggregate Crushers - Feeders - Screening Equipment - Gantry girder.

Unit – IV	Concreting Equipment:	9

Batching and Mixing Equipment - Hauling equipment - RMC- Modern Formwork Techniques - Shuttering - Types of pumps used for Construction - Boom placer- Equipment for Grouting and Dewatering - 3D Concrete Printing.

Unit – V	Surveying Equipment:	9

Modern electronic surveying equipments - Digital levels - Digital theodolite - Advanced Total station - Lasers and sensors in Surveying - Remote sensing - Geographical Information System.

Total:45

TEXT BOOK:

1.	Sharma.S. C., "Construction Equipment and Management", 1st Edition, Khanna Book Publishing Co. (P) Ltd., India, 2019.

REFERENCES:

1.	Peurifoy R.L., "Construction Planning, Equipment and Methods", 7th Edition, McGraw Hill, Singapore, 2013.
2.	Leonid Nadolinets, "Surveying Instruments and Technology", 1st Edition, CRC Press, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	select suitable equipment required for building construction	Understanding(K2)
CO2	identify the best earthwork equipment for different earth conditions	Understanding(K2)
CO3	infer equipment required for screening and transporting	Understanding(K2)
CO4	choose the best and effective equipment needed for concreting	Understanding(K2)
CO5	select modern equipments needed for surveying	Understanding(K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2		3	2			2	3			3	2
CO2	2	2	2		3	2			2	3			3	3
CO3	1	2	2		3	2			2	3			3	3
CO4	2	2	2		3	2			2	3			3	3
CO5	2	2	2		3	2			3	3			3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	33	67					100
CAT3	33	67					100
ESE	33	67					100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE27 - SURFACE HYDROLOGY

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Water Resources & Irrigation Engineering	7	PE	3	0	0	3

Preamble	This course imparts knowledge about various hydrological components and well hydraulics.	
Unit – I	**Hydrometeorology:**	**9**

Hydrology-Hydrologic cycle - Components of hydrologic cycle - Surface water resource in India – Triple cell air circulation – Recording and non-recording rain gauges – Density and adequacy of rain gauges – Optimum number of rain gauges.

Unit – II	**Precipitation:**	**9**

Forms and types of precipitation - Measurement of precipitation - Mean aerial depth of Precipitation - Computation of missing data, Double mass analysis, Computation of rainfall data network density - DAD curves.

Unit – III	**Abstractions from Precipitation:**	**9**

Evaporation process - Evaporimeters – Empirical evaporation equation – Blaney Criddle equation – Reservoir evaporation and reduction methods – Transpiration – Evapotranspiration – Measurement of evapotranspiration – FAO Penman-Monteith equation - Potential evapotranspiration – Actual evapotranspiration – Interception – Depression storage – Infiltration – Infiltrometer - Infiltration indices - Horton's curve.

Unit – IV	**Runoff and Hydrograph Analysis:**	**9**

Runoff volume - Flow duration curve - Flow mass curve – Droughts – Hydrograph – Factors affecting flood hydrograph – components - Base flow separation – Effective rainfall – Assumptions - Derivation, Uses, limitations, duration – Synthetic unit hydrograph.

Unit – V	**Floods:**	**9**

Flood control methods – Flood estimation – Flood Routing – Flood frequency: Rational method – Empirical formulae – Unit hydrograph method – Flood routing: Muskingum method of channel Routing – Reservoir routing – Modified pulse method.

	Total:45

TEXT BOOK:	
1.	Subramanya K., "Engineering Hydrology", 4th Edition, McGraw Hill Publishing Company, New Delhi, 2017.

REFERENCES:	
1.	Jaya Rami Reddy, P. "A Text book of Hydrology", Laxmi publications,2009.
2.	VenTe Chow, David R. Maidment, Larry W.Mays., "Applied Hydrology", Revised Edition, Tata McGraw-Hill Publishing Company, New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	illustrate the concept of hydrological cycle and types of rain gauges	Understanding (K2)
CO2	calculate the amount of precipitation and infiltration	Applying (K3)
CO3	calculate the evaporation losses	Applying (K3)
CO4	calculate the flood runoff and draw the hydrograph	Applying (K4)
CO5	determine the flood discharge using Gumbel's and Log Pearson method	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	3	2			3						2	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30	-			100
CAT2	20	40	25	15			100
CAT3	15	30	40	15			100
ESE	25	30	30	15			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE28 - INTELLIGENT TRANSPORT SYSTEM							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Transportation Engineering	7	PE	3	0	0	3

Preamble	This course imparts the importance of Intelligent Transportation System in transportation Engineering.

Unit – I	Introduction	9
Definition of ITS – ITS objectives – ITS user services - Historical background – Benefits of ITS - ITS data collection techniques – Detectors – Automatic Vehicle Location (AVL) – Automatic Vehicle Identification (AVI) – Geographic Information Systems (GIS)		
Unit – II	Telecommunications in ITS	9
Importance of telecommunications in ITS system – Information management – Traffic Management Centers (TMC). Vehicle – Road side communication – Vehicle positioning system		
Unit – III	ITS functional areas	9
Advanced Traffic Management Systems (ATMS) – Advanced Traveler Information Systems (ATIS) – Commercial Vehicle Operations (CVO) – Advanced Vehicle Control Systems (AVCS) – Advanced Public Transportation Systems (APTS) – Advanced Rural Transportation Systems (ARTS)		
Unit – IV	ITS user needs and services	9
Travel and traffic management – Public transportation management – Electronic Payment – Emergency Management – Advanced vehicle safety systems – Information Management.		
Unit – V	Automated Highway Systems	9
Critical ITS Issues - Vehicles in Platoons – Integration of automated highway systems – ITS Programs – Overview of ITS implementations in developed countries – Smart car – Smart road		
		Total:45

TEXT BOOK:	
1.	Pradip Kumar, Amit Kumar Jain, "Intelligent Transport System: Concept Technologies and applications", 1stEdition ,PHI Learning Pvt Ltd, New Delhi,2017.

REFERENCES:	
1.	Ignacio Julio,EnriqueOnieva , "Intelligent Transport Systems", 1st Edition, Wiley India PvtLtd,Noida, 2015.
2.	Mashrur A. Chowdhury, and Adel Sadek, "Fundamentals of Intelligent Transportation Systems Planning", 1st Edition, Artech House, Inc., 2003.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the common techniques and benefits of ITS,AVL and GIS	Understanding (K2)
CO2	Interpret the concepts of telecommunication in ITS	Applying (K3)
CO3	implement the various advanced ITS methodologies in transportation system	Applying (K3)
CO4	infer various public services and their usage	Understanding (K2)
CO5	make use of automated highway system	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	2	1				2							3	2
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	20	50	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE29 - REINFORCED SOIL STRUCTURES

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	**Geotechnical Engineering I & II**	**7**	**PE**	3	0	0	3

Preamble	This course imparts knowledge on geosynthetics, design principles and mechanism of reinforced soil, soil nailing and its applications in dams, embankments, pavements and foundation structures.

Unit – I	**Principles and Mechanisms of Soil Reinforcement:**	**9**

Historical background – Initial and recent developments – Principles – Concepts and mechanisms of reinforced soil – Factors affecting behaviour and performance of soil – Reinforcement interactions.

Unit – II	**Reinforcing Materials and their Properties:**	**9**

Materials used in reinforced soil structures – Fill materials, reinforcing materials, metal strips, geotextile, geogrids, geomembranes, geo - composites, geo - jutes, geofoam, natural fibres, coir geotextiles – bamboo – timber – facing elements – properties – methods of testing – Advantages and disadvantages – Preservation methods.

Unit – III	**Design of Soil Reinforcement and Applications:**	**9**

Design aspects of reinforced soil – Soil reinforcement function – separator, filtration, drainage, barrier function – design and applications of reinforced soil of various structures – retaining walls – mechanically stabilized earth walls –stability of internal and external walls - Foundations – embankments and slopes – seismic aspects.

Unit – IV	**Geosynthetics and Applications:**	**9**

Introduction – Historical background – Applications – Design criteria – Geosynthetics in roads – Design – Giroud and Noiray approach – Geosynthetics in landfills – Geosynthetic clay liner – Design of landfills – Barrier walls.

Unit – V	**Geosynthetics in environmental geotechnics:**	**9**

Application of geo synthetics in solid waste management, rigid or flexible liners, bearing capacity of compacted fills, foundation for waste fill ground.

	Total:45

TEXT BOOK:	
1.	Sivakumar Babu G.L., Introduction to Soil Reinforcement and Geosynthetics,2nd edition, University Press,2013.

REFERENCES:	
1.	Jones, C.J.F.P., Earth Reinforcement and Soil Structures, Earthworks, London, 1982.
2.	Koerner, R.M., Designing with Geosynthetics, (Third Edition), Prentice Hall, 1997.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the soil reinforcement interaction mechanism.	Understanding (K2)
CO2	summarize properties, testing methods of geosynthetics in earth reinforcement.	Understanding (K2)
CO3	select suitable reinforcing material to suit the functional requirement	Applying (K3)
CO4	select suitable design criteria for use of geosynthetics in landfills, pavement	Applying (K3)
CO5	Apply geosynthetics in environmental geotechnics.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	2	1				2							3	2
CO3	3	2	2			3						1	3	3
CO4	3	2	2			3						1	3	3
CO5	3	2	2			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	15	40	45				100
CAT3	10	40	50				100
ESE	10	40	50				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE30 - SAFETY IN CONSTRUCTION PRACTICES							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	PE	3	0	0	3

Preamble	To make the students well-versed with the latest safety and health regulations and the Indian Standards applicable to the construction industry.	
Unit – I	**Introduction to Construction Safety:**	**9**
History of safety in construction – Evolution of safety thinking - Basic terminology in safety-types of injuries - Safety pyramid - Accident patterns - Theories of accident - Causation – Role of top management and workers in construction safety.		
Unit – II	**Planning for safety:**	**9**
Introduction to OSHA regulations - Causes and effects of accidents at site - Safety personnel - Safety budget - Safety culture - Planning for PPE - Role of stakeholders in safety - Workers' compensation.		
Unit – III	**Site safety programs:**	**9**
SOP (Safe Operating Procedures) - Construction equipment - Materials handling - Disposal - Hand tools - Safety during construction - Alteration - Demolition works.		
Unit – IV	**Hazards in Construction Projects:**	**9**
Job Safety Analysis (JSA) - Job hazard analysis (JHA) – Health hazards – Types – Precautionary measures - Hazard management - Accident investigation - Accident indices – Violation – Penalty.		
Unit – V	**Safety in Construction:**	**9**
Safety concern in construction-Role of owners in safety and health management - Responsibility of owners in safety - Fostering total safety culture - Job site safety - Responsibility of workers at site.		
		Total:45

TEXT BOOK:	
1.	S.K.Bhattacharjee, "Safety Management in Construction",1st Edition, Khanna Publishers, New Delhi,2011

REFERENCES:	
1.	Stefan Mordue&Roland Finch, "BIM for Construction Health and Safety" 1st Edition, NBS Publications, Philippines,2014
2.	Rita Yi Man Li& Sun WahPoon,"Construction Safety" ,1st Edition, Springer, New York,2013

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Explain the role of safety in construction site	Understanding (K2)
CO2	Illustrate the causes and effects of construction accidents	Applying (K3)
CO3	Implement site safety programs in construction site	Applying (K3)
CO4	Identify the hazards in construction projects	Applying (K3)
CO5	Execute safety in construction site	Applying (K3)

<div align="center">Mapping of COs with POs and PSOs</div>

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		3			3			3				1	
CO2	2		2			3			3		3		1	
CO3	3		2			3							1	
CO4	3	3	2			3							1	2
CO5	3		2			3							1	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<div align="center">ASSESSMENT PATTERN - THEORY</div>

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	7	60	33				100
CAT2	7	20	73				100
CAT3	10	33	57				100
ESE	10	40	50				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE31 – BASICS OF BRIDGE ENGINEERING							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Structural Analysis & Design of RC Elements	8	PE	3	0	0	3

Preamble	The course deals with the analysis and design of long and short span bridges. It also deals with the bearings and balanced cantilever bridges

Unit – I	Introduction	9

Introduction to bridges – Classification – Computation of discharge – Linear waterway – economic span – Afflux, scour depth – Design loads for bridges – Introduction to I.R.C. loading standards – Load Distribution Theory – Bridge slabs – Effective width –Introduction to methods as per I.R.C.

Unit – II	Short span bridges and culvert:	9

Load distribution theory – General design principles for concrete slab bridge deck – Slab culverts – pipe culvert – T-beam and slab bridges.

Unit – III	Long span bridges:	9

General design principles for deck slab – Girder, wing wall, return wall –Detailing of slab and girder bridges - Detailing of skew slab and curved bridge.

Unit – IV	Piers and bearings:	9

Introduction to Bridge bearings - Types of bearings – Piers – Bed block – Materials for piers and abutments – Types of piers – Forces acting on piers and design of pier. Abutments –Forces acting on abutments – design of abutment – Types of wing walls and approaches.

Unit – V	Balanced cantilever bridges:	9

General features – arrangement of supports – Design features – Shear variation – Articulation – Design procedure of double cantilever bridge.

	Total:45

TEXT BOOK:

1.	Krishna Raju N., "Design of Bridges", 5th Edition, Oxford and IBH Publishing Company, New Delhi, 2019

REFERENCES:

1.	Jagadeesh T.R., "Design of Bridge Structures", 2nd Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2010.
2.	Haifan X., "Conceptual Design of Bridges", 1st Edition, S.K. Kataria & Sons, New Delhi, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	classify the forces acting on bridges as per IRC loading standards	Understanding (K2)
CO2	explain the design principles of short span bridges	Understanding (K2)
CO3	explain the design principles of long span bridges	Understanding (K2)
CO4	determine the stability of the piers and abutments	Applying (K3)
CO5	explain the design principles of balanced cantilever and rigid frame bridges	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1			2							3	2
CO2	2	1	1			2							3	2
CO3	2	1	1			2							3	2
CO4	3	2	1			3							3	3
CO5	2	1	1			2							3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	25	50	25				100
CAT3	20	50	30				100
ESE	35	40	25				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE32 - ADVANCED REINFORCED CONCRETE DESIGN							
(IS 456 -2000, SP16, IS 3370 – 2009 (Part-I, II & IV) and IS1893-2002 (Part-I) are permitted)							
Programme& Branch	**B.E. & CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Structural Analysis & Design of RC Elements**	8	PE	3	0	0	3
Preamble	This course enhances the knowledge of students in the design of water tank, shear wall, retaining walls, flat slab and corbels.						
Unit – I	**Design of Water Tank:**						**9**
Design of circular and rectangular water tanks resting on ground - Design principles for elevated water tank.							
Unit – II	**Design of RC Shear Wall:**						**9**
Introduction – Slenderness ratio - Design of RC wall – Types and use of shear walls – Design of shear wall with boundary elements.							
Unit – III	**Design of Retaining Wall:**						**9**
Introduction – Earth pressure theories – Types of retaining wall – Design and detailing of cantilever and counterfort retaining wall.							
Unit – IV	**Design of Flat Slabs and Yield Line Theory:**						**9**
Introduction – Methods of analysis of flat slab - Design of flat slab (IS Code Method). Yield line theory – Equilibrium and virtual work method – Analysis and design of simply supported square, rectangular and circular slabs.							
Unit – V	**Design of Special RC Elements:**						**9**
Design and detailing of corbels (IS code method) – Design of pile caps – Design principles of bunkers and silos.							
							Total:45

TEXT BOOK:	
1.	Design and detailing of corbels (IS code method) – Design of pile caps – Design principles of bunkers and silos.
REFERENCES:	
1.	Varghese P.C., Advanced Reinforced Concrete Design, 2nd Edition, Prentice Hall of India, New Delhi, 2013
2.	Unnikrishna Pillai S. and Devdas Menon, Reinforced Concrete Design, 3rd Edition, Tata McGraw-Hill, New Delhi, 2011

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	design the water tank with appropriate design procedure	Applying (K3)
CO2	design RC wall and shear wall under various loading conditions	Applying (K3)
CO3	design the retaining wall and perform the stability check	Applying (K3)
CO4	analyse and design different types of slabs	Applying (K3)
CO5	design the corbel and pile cap	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3				1		2	3	3
CO2	3	2	1			3				1		2	3	3
CO3	3	2	1			3				1		2	3	3
CO4	3	2	1			3				1		2	3	3
CO5	3	2	1			3				1		2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	15	75				100
CAT2	10	15	75				100
CAT3	10	15	75				100
ESE	10	15	75				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE33 - DISTRESS MONITORING AND REHABILITATION OF STRUCTURES (IS 801,807,811,875, 1024,3370,6533 (part 2) codes are permitted)						

Programme& Branch	**B.E. & CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Concrete Technology**	**8**	**PE**	3	0	0	3

Preamble	This course aims to impart knowledge in maintenance and rehabilitation of concrete structures by the application of various repair materials and suitable strengthening techniques.

Unit – I	**Introduction:**	**9**

Maintenance, rehabilitation, repair, retrofit and strengthening - need for rehabilitation of structures - Cracks in R.C. buildings - causes and effects - importance of maintenance, routine and preventive maintenance.

Unit – II	**Repair Materials:**	**9**

Criteria for material selection -Special mortars and concrete - Polymer Concrete and Mortar - Quick setting compounds - Grouting materials - Gas forming grouts - Bonding agents -Latex emulsions - Epoxy bonding agents - Protective coatings - FRP sheets.

Unit – III	**Crack Repair Techniques:**	**9**

Methods of crack repair – Grouting – Routing – sealing – Stitching - Dry packing - Repair of active cracks - dormant cracks - Corrosion of embedded steel in concrete – Mechanism - Stages of corrosion - Repair techniques of corroded structural elements.

Unit – IV	**Damage Diagnosis and Assessment :**	**9**

Visual inspection – Non-Destructive Testing - Rebound hammer, Ultra sonic pulse velocity - Semi destructive testing - Probe test - Pull out test - Chloride penetration test – Carbonation - Corrosion activity measurements.

Unit – V	**Retrofitting of Structures:**	**9**

Jacketing - Column jacketing - Beam jacketing - Beam Column joint - Reinforced concrete jacketing - Steel jacketing - FRP jacketing – Strengthening - Shear strengthening - Flexural strengthening.

	Total:45

TEXT BOOK:	
1.	Concrete Structures: Protection, Repair and Rehabilitation by R. Dodge Woodson, Delhi: Elsevier India Pvt Limited, 2012

REFERENCES:	
1.	Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India.
2.	Handbook on seismic retrofit of buildings, A. ChakrabartiNarosa Publishing House, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	summarize the causes and effects of distress in concrete structures	Understanding (K2)
CO2	summarize the importance of maintenance of structures, types and properties of repair materials.	Understanding (K2)
CO3	identify the damage of corroded structures	Applying (K3)
CO4	apply various repair techniques for cracked and corroded elements	Applying (K3)
CO5	apply various methods of strengthening the structural components	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1			2						1	3	2
CO2	2	1	1			2						1	3	2
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	25	25	50				100
CAT3	25	25	50				100
ESE	25	25	50				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

	22CEE34 - WATER POWER ENGINEERING						

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Environmental Engineering, Fluid Mechanics and Hydraulics	8	PE	3	0	0	3

Preamble	This course helps to understand the importance and function of Hydro power plants and the components, layouts needed to generate power in a powerhouse.

Unit – I	Water power:	9

Introduction - Sources of energy– Water power - development and use - Statistics of power - estimation of hydropower potential - Mini and pumped storage plant - cost and value of waterpower - Relation of waterpower and hydrology- Collection and analysis of stream flow data, mass curve, and flow duration curves.

Unit – II	Hydro Power Plants and Machines:	9

Classification of hydropower plants - General arrangements - Valley dam plants - Diversion canal plants - High head diversion plants - Storage and poundage - Unit Arrangements - Impact of Jets - Turbines - Basic Principles – Classifications - Pumps- Classifications – Centrifugal pumps- Problems on Efficiency.

Unit – III	Water Conveyance:	9

Penstock - Types - Design criteria - Anchor Blocks - Valves, Bends, and Manifolds- Intakes -Types - Losses - Aeration - Fore bays - Canals – Tunnels - Water Hammer - Surge tanks.

Unit – IV	Tidal Power:	9

Tidal Phenomenon - Tidal power - Basic principle - Location - Difficulties - Components -Modes of generation - Constructional aspects - Estimate of energy and power - Regulation of power output - Economic feasibility - Promising sites.

Unit – V	Powerhouse and Equipment:	9

Surface power stations - Powerhouse structure - Dimensions - Lighting and ventilations -Design variations. Underground power stations - Location - Types - Advantages -Components - Layout types - Limitations. Environmental impact of Hydroelectric power projects - Introduction to the economic analysis of Hydropower projects.

	Total:45

TEXT BOOK:

1.	Dandekar M.M. and Sharma K.N., - "Water Power Engineering", 2nd Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2009.

REFERENCES:

1.	Sharma R.K. and Sharma T.K., - "A Text Book of Water Power Engineering", 2nd Edition, S.Chand& Co. Ltd., New Delhi, 2012.
2.	Duggal K.N. and Soni J.P., -"Elements of Water Resources Engineering", 1st Edition, New Age International Publishers, Chennai, 2001.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Explain the source of energy and the stream flow data	Understanding (K2)
CO2	solve the problems in the operation of pumps and turbines	Applying (K3)
CO3	calculate the losses in water conveyance in a hydro power plant	Applying (K3)
CO4	identify the economic feasibility of tidal power generation	Applying (K3)
CO5	explain the various components of hydroelectric power stations	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	2	1				2							3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	30				100
CAT2	20	40	40				100
CAT3	15	40	45				100
ESE	25	45	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE35 - Transportation Economics							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Transportation Engineering	8	PE	3	0	0	3

Preamble	This course helps the students to understand the concept and evaluation of economics in various transportation projects

Unit – I	ECONOMIC EVALUATION:	9

Need for economic evaluation of urban transport projects – Principles of economic analysis – Methods of economic evaluation – Comparison of various methods – Application of simulation modelling in evolving suitable evaluation techniques – Sensitivity analysis.

Unit – II	MODELING OF ROAD USER COSTS:	9

Components of vehicle operating cost – Factors affecting vehicle operating cost – Value of travel time saving – Accident cost – Concept of route switching mechanism – Ripple effects in developing new infrastructure – Simulation modeling exercise.

Unit – III	TRANSPORT DEMAND SUPPLY CONCEPT:	9

Transport demand and supply concepts - Status of transport demand supply in metropolitan cities – Demand and Supply equilibrium – Subsidy in Transport demand – Supply augmentation and saturation consideration – simulation modelling of transport demand and supply for sustainability.

Unit – IV	TRANSPORT PRICING:	9

Transport costs – Elasticity of demand – Average cost and marginal cost pricing – Market pricing and market segmentation – Second best pricing – Pricing policy – Congestion pricing – Public and private transport pricing – Price Co-ordination.

Unit – V	FINANCING TRANSPORT SYSTEM:	9

Characteristics of transportation infrastructure – Trends in transportation infrastructure – Investment needs, options and budgetary support in transport sector – Existing financing practices – Principles of build, operate and transfer (BOT) – BOT variants and its applicability– Special purpose vehicles – Alternative financial resources.

	Total:45

TEXT BOOK:

1.	Khanna, S.K., Justo C.E.G. and Veeraragavan, A. "Highway Engineering", New Chand and Brothers, Roorkee, Revised 10th Edition, 2018.

REFERENCES:

1.	Kadiyali, L.R. and Lai, N.B. "Highway Engineering (Including Expressways and Airport Engineering)", Khanna Publishers, New Delhi, 5th Edition, 2013.
2.	Kadiyali.L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 10th Edition,2016

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Identify the concepts of economic evaluation of urban transport projects	Applying (K3)
CO2	make use of vehicle operating cost for modelling	Applying (K3)
CO3	develop demand supply concept in metropolitan cities	Applying (K3)
CO4	explain the concepts of road pricing in public and private transportation	Understanding (K2)
CO5	illustrate various budgetary support in transportation projects	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			3						1	3	3
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	2	1				2							3	2
CO5	2	1				2							3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	20	40	40				100
CAT3	20	80					100
ESE	20	50	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE36 - GEOTECHNICAL EARTHQUAKE ENGINEERING							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Geotechnical Engineering I & II	8	PE	3	0	0	3

Preamble	This course imparts knowledge on earthquake mechanism, earthquake hazards and mitigation, ground motion, liquefaction and earthquake resistant design in the field of geotechnical engineering	
Unit – I	**Seismology and Earthquakes:**	**9**

Seismic waves and their properties – internal structure of the Earth - Continental drift and plate tectonics – Faults and their properties – Elastic Rebound Theory – Location and Size of Earthquakes

Unit – II	**Ground Motion and Seismic Hazard Analysis:**	**9**

Strong ground motion parameters – amplitude - frequency content - duration, Estimation of ground motion parameters - Deterministic seismic hazard analysis - probabilistic seismic hazard analysis

Unit – III	**Ground Response Analysis:**	**9**

Kinematics of earthquake wave propagation from source to site - characteristics of ground motion – Factors influencing ground motion – Evaluation of shear wave velocity – Lab tests – Site effects - Design ground Motion - developing design ground motion -need for ground response analysis – methods of ground response analysis.

Unit – IV	**Liquefaction:**	**9**

Concepts of liquefaction - factors affecting liquefaction potential - cyclic shear stress - laboratory determination of liquefaction potential - cyclic resistance ratio and its determination using field and laboratory experiments - factor of safety against liquefaction - simplified procedure for evaluation of liquefied potential as per IS 1893 - (part 1): 2016 (SEED Method)

Unit – V	**Seismic Analysis and Design of Various Geotechnical Structures:**	**9**

Pseudo-static method - pseudo dynamic method - other dynamic methods - seismic analysis of retaining wall - seismic slope stability analysis - behaviour of reinforced soil under seismic - conditions - seismic design of retaining structures - seismic design of shallow foundations, seismic design of pile foundations - Codal provisions/guidelines for seismic design of geotechnical structures.

	Total:45

TEXT BOOK:	
1.	Kramer S.L., Geotechnical Earthquake Engineering, Prentice Hall, International series Pearson Education (Singapore) Pvt. Ltd.,1st edition, 2003.

REFERENCES:	
1.	Bharat Bhushan Prasad, Fundamentals of Soil Dynamics and Earthquake Engineering,1st edition, PHI Learning Pvt.Ltd.,New Delhi, 2009.
2.	Bharat Bhushan Prasad, Advanced Soil Dynamics and Earthquake Engineering, 1st edition, PHI Learning Pvt.Ltd.,New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the intensity of earthquake and strong ground motion parameters from a recorded seismogram	Understanding (K2)
CO2	identify seismic hazard considering the different soil properties and site conditions	Applying (K3)
CO3	apply the principles of wave propagation through soil media to derive ground response analysis	Applying (K3)
CO4	determine factor of safety against liquefaction.	Applying (K3)
CO5	design earthquake resistant geotechnical structures	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	2	1			3						1	3	3
CO5	3	2	1			3						1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	40	30			100
CAT2	10	20	30	40			100
CAT3	10	20	30	40			100
ESE	10	10	40	40			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEE37 - DISASTER PREPAREDNESS AND PLANNING							

Programme& Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	8	PE	3	0	0	3

Preamble	This course imparts knowledge about various natural hazards like earthquakes, slope stability, floods, droughts, and Tsunami and the mitigation measures	
Unit – I	**Introduction to Disasters:**	**9**
Definition - Disaster, Hazard, Vulnerability, Resilience, Risks - Disasters: Types of disasters - Earthquake, Landslide, Flood, Drought, Fire, Forest Fire, Industrial and Technological disasters, Climate Change - Classification, Causes, Impacts - Do's and Don'ts during disaster - Global trends in disasters: Urban disasters, Pandemic, Complex emergencies, Climate change		
Unit – II	**Earthquakes and Tsunami:**	**9**
Earthquakes - Causes of earthquakes – Effects - Plate tectonics - Seismic waves - Measures of size of earthquakes - Earthquake resistant design concepts. Tsunami – Causes – Effects – Undersea earthquakes – Landslides – Volcanic eruptions – Impact of sea meteorite –Remedial measures – Precautions – Case studies.		
Unit – III	**Floods and Droughts**:	**9**
Climatic Hazards – Floods - Causes of flooding - Regional flood frequency analysis – Flood control measures - Flood routing - Flood forecasting - Warning systems. Droughts – Causes - Types of droughts - Effects of drought – Mitigation - Case studies.		
Unit – IV	**Landslides and Slope stability:**	**9**
Landslides - Causes - Principles of stability analysis – Remedial and corrective measures for slope stabilization – Mitigation – Case studies.		
Unit – V	**Disaster Preparedness and Management:**	**9**
Preparedness: Monitoring of phenomena triggering a disaster or hazard, Evaluation of Risk: Application of remote sensing, Data from meteorological and other agencies, Media Reports: Governmental and Community Preparedness. NDLA, National Disaster Management.		
		Total:45

TEXT BOOK:	
1.	Nishith, R. and Singh AK, "Disaster Management in India: Perspectives, issues and strategies, 1stEdition (Reprint), New Royal Book Company**,** 2021.

REFERENCES:	
1.	Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi.
2.	J Michael Duncan and Stephan G Wright, Soil Strength and Slope Stability,2nd edition, John Wiley & Sons, Inc, 2005.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain different forms of disaster and their causes	Understanding (K2)
CO2	identify the causes, effects and precautionary measures of earthquakes and tsunami	Applying (K3)
CO3	articulate the causes and control measures of flood and droughts	Applying (K3)
CO4	choose suitable remedial measures for slope stabilization	Applying (K3)
CO5	develop a disaster management cycle with disaster risk reduction measures	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				2							3	2
CO2	3	2	1			3	1					1	3	3
CO3	3	2	1			3	1					1	3	3
CO4	3	2	1			3	1					1	3	3
CO5	3	2	1			3	1					1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	10	40	50				100
CAT3	10	40	50				100
ESE	20	40	40				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEX01 - REMOTE SENSING AND ITS APPLICATIONS							
(OFFERED BY DEPARTMENT OF CIVIL ENGINEERING)							
Programme& Branch	ALL B.E. / B.TECH PROGRAMMES EXCEPT CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	OE	3	0	2	4
Preamble	This course gives the knowledge on the remote sensing and its working principles. It also describes the Image processing techniques using GIS for real time applications which motivates towards innovations in the relevant fields.						

Unit – I	Principles of Remote Sensing:	9

Definition - Components of Remote sensing - EMR Spectrum - EMR interactions with atmosphere - EMR interactions with Earth - Spectral signature curves of Earth surface features – Concept of Photogrammetry- IFOV – Stereoscope and Its applications.

Unit – II	Orbits and Platforms:	9

Motions of planets and satellites – Newton's law of gravitation - Gravitational field and potential - Escape velocity - Kepler's law of planetary motion - Orbit elements and types – Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Airborne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites .

Unit – III	Sensing Techniques:	9

Classification of remote sensors – Resolution concept : spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors – microwave sensors – Calibration of sensors - High Resolution Sensors - LIDAR , UAV –Orbital and sensor characteristics of live Indian earth observation satellites.

Unit – IV	Data products and interpretation:	9

Photographic and digital products – Types, levels and open source satellite data products –- selection and procurement of data– Visual interpretation: basic elements and interpretation keys – Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification.

Unit – V	Remote Sensing for Urban Planning:	9

Urban Area Definition and Characterization–Base Map Preparation – Urban Land use Classification –Visual and Digital Techniques for Land use Mapping - Urban Structure and Patterns– Urban Land Cover Classification –Feature Extraction techniques –Change Detection – Sprawl Detection and Characterization - Mapping of Urban Morphology –Building Typology

LIST OF EXPERIMENTS / EXERCISES:

1.	Study of Toposheet ,Aerial Photographs and Satellite Images.
2.	Data Input – Onscreen Digitisation – Creation of Point, Line and Polygon layers.
3.	Geo-referencing the base image.
4.	Preparation of Base Map from Survey of India Toposheets.
5.	Extracting area of Interest (AOI).
6.	Preparation of Land use map using Satellite Data.
7.	Preparation of Land cover map using Satellite Data.
8.	Testing stereovision with test card and Stereoscopic acquity.
9.	Mirror stereoscope- base lining and orientation of aerial photographs.
10.	Use of parallax bar to find the height of point.

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Thomas Lillesand, Ralph W. Kiefer, Jonathan ChipmanThomas Lillesand, Ralph W. Kiefer & Jonathan Chipman, "Remote Sensing and Image Interpretation", 7th Edition, Willey Publications, United States, 2015.

REFERENCES/ MANUAL / SOFTWARE:

1.	George Joseph, Jeganathan C, "Fundamentals of Remote Sensing", 3rd Edition, Universities Press (India) Private limited, Hyderabad, 2018.
2.	Basudeb Bhatta, "Remote Sensing and GIS", 2nd Edition, Oxford University Press, Oxford, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	associate the principles of EM spectrum to categories the earth features in an image and the sensor properties for various applications of remote sensing	Understanding (K2) Precision (S3)
CO2	classify the usage about different types of satellites and their orbits	Understanding (K2) Precision (S3)
CO3	discuss the different types of remote sensors	Understanding (K2) Precision (S3)
CO4	demonstrate the concepts of interpretation of satellite imagery	Applying (K3) Precision (S3)
CO5	organize Remote Sensing procedure for Mapping of Urban Elements and their Processes	Applying (K3) Precision (S3)

Mapping of Cos with Pos and PSOs

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		3		3			1			1		
CO2	2	1		3		3			1			1		
CO3	2	1		3		3			1			1		
CO4	3	2	1	3		3			1			1		
CO5	3	2	1	3		3			1			1		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	30				100
CAT2	30	40	30				100
CAT3	10	40	50				100
ESE	30	40	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEO01 - DISASTER MANAGEMENT							
(OFFERED BY DEPARTMENT OF CIVIL ENGINEERING)							
Programme& Branch	**ALL B.E. / B.TECH PROGRAMMES EXCEPT CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**6**	**OE**	3	1	0	4

Preamble	To get idea about the various natural hazards like Earthquakes, slope stability, floods, droughts and Tsunami and the mitigation measures.	
Unit – I	**Introduction to Disasters:**	**9+3**
Definition - Disaster, Hazard, Vulnerability, Resilience, Risks - Disasters: Types of disasters - Earthquake, Landslide, Flood, Drought, Fire, Forest Fire, Industrial and Technological Disasters, Climate Change- Classification, Causes, Impacts – Do's and Don'ts during disaster - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change.		
Unit – II	**Pre and Post Disaster Risk Reduction Strategies:**	**9+3**
Disaster cycle - Phases of Disaster - Disaster Mapping - Predictability, forecasting and Warning - Disaster Preparedness Plan - Land-use Zoning for Disaster Management - Preparing Community through IEC - Disaster Mitigation - Disaster Relief: Search, Rescue and Evacuation - Shelter for Victims - Livestock and Relief Measures - Clearance of Debris and Disposal of the Dead - Control of Situation - Damage Assessment -Rehabilitation: Social and economic Aspects - Reconstruction and Rehabilitation as means of Development.		
Unit – III	**Inter-Relationship between Disasters and Development:**	**9+3**
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Landuse etc. - Climate Change Adaptation - IPCC Scenario and Scenarios in the context of India.		
Unit – IV	**Disaster Management in India:**	**9+3**
Disaster Management Act 2005 - Hazard and Vulnerability profile of India, Roles and responsibilities of community, Panchayat Raj Institutions/Urban Local Bodies (PRIs/ULBs), NGO's States, Centre - Disasters of India and Lesson learnt from it.		
Unit – V	**Applications of Science and Technology for Disaster Management:**	**9+3**
Geo-informatics in Disaster Management (RS, GIS & GPS)- Early Warning and Its Dissemination-Land Use Planning and Development Regulations-Disaster Safe Designs and Constructions-Structural and Non Structural Mitigation of Disasters - Institutions for Disaster Management in India.		
	Lecture:45, Tutorial:15, Total:60	

TEXT BOOK:	
1.	Singhal J.P., "Disaster Management", 1st Edition, Laxmi Publications, India, 2007.

REFERENCES:	
1.	Gupta.M.C., "Manual on natural disaster management in India", NIDM, New Delhi, 2000.
2.	"National Disaster Management Policy", Government of India, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	diagnose the different forms of disaster and their causes.	Understanding (K2)
CO2	construct a disaster management cycle with disaster risk reduction measures	Applying (K3)
CO3	interpret the various effects of development projects	Applying (K3)
CO4	identify the agencies involved to manage the disaster in india	Understanding (K2)
CO5	summarize the role of technology in disaster	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3	1					1		
CO2	3	2	1			3	1					1		
CO3	3	2	1			3	1					1		
CO4	2	1				3	1					1		
CO5	2	1				3	1					1		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	10	30	60				100
CAT3	30	70					100
ESE	20	50	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEO02 - INTRODUCTION TO SMART CITIES							
(OFFERED BY DEPARTMENT OF CIVIL ENGINEERING)							
Programme& Branch	**ALL B.E. / B.TECH PROGRAMMES EXCEPT CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**7**	**OE**	3	0	0	3
Preamble	To understand and explain national smart city mission of India, components, policies, challenges and future of smart city in India.						

Unit – I	**Introduction:**	**9**
Definitions – Evolution – Features and strategies – Challenges – India 100 smart cities policy and mission, smart city planning and development, financing smart cities development. Governance of smart cities – case studies in India.		
Unit – II	**Smart Urban Mobility and Smart Energy:**	**9**
Need for urban mobility – multiple perspectives – objectives – components – emerging concepts and strategies – ICT supported smart mobility systems – policy priorities. Introduction to smart energy – urban density and energy use – objectives – elements of smart energy management system – strategies – smart grid – challenges.		
Unit – III	**Water and Waste Management:**	**9**
Smart water management – definitions – water resource and cycle – functions and objectives – steps in implementation – benefits – policy challenges. Smart waste management – approaches and implementation – existing systems – strategies – challenges and polices.		
Unit – IV	**Smart Environment and Smart Buildings:**	**9**
Global background of environmental concerns – concept of environmental resources - basic environmental challenges – smart environment – stakeholders – ICT framework for environmental management. Intelligent buildings – objectives – components – systems of smart building – benefits, challenges.		
Unit – V	**E- Governance and ICT:**	**9**
Governance challenges in new era – history of smart governance – functions and objectives – ICT in governance – system infrastructure – benefits, challenges and future vision. Taxonomy of layers of ICT architecture – major technology areas – components – emerging technologies in ICT – challenges and concerns in ICT.		
		Total:45

TEXT BOOK:	
1.	Anilkumar P.P, "Introduction to Smart Cities", 1st Edition, Pearson India Education Service Pvt Ltd, Noida,Uttar Pradesh, India, 2019.

REFERENCES:	
1.	Germaine R. Halegoua, "Smart Cities", 1st Edition, The MIT Press Essential Knowledge Series, London, England, 2020.
2.	Andy Pike, Andres Rodriguez-Pose & John Tomaney, "Handbook of Local and Regional Development", 3rd Edition, Taylor & Francis, United Kingdom, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	discuss the importance, features and case histories of smart cities in India	Understanding (K2)
CO2	describe mobility and energy in smart city	Understanding (K2)
CO3	explain water and waste management techniques in smart city	Understanding (K2)
CO4	model smart environment and smart buildings	Applying (K3)
CO5	plan e-governance and ICT in smart city	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		1										
CO2	2	1		1										
CO3	2	1		1	3									
CO4	3	2	1	1	3									
CO5	3	2	1	1	3									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	30	70					100
CAT3	10	30	60				100
ESE	20	50	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEO03 - ENVIRONMENTAL HEALTH AND SAFETY							
(OFFERED BY DEPARTMENT OF CIVIL ENGINEERING)							
Programme& Branch	**ALL B.E. / B.TECH PROGRAMMES EXCEPT CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**7**	**PE**	**3**	**0**	**0**	**3**

Preamble	To enhance the knowledge in regulation and statutory requirements relevant to Environmental, Health and Safety.	
Unit – I	**Occupation, Safety and Management:**	**9**
Occupational Safety - Health and Environmental Safety Management - Principles & practices - Role of Management in Industrial Safety - Organization Behaviour - Human factors contributing to accident.		
Unit – II	**Monitoring for Safety, Health & Environment:**	**9**
Bureau of Indian Standards on Safety and Health: 14489 - 1998 and 15001 - 2000 - ILO and EPA Standards - Principles of Accident Prevention - Definitions - Incident - accident - injury - dangerous - occurrences - unsafe acts - unsafe conditions - hazards - error - oversight - mistakes.		
Unit – III	**Education, Training and Employee Participation in Safety:**	**9**
Element of training cycle - Techniques of training, design and development of training programs - Training methods and strategies types of training - Competence Building Techniques (CBT) - Employee Participation: Purpose - methods - Role of trade union in SHE.		
Unit – IV	**Management Information System:**	**9**
Sources of information on Safety, Health and Environment - Compilation and collation of information - Analysis & use of modern methods of programming - storing and retrieval of MIS for Safety, Health and Environment - QCC HS Computer Software Application and Limitations.		
Unit – V	**Legislation on Safety, Health & Environment:**	**9**
Overview of SHE - The factories act, 1948 (Amended) and Rules - Contract Labour Act - Social Accountability - SA 8000 - Water (Prevention & Control of Pollution) Act 1974 and Rules - Air (Prevention & Control of Pollution) Act 1981 and Rules - Environment Protection Act.		
		Total:45

TEXT BOOK:	
1.	Narayanan K.T., "Safety, Health and Environment Handbook", 1st Edition, McGraw Hill, New Delhi, 2017.

REFERENCES:	
1.	Nicholas P.Cheremisinoff & Madelyn L.Graffia, "Environmental and Health & Safety Management- A Guide to Compliance", 1st Edition, William Andrew Publisher, Norwich, 1995.
2.	David Yates W., "Safety Professional's Reference & Study Guide", 2nd Edition, CRC Press Publishers, New Delhi, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the concept of EHS and their framework.	Applying (K3)
CO2	identify the monitoring principles in workplace systems.	Applying (K3)
CO3	choose the need of training and methods of EHS.	Applying (K3)
CO4	organize the safety auditing management systems and their prevention techniques.	Applying (K3)
CO5	identify the key steps involved in HSE legislations.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1			2	3							
CO2	3	2	1			2	3							
CO3	3	2	1			2	3							
CO4	3	2	1			2	3							
CO5	3	2	1			2	3							

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	15	40	45				100
CAT3	25	40	35				100
ESE	20	45	35				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEO04 - INFRASTRUCTURE PLANNING AND MANAGEMENT							
(OFFERED BY DEPARTMENT OF CIVIL ENGINEERING)							
Programme& Branch	ALL B.E. / B.TECH PROGRAMMES EXCEPT CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	NA	8	PE	3	0	0	3
Preamble	To understand and explain the basic concepts of infrastructure and the challenges to successful infrastructure planning and implementation.						
Unit – I	Basic Concepts Related to Infrastructure:						9
Introduction to infrastructure, Governing Features, Historical overview of Infrastructure development in India, Infrastructure Organizations & Systems							
Unit – II	Infrastructure Planning:						9
Typical infrastructure planning steps, Planning and appraisal of major infrastructure projects, Screening of project ideas, Life cycle analysis, Multi-criteria analysis for comparison of infrastructure alternatives, Procurement strategies, Scheduling and management of planning activities, Infrastructure Project Budgeting and Funding, Regulatory Framework, Sources of Funding							
Unit – III	Private Involvement in Infrastructure:						9
Overview of Infrastructure Privatization - Benefits of Infrastructure Privatization - Problems and Challenges in Infrastructure Privatization							
Unit – IV	Challenges to Successful Infrastructure Planning and Implementation:						9
Mapping and Facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks - 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 – V	Strategies For Successful Infrastructure Project Implementation:						9
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.							
							Total:45

TEXT BOOK:

1.	Neil S Grigg, "Infrastructure Engineering and Management", 1st Edition, John Wiley & Sons, 1988.

REFERENCES:

1.	Ronald Hudson W., Ralph Haas & Waheed Uddin, "Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation", 1st Edition, McGraw-Hill, New Delhi, 1997.
2.	World Development Report: Infrastructure for Development, 1994.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the basic concepts related to Infrastructure	Understanding (K2)
CO2	demonstrate the various analysis techniques in infrastructure planning	Applying (K3)
CO3	explain the role of private sector in infrastructure growth	Understanding (K2)
CO4	explain the challenges in infrastructure planning and management	Understanding (K2)
CO5	carry out strategic planning for successful Infrastructure Project implementation.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1			1									
CO2	3	2	1		1									
CO3	2	1			1									
CO4	2	1			1									
CO5	3	2	1		1									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	30				100
CAT2	30	40	30				100
CAT3	30	40	30				100
ESE	30	40	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEO05 - ENVIRONMENTAL LAWS AND POLICY						
(OFFERED BY DEPARTMENT OF CIVIL ENGINEERING)						
Programme& Branch	**ALL B.E. / B.TECH PROGRAMMES EXCEPT CIVIL ENGINEERING**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**NIL**	**8**	**PE**	3	0	0	3

Preamble	To enhance the basic concepts of environmental regulations to ensure environmental safety along with the amendments.	
Unit – I	**Overview of Environment & Law:**	**9**
Origin of Environmental Law - Indian Constitution and Environmental Protection - Multilateral Environmental agreements and Protocols - Montreal Protocol, Kyoto agreement, Rio declaration - Environmental Protection Acts.		
Unit – II	**Environment Protection Mechanisms:**	**9**
Introduction to Public Interest Litigation - Forest Cases & Responses (Case Laws) - Right to Information Act - Introduction to Environment Tribunals -The National Green Tribunal Act, 2010.		
Unit – III	**National Environmental Laws:**	**9**
Environmental Law and the Indian Constitution - The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 and Forest Conservation Act, 1980 - Panchayats Extension to Scheduled Areas (PESA) Act 1996 - Wildlife Protection Act, 1972 - Land Acquisition Act, 1894 - Tenure & Property Rights and Community Rights.		
Unit – IV	**Environment (Protection) Act 1986:**	**9**
Provisions of Act - Delegation of powers - Role of state and central government - Siting of industries - Coastal zone regulations - Responsibilities of local bodies - Legislation's on Solid waste Management (MSW, Biomedical, Plastic, E-waste & Hazardous waste)		
Unit - V	**Role of Regulatory Boards:**	**9**
Sustainable Development - Roles and functions of Regulatory bodies and Local bodies - Significance - Organisational setup - TNPCB - CPCB -TWAD Board - CMWSSB - Case Studies.		
		Total:45

TEXT BOOK:	
1.	Aruna Venkat, "Environmental Law and Policy", 1st Edition, PHI learning private limited, New Delhi, 2011.
REFERENCES:	
1.	CPCB, "Pollution Control Acts, Rules and Notifications issued there under Pollution Control Series -PCL/2/1992", 1st Edition, Central Pollution Control Board, New Delhi, 1997.
2.	Shyam Divan & Armin Roseneranz, "Environmental law and policy in India", 1st Edition, Oxford University Press, New Delhi, 2001.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the origin and behaviour of environmental protection acts.	Understanding (K2)
CO2	illustrate the environmental protection mechanisms based on environmental indicators.	Understanding (K2)
CO3	describe the national environmental policies for enhanced ecology.	Understanding (K2)
CO4	classify the significance of federal and state environmental protection acts.	Understanding (K2)
CO5	recommend the code of ethics given by pollution regulatory boards to safeguard the environment.	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1			3									
CO2	2	1			3									
CO3	2	1			3									
CO4	2	1			3									
CO5	3	2			3									

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40		100				
CAT2	40		100				
CAT3	35		100				
ESE	35		100				

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CYO01 - INSTRUMENTAL METHODS OF ANALYSIS

Programme & Branch	All BE / BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	Instrumental methods of analysis aim to prepare the students to have all-encompassing knowledge of spectral methods in order to identify the molecules and reaction mechanism for the process to enhance application towards the industries.

Unit – I	Absorption and Emission Spectroscopy	9+3

Basic concepts of Absorption and Emission Spectroscopy – representation of spectra – basic elements of practical spectroscopy – signal to noise ratio - techniques for signal to noise enhancement – resolving power – Fourier transform spectroscopy – evaluation of results – basic principles, instrumentation and applications of Atomic Absorption, Atomic Fluorescence and Atomic Emission Spectroscopy.

Unit – II	IR, Raman and NMR Spectroscopy	9+3

Infrared Spectroscopy – correlation of IR Spectra with molecular structure, instrumentation, samplings technique and quantitative analysis.
Raman Spectroscopy – Classical and Quantum theory instrumentation, Structural analysis and quantitative analysis.
Nuclear Magnetic resonance Spectroscopy – basic principles – pulsed Fourier transform NMR spectrometer – Structural elucidation using NMR spectra and quantitative analysis.

Unit – III	Surface Studies	9+3

Surface Study – X-Ray Emission Spectroscopy (XES), X- Ray Photo Electron Spectroscopy (XPS) - Auger Electron Spectroscopy (AES) - Transmission Electron Microscopy (TEM) - Scanning Electron Microscopy (SEM) - Surface Tunneling Microscopy (STEM) - Atomic Force Microscopy (AFM).

Unit – IV	Mass Spectroscopy	9+3

Mass spectroscopy – Ionization methods in mass spectroscopy – mass analyzer – ion collection systems - correlation of molecular spectra with molecular structure - Instrumentation design and application of Fourier Transform Mass Spectroscopy (FT-MS) and Ion Microprobe Mass Analyzer (IMMA).

Unit - V	Thermal Analysis	9+3

Thermal Analysis: principles and instrumentations and applications of Thermogravimetry (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC), evolved gas detection, Thermo Mechanical Analysis and Thermometric Titration.

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1.	Chatwal. G. R., Anand, Sham K., "Instrumental Methods of Chemical Analysis" 5th Edition, Himalaya Publishing House, 2019.

REFERENCES:

1.	B.K. Sharma, Instrumental Method of Chemical Analysis, Krishna Prakashan Media (P) Ltd. 2019.
2.	Willard,H.H, Merritt,L.L, Dean,J.A, and Settle, F.A, "Instrumental methods of analysis" CBS Publishers & Distributors, 7 Ed, 2004.
3.	Kaur. H, "Instrumental Methods of Chemical Analysis", XII Edition, Pragati prakashan, Meerat, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	illustrate the basics of spectroscopy to understand the instrumentation of various spectral techniques.	Understanding (K2)
CO2	apply the IR, Raman and NMR for quantitative analysis of the sample.	Applying (K3)
CO3	apply the various techniques for the better understanding of surface morphology.	Applying (K3)
CO4	explain the principle, instrumentation of mass spectroscopy for the analysis of organic sample.	Understanding (K2)
CO5	illustrate the thermal analysis for the identification of thermal stability of the compounds.	Understanding (K2)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	1												
CO5	3	1												

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

22CYO02 - CHEMISTRY CONCEPTS FOR COMPETITIVE EXAMINATIONS

Programme & Branch	All BE / BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	This course aims to refresh the knowledge of chemistry required for competitive examinations and equip the students with a capacity to solve the problems in chemistry while participating various competitive examinations including TNFUSRC-FORESTER (paper-II: General science-chemistry), UPSC-IAS (prelims: General science-chemistry), GATE (thermodynamics concept for chemical & mechanical engineering).

Unit – I	Periodic Classification of Elements	9+3

Mendeleev's periodic table-Law and classification of elements- Modern periodic law-Modern periodic table and its characteristics - Periodic properties – important aspects of s, p & d block elements -Reactivity series and Uses - Alloys-Uses of Alloys- Properties of nano metals and oxides.

Unit – II	Chemical Equations and Bonding	9+3

Chemical Equations: Types of ions and radicals- oxidation and reduction-redox reactions - balancing ionic equations.
Chemical Bonding: Octet rule -types of chemical bond -formation of ionic and covalent bond- common properties of ionic and covalent compounds- differences between ionic and covalent compounds-Coordinate covalent bond- Coordination compounds – nomenclature and isomerism - application in analytical chemistry.

Unit – III	Acids, Bases, Salts and Metallurgy	9+3

Acid- base theory – Bronsted- Lowry theory- conjugate acid-base- Lewis concept- HSAB- applications- pH scale- Importance of pH in everyday life-salts-classification of salts-uses of salts.
Metallurgy: introduction-terminologies in metallurgy-differences between minerals and ores-occurrence of metals- metallurgy of aluminum, copper and iron.

Unit – IV	Carbon and its Compounds	9+3

Introduction-compounds of carbon-modern definition of organic chemistry- bonding in carbon and its compounds-allotropy-physical nature of carbon and its compounds-chemical properties of carbon compounds-homologous series-hydrocarbons and their types-functional groups- classification of organic compounds based on functional group-ethanol-ethanoic acid.

Unit – V	Thermodynamics	9+3

Introduction- some important terms in thermodynamics-thermodynamic system, process, properties and energy- first law of thermodynamics: mathematical expression and interpretation- applications of first law of thermodynamics-molar heat capacity-reversible isothermal expansion/compression of an ideal gas-adiabatic expansion of an ideal gas-isobaric and isochoric processes in ideal gases- second laws of thermodynamics: entropy- entropy change for isolated system (system and surroundings)- entropy change for system only (ideal gas)- entropy change for mixing of ideal gases-entropy of physical changes- entropy of chemical changes-Maxwell relations.

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1.	Steven S. Zumdahl, Susan A. Zumdahl and Donald J. DeCoste , "Chemistry", 10th Edition, Cengage Learning, 2018., for Units-I, II, III, IV.
2.	Wiley editorial board. "Wiley Engineering Chemistry". 2nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019, for Units- I, II, III, V.

REFERENCES:

1.	B.R. Puri, L.R. Sharma, Principles of Inorganic Chemistry, 33rd Edition, Vishal Publishing Co., 2020.
2.	Paula Bruise, "Organic Chemistry", 8th Edition, Pearson Education, 2020.

	COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	apply the basic concept of periodic classification of elements to explain the periodic properties and reactivity series of s, p & d block elements.	Applying (K3)
CO2	utilize the concepts of chemical equation and bonding to solve the problems in balancing ionic equation and differentiate ionic and covalent compounds.	Applying (K3)
CO3	apply the concept of acid, base, salts and metallurgy to explain HSAB concepts, Importance of pH in everyday life, classification of salts and metallurgy of Al, Cu & Fe.	Applying (K3)
CO4	make use of the concept of carbon and its compounds to explain bonding and classification of carbon compounds.	Applying (K3)
CO5	utilize the important terms and concepts of thermodynamics to explain the first law and second law of thermodynamics with examples.	Applying (K3)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	2	1											
CO3	3	2	1											
CO4	3	2	1											
CO5	3	2	1											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100
* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)							

22CYO03 – ORGANIC CHEMISTRY FOR INDUSTRY							

Programme & Branch	All BE / BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5	OE	3	1	0	4

Preamble	Organic Chemistry for Industry aims to equip the students to have wide-range knowledge on organic chemistry in order to meet the industrial needs.

Unit – I	Basic aspects of Organic Chemistry	9+3

Organic intermediates: carbocations, carbanions, free radicals, carbenes and nitrenes, their method of formation, stability and synthetic applications- Nucleophilic uni- and bimolecular reactions (SN1 and SN2)- Elimination reactions (E1 & E2; Hoffman & Saytzeff's rule).

Unit – II	Molecular Rearrangements	9+3

Reactions involving electron deficient, carbon, nitrogen, oxygen centers, emphasis on synthetic utility of the rearrangements - Migration of carbon: Wagner-Meerwein, Pinacol-pinacolone, benzyl-benzilic acid rearrangement – Migration of nitrogen: Beckmann rearrangement, Hofmann, Curtius, Lossen rearrangements- Migration of oxygen: Bayer-Villiger oxidation.

Unit – III	Synthetic Reagents & Applications	9+3

Lithium aluminium hydride- sodium borohydride- selenium-di-oxide- osmium tetroxide- phenyl isothiocyanate- N-bromosuccinamide (NBS)- lead tetraacetate - dicyclohexylcarbodiimide (DCC) – pyridinium chlorochromate (PCC) – Swern oxidation –p-toluenesulphonyl chloride – trifluoroacetic acid- lithium diisopropylamide (LDA) – 1,3- dithiane (reactive umpolung) - crown ethers-Trimethyl silyl iodide - dichlorodicyanobenzoquinone (DDQ) – Gilman reagent– phase transfer catalysts- Wilkinson's catalysts.

Unit – IV	Unit Operations	9+3

Extraction: Liquid equilibria-extraction with reflux-extraction with agitation-counter current extraction. **Filtration:** Theory of filtration- pressure and vacuum filtration-centrifugal filtration.
Distillation: Azeotropic and steam distillation. **Evaporation**: Types of evaporators-factors affecting evaporation. **Crystallization:** Crystallization from aqueous-non- aqueous solutions factors affecting crystallization-nucleation.

Unit – V	Unit Processes	9+3

Nitration: Nitrating agents-aromatic nitration-kinetics and mechanism of aromatic nitration- process equipment for technical nitration-mixed acid for nitration.
Halogenation: Kinetics of halogenations-types of halogenations-catalytic halogenations-Case study on industrial halogenation process.
Fermentation: Aerobic and anaerobic fermentation. Production of Antibiotics: Penicillin and Streptomycin-Production of Vitamins: B2 and B12.

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:	
1.	P.S.Kalsi," Organic Reactions and their Mechanisms", 5th Edition, New Age International publishers, 2020, for Unit-I, II, III, V.
2.	Arun Bahl, B.S.Bahl, "Advanced Organic Chemistry", 6th Edition, S Chand, 2022, for Unit-IV, V.

REFERENCES:	
1.	V.K.Ahluwalia, Rakesh Parashar, "Organic Reaction Mechanisms" Fourth Edition, 2011
2.	Jonathan Clayden, Nick Greeves, Stuart Warren, "Organic Chemistry", 2nd Edition, Oxford University Press, 2014.
3.	Paula Yurkanis Bruice, "Organic Chemistry",8th Edition, Pearson, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	illustrate the basic concept of organic intermediates to explain the SN1, SN2, E1 and E2 reactions.	Understanding (K2)
CO2	utilize the concepts of molecular rearrangement to explain reactions involving electron deficient, carbon, nitrogen, oxygen centers, emphasis on synthetic utility of the rearrangements.	Applying (K3)
CO3	select the suitable synthetic regents for various functional group conversions in organic synthesis.	Applying (K3)
CO4	make use of the concept of extraction, filtration, distillation, evaporation, crystallization for the purification of organic compounds.	Applying (K3)
CO5	apply the concept of nitration, halogenations and fermentation to explain the industrial unit process.	Applying (K3)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100
* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)							

	22CYO04 - CORROSION SCIENCE AND ENGINEERING						

Programme & Branch	**All BE / BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**6**	**OE**	**3**	**1**	**0**	**4**

Preamble	Corrosion science and engineering aims to equip the students to have a wide-range of knowledge on corrosion and prevention methods in order to meet the industrial needs.

Unit – I	**Corrosion and its Units**	**9+3**

Introduction- electro chemical mechanism Vs chemical mechanism - emf series and Galvanic series – galvanic corrosion – area effect in anodic and cathodic metal coatings – prediction using emf series and galvanic series - Pilling Bedworth's ratio and it consequences (Problems) – units of corrosion rate: mdd (milligrams per square decimeter per day), mmpy (millie miles per year) and mpy (mils per year) –- importance of corrosion prevention in various industries: direct and indirect effects of determining corrosion rates - weight loss method, weight gain method and chemical analysis of solution.

Unit – II	**Thermodynamics of Corrosion**	**9+3**

Electrode potentials, Electrical double layer, Gouy−Chapman model, Stern model, Bockris – Devanathan−Müller model - free energy and oxidation potential - criterion of corrosion (Problems) - basis of Pourbaix Diagrams - Pourbaix diagrams of water, magnesium, aluminium and Iron - limitations.

Unit – III	**Kinetics of Corrosion**	**9+3**

Electrochemical polarization – Evan's diagram – activation polarization – concentration polarization - mixed potential theory(Wagner and Traud) – application of mixed potential theory – effect of metal in acid solution – cathodic protection of iron in acid solution – effect of cathodic reaction – effect of cathodic area – passivity – Flade potential – theories of passivity - adsorption theory – oxide film theory – film sequence theory.

Unit – IV	**Types of Corrosion**	**9+3**

Introduction - (i) Crevice - differential aeration corrosion (ii) pitting – mechanism and factors (iii) intergranular- chromium depletion theory, weld decay and knife line attack (iv) stress - SCC mechanism and fatigue- Cavitation damage – fretting damage (v) stray current corrosion - causes and its control.

Unit - V	**Prevention of Corrosion**	**9+3**

Inhibitors – types of inhibitors, chemisorption of inhibitors, effect of concentration, effect of molecular structure, vapour phase inhibitors – prevention of corrosion at the design stage and in service conditions – control of catastrophic oxidation and hydrogen disease – Langelier saturation index and its uses - corrosion prevention by surface coatings – phosphating and its uses -principles and procedures of cathodic protection: sacrificial anodes and external cathodic current impression- painting, vitreous enamels, plastic lining.

	Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:	
1.	E. McCafferty, Introduction to Corrosion Science, 2nd Edition, Springer, 2017.

REFERENCES:	
1.	R. Winston, Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering, Revised 4th Edition, Wiley publisher, 2008.
2.	Fontanna, "Corrosion Engineering", (Materials Science and Metallurgy series), McGraw Hill international Ed., 2005.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	illustrate the mechanism, expression of rate of corrosion and importance of corrosion studies to familiarize for industrial needs.	Understanding (K2)
CO2	demonstrate the thermodynamics and kinetics of different models of corrosion with respect to the environment.	Applying (K3)
CO3	utilize the theories of corrosion to interpret with the real time applications.	Applying (K3)
CO4	organize the various types of corrosion to understand the corrosion problems.	Applying (K3)
CO5	summarize the corrosion prevention methods to avoid corrosion related issues.	Understanding (K2)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	1												

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

22CYO05 - CHEMISTRY OF COSMETICS IN DAILY LIFE

Programme & Branch	All BE / BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	OE	3	1	0	4

Preamble	
	This course aims to provide knowledge on chemistry of cosmetics for engineering students.

Unit 1	Formulation of Cosmetic Product	9+3

Introduction - basic sciences of cleansing – surfactant and adsorption, surfactant micelles, surfactants and cleansing, surfactants and foam (foam formation, stability, drainage, rupture and collapse and defoaming) - basics of dispersions - electrical charges associated with surfaces and barriers – basics of emulsion (stability, Ostwald ripening, prevention of creaming and sedimentation).

Unit 2	Structuring Materials and Regulation for Cosmetics	9+3

Introduction - water/hydrophilic base materials, oleaginous/hydrophobic base materials and amphiphilic substances - adding functions and effects - materials that add or improve functional value, emotional value and materials for quality control – cosmetic and personal care product safety – potential contaminants in cosmetics – regulations related to cosmetics – cosmetic regulation in india - future challenges in cosmetics material development.

Unit 3	Polymers in Cosmetic Products	9+3

Polymers in Cosmetics - polymer solubility and compatibility, polymer conformation - polymers that modify surfaces - film-forming polymers in cosmetics and personal care products - hair-conditioning polymers - polymers for the treatment of skin - polymers as controlled release matrices - dendritic polymers - polymeric antimicrobials and bacteriostats.

Unit 4	Natural Products and Fragrance in Cosmetics	9+3

Introduction – natural products – extraction methods - encapsulation and controlled release - allergens in cosmetics – testing for allergens - aroma chemicals - fragrance creation and duplication - fragrance applications -– malodor – fragrance allergies and sensitivities.

Unit 5	Preparation of Cosmetics	9+3

Cosmetics in day to day life – characteristics, types, formulation, preparation and evaluation methods of lipstick, shampoo, powder, nail lacquer, creams, toothpaste and hair dye.

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:	
1.	Kazutami Sakamoto, Robert Y. Lochhead, Howard I. Maibach, Yuji Yamashita, Cosmetic Science and Technology: Theoretical Principles and Applications, Elsevier, 2017 , for Units- I, II, III, IV, V.
2.	Gaurav Kumar Sharma, Jayesh Gadiya, Meenakshi Dhanawat A text book of cosmetic formulation, 2018, for Unit-V.

REFERENCES:	
1.	R.K. Nema, K.S. Rathore , B.K. Dubey, Textbook of Cosmetics, CBS Publishers and Distributors, 2017.
2.	Bruno Burlando, Elisa Bottini-Massa, LuisellaVerotta, Laura Cornara, Herbal Principles in Cosmetics: Properties and Mechanisms of Action, CRC Press, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	outline the formulation of cosmetics products.	Understanding (K2)
CO2	identify the structuring materials and regulation involved in cosmetics development.	Applying (K3)
CO3	interpret the polymers and its role in cosmetics.	Understanding (K2)
CO4	develop knowledge about natural products and Fragrance in Cosmetics.	Applying (K3)
CO5	apply the knowledge of cosmetics to explain the characteristics, formulation, preparation and quality control of different cosmetic products used in day to day life.	Applying (K3)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	3	2	1											
CO3	3	1												
CO4	3	2	1											
CO5	3	2	1											

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100
* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)							

22CYO06 – NANOCOMPOSITE MATERIALS							

Programme& Branch	All BE / BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	OE	3	1	0	4

Preamble	This course aims to equip the students to have knowledge on processing, characterization, properties, features and applications of nanocomposites.

Unit – I	Introduction of nanocomposites	9+3

Introduction – nanocomposites – nanocomposites past and present – nomenclature – composite materials: introduction to solids - atomic and molecular solids – role of statistics in materials – primary, secondary and tertiary structure – transitions.

Unit - II	Properties and features of nanocomposites	9+3

Properties: physics of modulus – continuum measurements – yield – fracture – rubbery elasticity and viscoelasticity – composites and nanocomposites – surface mechanical properties –diffusion and permeability – features of nanocomposites: basics of polymer nanocomposites - nano reinforcements – matrix materials – hazards of particles.

Unit - III	Processing of nanocomposites	9+3

Viscosity: types of flow, experimental viscosity, non-newtonian flow -low-viscosity processing: solvent processing, particle behavior, in situ polymerization, post-forming, hazards of solvent processing - melt, high shear and direct processing: melting and softening, melt processes with small shears or low-shear rates flow, meltprocesses with large deformations or high-shear rates, thermo-kinetic processes.

Unit - IV	Characterization of nanocomposites	9+3

Introduction to characterization – experiment design – sample preparation – imaging –structural characterization – scales in nanocomposites – texture – electromagnetic energy –visualization – physicochemical analysis – characterization of physical properties.

Unit - V	Applications of nanocomposites	9+3

Nanocomposites – optical, structural applications – nanoparticulate systems with organic matrices – applications – biodegradable protein nanocomposites – applications-polypropylene nanocomposites – application as exterior automatic components – hybrid nanocomposite materials – application for corrosion protection.

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1.	Thomas E. Twardowski, "Introduction to Nanocomposite Materials – Properties, Processing, Characterization", DesTech Publications, April 2007, for Units-I, II, III, IV.
2.	Klaus Friedrich, Stoyko Fakivov, Zhony Shang, "Polymer Composites from Nano – to Macro – scale", Springer USA, 2005, for Units-I, II, V.

REFERENCES:

1.	Pulickel M. A, Linda S. S, Paul V.B, "Nanocomposite Science and Technology", Wiley-VCH, 2006.
2.	Vikas Mittal, Characterization techniques for polymer nonocomposites, Wiley-VCH, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the knowledge of nanocomposites and to explain its structure.	Applying (K3)
CO2	apply the knowledge on various properties and features of nanocomposites.	Applying (K3)
CO3	choose the various concepts involving in the processing of nanocomposites.	Applying (K3)
CO4	apply the acquired knowledge on characterization of nanocomposites.	Applying (K3)
CO5	organize the applications of nanocomposites in various fields.	Applying (K3)

Mapping of COs with POs and PSOs														
COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

22CYO07 - WASTE AND HAZARDOUS WASTE MANAGEMENT							

Programme & Branch	All BE / BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	OE	3	0	0	3

Preamble	Waste and Hazardous waste management aims to equip the students to have a wide-range of knowledge on waste management.

Unit – I	Solid Waste Management	9

Solid wastes: definition, sources, types, composition of solid waste- Solid waste management system: collection, separation, processing and transformation of solid waste – combustion, aerobic composting, vermicomposting, pyrolysis, landfill-classification, types, methods and control of leachate in landfills - recycling of material found in municipal solid waste- recycling of paper and cardboard, recycling of plastics, recycling of glass.

Unit – II	Hazardous Waste Management	9

Hazardous wastes: definition, nature and sources of hazardous waste, classification and characteristics of hazardous waste-chemical class of hazardous waste, generation, segregation, treatment and disposal: waste reduction, waste minimization, recycling - chemical treatment: acid base neutralization, chemical precipitation, oxidation/reduction, hydrolysis, electrolysis, chemical extraction and leaching, ion exchange, photolytic reaction- thermal treatment methods: incineration – biodegradation of hazardous waste: aerobic, anaerobic, reductive dehalogenations - land treatment and composting.

Unit – III	E- Waste & Biomedical Waste Management	9

E-Waste Management: definition, sources, classification, collection, segregation, treatment and disposal.
Biomedical Waste Management : Introduction-definition –components of biomedical waste-waste generation –waste identification and waste control-waste storage-labeling and color coding-handling and transportation-waste treatment and disposal-autoclave, hydroclave , microwave treatments- chemical disinfection – sanitary and secure landfill.

Unit – IV	Pollution From Major Industries And Management	9

Introduction- sources and characteristics - waste treatment flow sheets for selected industries such as textiles, tanneries, pharmaceuticals, sugar, petroleum refinery, fertilizer and dairy industries.

Unit – V	Solid Waste Management and Legislation	9

Solid waste management plan - solid waste (management and handling) rules - biomedical waste (management and handling) rules- plastic waste management rules - e-waste management rules - hazardous and other wastes (management and transboundary movement) rules - construction and demolition waste management rules.

	Total: 45

TEXT BOOK:

1.	George Tchobanoglous, Hillary Theisen, Samuel a Vigil, Integrated solid waste management (Engineering principle and management issues) McGraw hill Education (India) Pvt. Ltd., 2015, for Unit-I, II, V.
2.	SC Bhatia, Handbook of Industrial pollution and control (Volume-1), CBS Publisher and Distributers, New Delhi, 2002, for Unit-II, III, IV, V.

REFERENCES:

1.	Manual on Municipal Solid Waste management, Central public Health and Environmental Engineering Organization (CPHEEO), Govt. of India, May 2000.
2.	Michael D. LaGrega, Phillip L. Buckingham, Jeffrey C. Evans, Hazardous waste management, MEDTEC, 2015.
3.	Majeti Narasimha Vara Prasad, Meththika Vithanage, Anwesha Borthakur, "Handbook of Electronic Waste Management: International Best Practices and Case Studies" 1st Edition, Butterworth-Heinemann, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the technical points that are required to set up a solid waste management system.	Applying (K3)
CO2	explain the various disposal and treatment methods of hazardous wastes.	Understanding (K2)
CO3	organize the appropriate method for managing e-waste and biomedical waste.	Applying (K3)
CO4	identify the hazards from various industries and apply the waste management techniques for its treatment.	Applying (K3)
CO5	relate the legal legislation to solid waste management.	Understanding (K2)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1			3							
CO2	2	1					3							
CO3	3	2	1	1			3							
CO4	3	2	1	1			3							
CO5	2	1					3							

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

	22CYO08 - CHEMISTRY IN EVERY DAY LIFE						

Programme& Branch	**All BE / BTech Branches**	**Sem.**	**Category**	**L**	**T**	**P**	**Credit**
Prerequisites	**Nil**	**7**	**OE**	**3**	**0**	**0**	**3**

Preamble	This course aims to prepare the students to have the knowledge on oils, fats, sugar, adulterants in food, creams, milk powder, soil, fertilizer, pesticides, insecticides, fungicides and herbicides in order to know its chemistry in our everyday activities.

Unit – I	Oils, Fats and Sugar	9

Distinction between oils and fats – properties – classification – edible oils – vegetable oils –animal oils – manufacture of oils by solvent extraction – refining of crude vegetable oils – processing of animal fats – manufacture of cane sugar – manufacture of sucrose from beet root.

Unit – II	Adulterants in food	9

Food Adulteration and prevention – common food adulterants – food additives – food colorants– preservatives – flavourants – food poisoning – analysis of adulterants in edible oils, coffee powder, chilli powder, turmeric powder, meat , fish, ghee and milk – harmful effects of food adulterants

Unit – III	Creams and Milk powder	9

Creams: Composition-chemistry of creaming process- Factors influencing cream separation (Mention the factors only) - Estimation of fat in cream - Milk powder: Need for making powder-drying process- spraying, drum drying, jet drying and foam drying-principles involved in each.

Unit – IV	Soil and Fertilizers	9

Soil analysis: Composition of soil - Organic and Inorganic constituents-Soil acidity - buffering capacity of soils -Liming of soil - Fertilizers: primary nutrients –role of Nitrogen, potassium and phosphorous on plant growth –Complex fertilizers and mixed fertilizers and its composition - Secondary nutrients – micronutrients and their functions in plants -optimal addition of Fertilizers to obtain estimated yield.

Unit – V	Pesticides, Insecticides, Fungicides and Herbicides	9

Pesticides – Classification – general methods of application and toxicity, Safety measures when using pesticides-Insecticides: Inorganic pesticides – borates - Organic pesticides – D.D.T. and BHC-Plant derivatives: pyrethrin and Nicotine - Synthetic organic pesticides: Endrin and Aldrin (Chemical name - Structure- functions and uses)-Fungicides: Inorganic (Bordeaux mixture) and organic (dithiocarbamate) fungicides - Industrial fungicides: Creosote fractions - Herbicides: Selective and non-selective - 2, 4-dicholorophenoxyacetic acid and 2,4,5-tricholorophenoxyaceticacid (structure and function).

	Total: 45

TEXT BOOK:	
1.	Sharma B K , Industrial Chemistry, Goel publishing house, New Delhi, 2011, for Units- I, II, IV
2.	Alex V Ramani, Food Chemistry, MJP Publishers, Chennai, 2009, for Units -II, III, V.

REFERENCES:	
1.	Dilip Kumar Das, Introductory Soil Science, 1st Edition, Kalyani Publishers, Reprint 2002.
2.	K. Bagavathi Sundari– "Applied Chemistry", MJP Publishers, Chennai, 2006.
3.	Ashutosh Kar, Medicinal Chemistry, Wiley Eastern limited, New Delhi, 1993.

COURSE OUTCOMES: On completion of the course, the students will be able to	**BT Mapped (Highest Level)**
CO1	outline the importance of oils, fats and sugar.	Understanding (K2)
CO2	identify the harmful effects of adulterants in food.	Applying (K3)

CO3	develop the knowledge on creams and milk powder.		Applying (K3)
CO4	interpret the nature and composition of soil and fertilizers.		Understanding (K2)
CO5	illustrate the difference of pesticides, insecticides, fungicides and herbicides.		Understanding (K2)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1												
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	1												
CO5	3	1												

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

22CYO09 - CHEMISTRY OF NUTRITION FOR WOMEN HEALTH

Programme & Branch	All BE / BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	**Nil**	**8**	**OE**	**3**	**0**	**0**	**3**

Preamble	This course aims to provide knowledge for engineering students on components of health, fitness and also the role of nutrition for women health.

Unit 1	**Nutrition**	9

Energy- functions, sources and concept of energy balance - recommended dietary allowances, dietary sources - effects of deficiency and/ or excess consumption on health of the following nutrients: carbohydrates and dietary fibre – lipids – proteins - fat soluble vitamins: A, D,E and K - water soluble vitamins: Thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C – minerals: calcium, iron, zinc and iodine.

Unit 2	**Women Health**	9

Disease pattern and reproductive health- menopause – hypothyroid- PCOD-diabetes - policies and programs for promoting maternal and child nutrition and health - concept of small family - methods of family planning - merits and demerits.

Unit 3	**Nutrition for Nursing Mother and Infants**	9

Physiology and psychology of lactation, hormonal control, composition of colostrums and breast milk, nutritional requirements of a nursing mother, advantages of breast feeding, food and nutritional requirements for infants, weaning and supplementary foods for infants and immunization.

Unit 4	**Nutrition for Physical Fitness**	9

Significance of physical fitness and nutrition in the prevention and management of weight control, obesity, diabetes mellitus, CV disorders, bone health and cancer - nutrition and exercise regimes for pre and postnatal fitness - nutritional and exercise regimes for management of obesity - critical review of various dietary regimes for weight and fat reduction - prevention of weight cycling.

Unit 5	**Role of Women in National Development**	9

Women in family and community: Demographic changes menarche, marriage, fertility, morbidity, mortality, life expectancy, sex ratio, aging, widowhood. Women in society: Women's role, their resources, and contribution to family, and effect of nutritional status.

	Total: 45

TEXT BOOK:	
1.	Srilakshmi, B., Nutrition Science, New Age International (P) Ltd., New Delhi, 2017, for Units- I, IV, V.
2.	Arpita Verma, Women's Health and Nutrition: Role of State and Voluntary Organizations, Rawat Publishers, 2017, for Units - II, III, IV.

REFERENCES:	
1.	Shubhangini A Joshi , Nutrition and Dietetics, TataMacGraw Hill, 2010.
2.	Rujuta Diwekar, Women and The Weight Loss Tamasha, Westland ltd, 2010.
3.	Swaminathan, M., Advanced Textbook on Food and Nutrition, Vol. 1, Second Edition, Bangalore Printing and Publishing Co. Ltd., Bangalore, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	make use of the knowledge of dietary sources in day to day life.	Applying (K3)
CO2	explain the disease pattern and policies towards women health.	Understanding (K2)

CO3	develop knowledge about nutrition during lactation and for infants.		Applying (K3)
CO4	utilize the knowledge of physical fitness and nutrition towards good health.		Applying (K3)
CO5	interpret the various role of women in society.		Understanding (K2)

Mapping of COs with POs and PSOs

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1											
CO2	3	1												
CO3	3	2	1											
CO4	3	2	1											
CO5	3	1												

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	35	40				100
CAT3	25	35	40				100
ESE	25	35	40				100

* ±3% may be varied (CAT 1, 2 & 3 – 50 marks & ESE – 100 marks)

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE-638060

(AUTONOMOUS)

BOARD OF CIVIL ENGINEERING

DEGREE & PROGRAMME : BE CIVIL ENGINEERING

HONOURS DEGREE TITLE: CONSTRUCTION TECHNOLOGY

S.No	Course Code	Course Title	Credits	Prerequisites	Semester
1.	22CEH01	Sustainable Construction Methods	4	Nil	5
2.	22CEH02	Advanced Concrete Technology	3	Nil	5
3.	22CEH03	Construction Project Planning Systems	4	Nil	6
4.	22CEH04	Construction Cost Analysis	4	Nil	6
5.	22CEH05	Project Formulation and Appraisal	3	Nil	7

22CEH01 - SUSTAINABLE CONSTRUCTION METHODS

Programme & Branch	BE & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5/6/7	HN	3	1	0	4

Preamble	To impart the knowledge on benefits of sustainable construction and methods to Preserve and protect the natural resources that surround the construction site.

Unit – I	Introduction:	9+3

Definitions of Sustainability - Various types of sustainability - Pillars of Sustainability - Circle of Sustainability - Need for Sustainability - systems and their sustainability - sustainability in the built environment context - Green Buildings -Difference between Green and Sustainability - Climate Change, Global warming - National and International policies and Regulations on sustainability

Unit – II	Technology and its effects on the Environment:	9+3

Global Warming, climate change loss of biodiversity - Technological advancements and their effects on the environment - Advancement in building and construction technologies such as steel and concrete technologies, Development of framed structures, multistoried buildings, large span structures, invention of plastics - Effects on the environment - Generation of waste, use of high manufacturing energy, peak oil, depletion of fossil and natural resources.

Unit – III	Green Building Technologies:	9+3

Introduction- Necessity - Concept of Green building. Principles of green building – Selection of site and Orientation of the building – usage of low energy materials – effective cooling and heating systems – effective electrical systems – effective water conservation systems - Certification systems- Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED), case studies

Unit – IV	Sustainable Construction Techniques:	9+3

Alternative construction techniques such as SMB, CSEB, and steam cured blocks, composite beam and panel, funicular shells, filler slabs, reinforced concrete masonry, vaulted roofs, ferrocement walls etc., - Case studies

Unit – V	Waste As A Resource:	9+3

Recycling industrial, agricultural and municipal waste - Recycling waste as alternative material for buildings, landscape and other products - Study of innovative practices for use of recycled material, specifications and construction methods for using recycled waste - Demonstrative architecture and landscape using waste, vermicomposting, biological and thermal energy options - Energy from sanitary landfills, refuse derived fuel and other options.

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	R.L.Rag, "Introduction to Sustainable Engineering",1st Edition, PHI Learning Pvt. Ltd, New Delhi,2015

REFERENCES:

1.	Bill Reed, "The Integrative Design Guide to Green Building: Redefining the Practice of Sustainability", 1st Edition,Wiley India Private Ltd, New Delhi,2009
2.	Rogers Peter P, "An Introduction to Sustainable Development", 1st Edition, Glen Educational Foundation Inc, USA, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	assimilate the concept of sustainability for future	Understanding (K2)
CO2	examine the environmental impact	Applying (K3)
CO3	use of green building technologies	Applying (K3)
CO4	implement sustainable construction techniques	Applying (K3)
CO5	carry out waste as a resource	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	2
CO2	3	2	1										2	2
CO3	3	2	1										2	2
CO4	3	2	1										2	2
CO5	3	2	1										2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	13	70	17				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	10	30	60				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEH02 - ADVANCED CONCRETE TECHNOLOGY								
Programme & Branch	**BE & Civil Engineering**	**Sem.**	**Category**	**L**	**T**	**P**		**Credit**
Prerequisites	**Nil**	**5/6/7**	**HN**	**3**	**0**	**0**		**3**

Preamble	This course imparts knowledge on the microstructure of concrete, advances in concrete technology and non-destructive testing techniques for concrete	
Unit – I	**Microstructure and Properties of Hardened Concrete:**	**9**
Microstructure of aggregate phase – Microstructure of hydrated cement paste – Interfacial transition zone in concrete. Strength – porosity relationship – Failure modes in concrete – Compressive strength and factors affecting the compressive strength- Behavior of concrete under various stress states. Dimensional stability – Elastic behavior – Drying shrinkage & creep – Thermal shrinkage – Thermal properties of concrete.		
Unit – II	**Concrete at Early Age:**	**9**
Workability -Slump loss – Segregation and bleeding – Early volume changes – Setting time – Temperature of concrete – Testing and control of concrete quality – Early age cracking in concrete.		
Unit – III	**Durability of Concrete:**	**9**
Water as an agent of deterioration – Permeability – Classification of the causes of concrete deterioration – Surface wear – Crystallization of salts on the pores – Frost action – Effect of fire – Deterioration of concrete by chemical reactions – Sulfate attack – Alkali-aggregate reaction – Hydration of crystalline MgO and CaO – Corrosion of embedded steel in concrete - Concrete in the marine environment.		
Unit – IV	**Advances in Concrete Technology:**	**9**
Structural light weight concrete – High-Strength concrete – Seif-consolidating concrete – High performance concrete – Shrinkage compensating concrete – Fiber-reinforced concrete – Concrete containing polymers – Shotcrete – Heavyweight concrete for radiation shielding – Pervious concrete – Mass Concrete – Roller-compacted concrete		
Unit – V	**Non-Destructive Testing Methods:**	**9**
Surface hardness methods - Penetration resistance techniques - Pullout tests - Maturity methods - Concrete quality from absorption & permeability tests - Stress wave propagation methods - Electrical methods - Electrochemical methods - Electromagnetic methods - Topography of reinforced concrete.		
		Total:45

TEXT BOOK:

1.	Mehta P. K., and Monteiro P. J. M., "Concrete: Microstructure, Properties, and Materials", 4th Edition, McGraw Hill Education, New Delhi, 2017.

REFERENCES:

1.	Neville A. M. & Brooks, J.J., "Concrete Technology" Pearson Education Limited, 2nd Edition,Pearson Education Limited, Chennai, 2019.
2.	Shetty M.S., "Concrete Technology Theory and Practice", 8th Edition, S.Chand & Company Ltd., New Delhi, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the microstructure and hardened properties of concrete	Understanding (K2)
CO2	outline the factors influencing the concrete at early age	Understanding (K2)
CO3	identify the factors affecting the durability of concrete	Applying (K3)
CO4	compare and contrast the various types of special concrete	Understanding (K2)
CO5	explain the various non-destructive testing techniques in concrete	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3							3	2
CO2	2	1				3							3	2
CO3	3	2	1			3							3	2
CO4	2	1				3							3	2
CO5	2	1				3							3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	60	20				100
CAT3	20	80					100
ESE	20	70	10				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEH03 - CONSTRUCTION PROJECT PLANNING SYSTEMS

Programme & Branch	BE & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	**Nil**	**5/6/7**	**HN**	**3**	**1**	**0**	**4**

Preamble	To enhance the knowledge among management tools and techniques for planning, scheduling, organizing, controlling and monitoring of construction projects.

Unit – I	**Introduction to Project:**	9+3

Concept of a Project – Characteristic features – Project Life cycle – Phases – Project Management – Tools and techniques for project management – Role of project managers - Organization and project team – Communication in project management.

Unit – II	**Construction Planning:**	9+3

Introduction to Construction Projects - Project Categories - Project Participants - Project Life Cycle – Planning – Role of Planning Department in Construction- objectives – principles - stages of planning –Defining work task and precedence relationships among activities- Estimating durations and resources requirements- Coding system

Unit – III	**Project Scheduling:**	9+3

Construction scheduling - Work Breakdown Structure - Project Cost and Time Estimation - Bar Chart - Milestone Chart - CPM - PERT - RPM - LOB - Software's in construction scheduling - Primavera - MSP.

Unit – IV	**Cost Control:**	9+3

Monitoring and control of construction projects – quality control- importance-objectives – methods - cost control –objectives – control systems – direct and indirect cost control – project budgetary control – Project risk analysis and mitigation.

Unit – V	**Organizing and Use of Project Information:**	9+3

Types of project information- accuracy – use of information – computerized information – uses – database – database models- relational model- centralized model- applications.

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Dr. Seetharaman S., "Construction Engineering and Management", 2nd Edition, Umesh Publications, 2000.

REFERENCES:

1.	Chitkara K.K., "Construction Project Management Planning Scheduling and Controlling", 18th Reprint, Tata McGraw Hill, 2009.
2.	Sengupta and Guha, "Construction Management and Planning", 1st Edition, Tata McGraw Hill Publication, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify the owners view on a project in consideration with entire life cycle of project.	Understanding (K2)
CO2	summarize the importance of planning	Understanding (K2)
CO3	determine the project time and cost	Applying (K3)
CO4	recognize the need of project control	Understanding (K2)
CO5	classify the database models and its applications in construction projects	Understanding (K2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											3	3
CO2	2	1											3	2
CO3	3	2	1										3	2
CO4	2	1											3	2
CO5	2	1											3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	40	40	20				100
CAT3	50	50					100
ESE	20	60	20				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEH04 - CONSTRUCTION COST ANALYSIS								

Programme & Branch	BE & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5/6/7	HN	3	1	0	4

Preamble	To improvise the installation and estimate procedure of various construction method and maintenance with effective cost analysis methods.	
Unit – I	**Cost Implications:**	**9+3**
Cost implications to different forms of construction and maintenance - Calculation of construction cost - Cost estimating - Investment Criteria - Discounting Criteria - Accounting -Concepts.		
Unit – II	**Cost Installation:**	**9+3**
Installation and running **-** cost of service - capital investment in project- Labour cost for construction - Cost for general conditions and requirements - Calculation of project cost -Miscellaneous cost in project.		
Unit – III	**Cost Analysis:**	**9+3**
Cost analysis by traders and functional element - Cost control during design and construction - Cost analysis methods - Break Even Analysis - Cash flow analysis - Risk analysis - Capitalized cost analysis - Benefit cost analysis		
Unit – IV	**Cost and Finance:**	**9+3**
Financing of projects-means of finance - Financial institutions - Direct and Indirect cost- Project Crashing - Budgetary control - Need, Objectives -Essentials of Budgeting - Different types of budgets.		
Unit – V	**Cost Estimates:**	**9+3**
Contracts - bonds - Insurance -cost estimates -Types of estimates - Life cycle cost - Strategic planning and cost programming -cost planning - cost curves.		
	Lecture:45, Tutorial:15, Total:60	

TEXT BOOK:

1.	Kumar Neeraj Jha, "Construction Project Management", 2nd Edition, Pearson India Education Services, New Delhi, 2018.

REFERENCES:

1.	Prasanna Chandra, "Projects - Planning Analysis Selection Implementation & Review", 4th Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi.2005.
2.	Joy P.K. "Total Project Management - The Indian Context (Chapters 3 7)", New Delhi, Macmillan India Ltd., 2002.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer the cost implications made to forms of construction	Understanding (K2)
CO2	calculate the serviceability cost of construction	Applying (K3)
CO3	analyse the different methods of cost during design and construction	Analysing (K4)
CO4	interpret the types of costs and budgets incurred for a construction project	Understanding (K2)
CO5	implement strategic planning for cost estimates and programming	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											3	3
CO2	3	2	1										3	2
CO3	3	2	2										3	2
CO4	2	1											3	2
CO5	2	1											3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	30				100
CAT2	20	30	30	20			100
CAT3	10	70	20				100
ESE	20	60	10	10			100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

22CEH05 - PROJECT FORMULATION AND APPRAISAL							

Programme & Branch	BE & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	5/6/7	HN	3	0	0	3

Preamble	To assimilate the elements involved in costing and financial aspects of projects

Unit – I	Project Formulation:	9

Generation and Screening of Project Ideas -Project identification –Preliminary Analysis, Market, Technical, Financial, Economic and Ecological -Pre-Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report –Different Project Clearances required.

Unit – II	Project Costing:	9

Project Cash Flows –Time Value of Money – Time lines and Notations -Cost of Capital - Present and future value of single amount - Simple Interest - Compound Interest- Project cash Flows - Principles of cash flow estimation.

Unit – III	Project Appraisal:	9

NPV–BCR –IRR –ARR –Urgency –Pay Back Period –Assessment of Various Methods –Indian Practice of Investment Appraisal – International Practice of Appraisal –Analysis of Risk –Different Methods –Selection of a Project and Risk Analysis in Practice.

Unit – IV	Project Financing:	9

Project Financing –Means of Finance –Financial Institutions –Special Schemes –Key Financial Indicators - Distinction between Management Accounting and Financial Accounting.

Unit – V	Private Sector Participation:	9

Private sector participation in Infrastructure Development Projects -BOT, BOLT, BOOT -Technology Transfer and Foreign Collaboration -Scope of Technology Transfer.

	Total:45

TEXT BOOK:

1.	Prasanna Chandra, "Projects -Planning Analysis Selection Implementation and Review", 21st Edition, Tata McGraw Hill, New Delhi, 2014.

REFERENCES:

1.	Shishir Dutta, "Project Management: Concepts and Guidance", 1st Edition, Excel India Publishers, New Delhi, 2019.
2.	Joy P.K, "Total Project Management -The Indian Context", 2nd Edition, Macmillan India Ltd, New Delhi, 2002.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	plan for clearances required for a project	Applying (K3)
CO2	calculate the capital in-flow for a project	Understanding (K2)
CO3	infer the appraisal methods and risk analysis for a project	Applying (K3)
CO4	assimilate the funding patterns of financial Institutions for construction projects and the risks involved in it	Understanding (K2)
CO5	interpret the need for technology transfer	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1										2	2
CO2	2	1											2	2
CO3	3	2	1										2	2
CO4	2	1											2	2
CO5	3	2	1										2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	33	34	33				100
CAT2	33	34	33				100
CAT3	33	34	33				100
ESE	33	34	33				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)