KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI ERODE – 638 060

TAMILNADU INDIA

Estd : 1984

REGULATIONS, CURRICULUM & SYLLABI - 2020

(CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION)

(For the students admitted during 2020 - 2021 and onwards)

BACHELOR OF ENGINEERING DEGREE
IN
CIVIL ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

KONGU
Assuring the Best

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638060

(Autonomous)

REGULATIONS 2020

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 2020 – 2021 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" means authorized person who is responsible for all examination related activities of the College.

xi. "Head of the Department" means Head of the Department concerned of the College.

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 in relevant branches of study.

(OR)

The candidates who hold a BSc degree (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 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, 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

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, Comprehensive Test & Viva, Entrepreneurships/Start ups and Internship 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 169.

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 8.0 CGPA and no history of arrears during the entire programme to opt for the honours degree.

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

S. No.	Specializations for Honours degree in emerging areas	To be offered as Honours, Only for the following branches mentioned against the specialization
1.	Construction Technology	Civil Engineering
2.	Robotics	Mechanical Engineering
3.	Electric Vehicles	Mechanical Engineering
4.	Artificial Intelligence and Machine Learning	Mechatronics Engineering
5.	Electric Vehicles	Automobile Engineering
6.	Artificial Intelligence and Machine Learning	Electronics and Communication Engineering
7.	Electric Vehicles	Electrical and Electronics Engineering
8.	Control Systems and Sensors Technology	Electronics and Instrumentation Engineering
9.	Cyber Security	Computer Science and Engineering
10.	Data Science	Computer Science and Engineering
11.	Cyber Security	Information Technology
12.	Data Science	Information Technology
13.	Waste Technology	Chemical Engineering

14.	Food Processing and Management	Food Technology

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, comprehensive test & viva, internship and entrepreneurships/start ups during the programme to gain/exhibit the knowledge/skills.

4.3.1 Professional Skills Training/ Entrepreneurships/Start Ups

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 fifth semester and phase II in sixth 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 sixth semester vacation period. Such candidate can earn two credits for this training course in place of Professional Skills Training course II in sixth semester. He/She shall attend Professional Skills Training Phase I in fifth 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 a maximum of 2 credits per semester for two semesters each in place of either Professional Skills Training I or 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 & 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 Internships

The curriculum enables a candidate to go for full time projects 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 I Phase II 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 Value Added 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 Value Added 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.

4.4 Value Added Courses / Online Courses / Self Study Courses

The candidates may optionally undergo Value Added Courses / Online Courses / Self Study Courses as elective courses.

4.4.1 **Value Added Courses:** Value Added courses each with One / Two credits 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 value added 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 value added 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 eighth 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. Total number of credits of such courses during the entire programme of study cannot exceed eight.

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), 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, Project Work, Professional Skills Training / Industrial Training, Internship 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 / Practical	50	50
2.	Theory cum Practical	The distribution of marks shall be decided based on the credit weightage assigned to theory and practical components.	
3.	Professional Skills Training / / Comprehensive Test & Viva / Entrepreneurships / Start ups / Project Work 1 / Industrial Training / Mandatory Course	100	---
4.	Project Work 2 Phase I / Project Work 2 Phase II / Internships	50	50
5.	Value Added Course	The distribution of marks shall be decided based on the credit weightage	---
6.	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 50 marks and the end semester examination shall be for 50 marks. However, the end semester examinations shall be conducted for 100 marks and the marks obtained shall be reduced to 50. The continuous assessment tests shall be conducted as per the schedule laid down in the academic schedule. Three tests shall be conducted for 50 marks each and reduced to 30 marks each. 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	30	Average of best two
	Test - II	30	
	Test - III	30	
2.	Tutorial	15	Should be of Open Book/Objective Type. Average of best 4 (or more, depending on the nature of the course, as may be approved by Principal)
3.	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	50	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 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 50 marks and the end semester examination shall be for 50 marks. Every exercise / experiment shall be evaluated based on the candidate's performance during the practical class and the candidate's 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.

7.6 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 (both Phase I and 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	Guide	Review Committee (excluding guide)	Guide	Review Committee (excluding guide)	Guide	Ext. Exr.	Guide	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 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 guide 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 Phase 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	Guide	Review Committee (excluding guide)	Guide	Review Committee (excluding guide)	Guide	Review Committee	Guide	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 4th semester vacation and during 5th semester. Phase II training shall be conducted for minimum of 80 hours in 5th semester vacation and during 6th semester. The evaluation procedure shall be approved by the Principal.

7.9 Comprehensive Test/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 two credits in sixth semester respectively 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 Projects through Internships

Each candidate shall submit a brief report about the internship undergone and a certificate issued from the organization concerned at the time of Viva-voce examination to the review committee. The evaluation method shall be same as that of the Project Work II as per clause 7.6.

7.12 Value Added Course

Minimum of two assessments shall be conducted during the value added course duration by the offering department concerned.

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 SF (Satisfactory). 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 Course

A candidate shall attend and complete the induction training program of duration three weeks at the beginning of the first semester. It is mandatory for all candidates who have joined in various branches of all BE/BTech programmes. The induction training program includes the courses recommended by AICTE. Apart from this induction program, a candidate shall undergo the courses listed by AICTE as mandatory courses during their programme. No credits shall be given for such courses and shall be evaluated through continuous assessment tests only vide clause 7.1 for a maximum of 100 marks each. Since these courses have no grade points assigned, these courses will not be counted for the purpose of GPA and CGPA calculations.

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

Courses such as YVHD and UHV shall be offered to all candidates of all BE/BTech programmes. 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, but the grade awarded shall be only the lowest passing grade irrespective of the marks secured.

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.

The candidates who have failed in the courses Professional Skill Training I/II and Comprehensive Test/Viva shall be permitted to take up supplementary examinations.

15. AWARD OF LETTER GRADES

Range of % of Total Marks	Letter Grade	Grade Point
91 to 100	O (Outstanding)	10
81 to 90	A+ (Excellent)	9
71 to 80	A (Very Good)	8
61 to 70	B+ (Good)	7
50 to 60	B (Average)	6
Less than 50	RA (Reappear)	0
Satisfactory	SF	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-2020 (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 and 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 7.00

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 Honours 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 8.00

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 Kongu Engineering 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. DEGREE IN CIVIL ENGINEERING
CURRICULUM UNDER REGULATIONS 2020
(For the candidates admitted from academic year 2020-21 onwards)

SEMESTER – I

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	Theory/Theory with Practical								
20EGT11	English Language Skills	3	0	0	3	50	50	100	HS
20MAC11	Matrices and Differential Equations	3	1*	2*	4	50	50	100	BS
20PHT11	Applied Physics	3	0	0	3	50	50	100	BS
20CYT11	Applied Chemistry	3	0	0	3	50	50	100	BS
20MEC11	Engineering Drawing	2	0	2	3	50	50	100	ES
20CET11	Construction Materials and Practices	3	0	0	3	50	50	100	PC
	Practical								
20PHL11	Physical Sciences Laboratory I	0	0	2	1	50	50	100	BS
20MEL11	Engineering Practices Laboratory	0	0	2	1	50	50	100	ES
20VEC11	Yoga and Values for Holistic Development	1	0	1	1	100	0	100	HS
20MNT11	Student Induction Program #	-	-	-	0	100	0	100	MC
	Total				**22**				

Induction Training Program (including, Indian Constitution and Essence of Indian Knowledge Tradition, etc.) to be conducted at the beginning of the semester for 2 weeks

SEMESTER – II

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
20EGT21	Advanced Communication Skills	3	0	0	3	50	50	100	HS
20MAC21	Multivariable Calculus and Complex Analysis	3	1*	2*	4	50	50	100	BS
20PHT21	Materials Science	3	0	0	3	50	50	100	BS
20CYT21	Chemistry of Building Materials	3	0	0	3	50	50	100	BS
20CET21	Surveying and Geomatics	3	0	0	3	50	50	100	PC
20CET22/ 20CSC31	Engineering Mechanics / Programming in C	3	0	0/2	3/4	50	50	100	ES
Practical									
20PHL20	Physical Sciences Laboratory II	0	0	2	1	50	50	100	BS
20CEL21	Surveying Laboratory	0	0	2	1	50	50	100	PC
				Total	**21/22**				

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

*Alternate week

B.E. CIVIL ENGINEERING CURRICULUM – R2020

SEMESTER – III									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
20MAT31	Probability and Partial Differntial Equations	3	1	0	4	50	50	100	BS
20CSC31/ 20CSC41	Programming in C / Python Programming	3	0	2	4	50	50	100	ES
20CET31/ 20CET22	Mechanics of Materials / Engineering Mechanics	3	1/0	0	4/3	50	50	100	ES
20CET32	Concrete Technology	3	0	0	3	50	50	100	PC
20CET33	Geotechnical Engineering I	3	0	0	3	50	50	100	PC
20CET34	Water Resources and Irrigation Engineering	3	0	0	3	50	50	100	PC
Practical / Employability Enhancement									
20CEL31	Strength of Materials Laboratory	0	0	2	1	50	50	100	ES
20CEL32	Concrete Technology Laboratory	0	0	2	1	50	50	100	PC
20MNT31	Environmental Science	2	0	0	0	100	0	100	MC
Total Credits to be earned					**23/22**				

SEMESTER – IV									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
20MAT41	Statistics and Numerical Methods	3	1	0	4	50	50	100	BS
20CSC41/ 20CET31	Python Programming / Mechanics of Materials	3	0/0	2/0	4	50	50	100	ES
20CEC41	Geotechnical Engineering II	2	0	2	3	50	50	100	PC
20CET41	Fluid Mechanics and Hydraulics Engineering	3	1	0	4	50	50	100	PC
	Open Elective I	3	1/0	0/2	4	50	50	100	PC
Practical / Employability Enhancement									
20CEL41	Fluid Mechanics and Machineries Laboratory	0	0	2	1	50	50	100	PC
20CEL42	Computer Aided Building Drawing Laboratory	0	0	2	1	50	50	100	PC
20EGL31	English for Workplace Communication Laboratory	0	0	2	1	50	50	100	HS
20GET31	Universal Human Values	2	0	0	2	100	0	100	HS
Total Credits to be earned					**24**				

B.E. CIVIL ENGINEERING CURRICULUM – R2020

SEMESTER – V									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
20CEC51	Environmental Engineering	2	0	2	3	50	50	100	PC
20CET51	Structural Analysis	3	1	0	4	50	50	100	PC
20CET52	Design of RC Elements	3	1	0	4	50	50	100	PC
	Professional Elective I	3	0	0	3	50	50	100	PE
	Open Elective II	3	1/0	0/2	4	50	50	100	OE
Practical / Employability Enhancement									
20CEL51	Computer Aided Structural Design Laboratory - I	0	0	2	1	50	50	100	PC
20CEL52	Computer Aided Building Information Modelling Laboratory	0	0	2	1	50	50	100	PC
20CEL53	Computational Laboratory for Construction Management	0	0	2	1	50	50	100	PC
20GEL51/ 20GEI51	Professional Skills Training I / Industrial Training I	--	--	--	2	100	0	100	EC
Total Credits to be earned					**23**				

SEMESTER – VI									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
20CEC61	Transportation Engineering	2	0	2	3	50	50	100	PC
20CET61	Design of Steel Structures	3	1	0	4	50	50	100	PC
20CET62	Advanced Reinforced Concrete Design	3	0	0	3	50	50	100	PC
	Open Elective III	3	0	0	3	50	50	100	OE
Practical / Employability Enhancement									
20CEL61	Computer Aided Structural Design Laboratory - II	0	0	2	1	50	50	100	PC
20CEL62	Structural Engineering Laboratory	0	0	2	1	50	50	100	PC
20CEL63	Computer Aided Structural Detailing Laboratory	0	0	2	1	50	50	100	PC
20GEL61/ 20GEI61	Professional Skills Training II / Industrial Training II	--	--	--	2	100	0	100	EC
20GEP61	Comprehensive Test and Viva	--	--	--	2	100	0	100	EC
20CEP61	Project Work I	0	0	4	2	100	0	100	EC
Total Credits to be earned					**22**				

B.E. CIVIL ENGINEERING CURRICULUM – R2020

SEMESTER – VII									
Course Code	**Course Title**	**Hours / Week**			**Credit**	**Maximum Marks**			**Category**
		L	**T**	**P**		**CA**	**ESE**	**Total**	
Theory/Theory with Practical									
20GET71	Engineering Economics and Management	3	0	0	3	50	50	100	HS
20CET71	Estimation and Quantity Surveying	3	0	0	3	50	50	100	PC
	Professional Elective II	3	0	0	3	50	50	100	PE
	Professional Elective III	3	0	0	3	50	50	100	PE
	Professional Elective IV	3	0	0	3	50	50	100	PE
	Professional Elective V	3	0	0	3	50	50	100	PE
Practical / Employability Enhancement									
20CEP71	Project Work II Phase I	0	0	6	3	100	0	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									
	Open Elective IV	3	0	0	3	50	50	100	OE
	Professional Elective VI	3	0	0	3	50	50	100	PE
Practical / Employability Enhancement									
20CEP81	Project Work II Phase II	---	---	14	7	50	50	100	EC
Total Credits to be earned					**13**				

Total Credits: 169

Course Code	Course Title	Hours/Week			Credit	Sem	Domain/ Stream
		L	T	P			
LIST OF PROFESSIONAL ELECTIVES							
Elective I-5 SEM							
20CEE01	Design of Prestressed Concrete Structures	3	0	0	3	V	SE
20CEE02	Construction Engineering and Management	3	0	0	3	V	CEM
20CEE03	Solid and Hazardous Waste Management	3	0	0	3	V	EE
20CEE04	Railway, Airport and Harbour Engineering	3	0	0	3	V	TE
20CEE05	Ground Improvement Techniques	3	0	0	3	V	GE
20CEE06	Remote Sensing and Geographical Information System	3	0	0	3	V	BG
Elective II-7 SEM							
20CEE07	Advanced Structural Analysis	3	0	0	3	VI	SE
20CEE08	Contract Management	3	0	0	3	VI	CEM
20CEE09	Environmental Impact Assessment	3	0	0	3	VI	EE
20CEE10	Public Transportation Systems	3	0	0	3	VI	TE
20CEE11	Environmental Geo-technology	3	0	0	3	VI	GE
20CEE12	Engineering Geology	3	0	0	3	VI	BG
Elective III-7 SEM							
20CEE13	Advanced Steel Design	3	0	0	3	VII	SE
20CEE14	Architecture and Town Planning	3	0	0	3	VII	CEM
20CEE15	Air and Noise Pollution Control Engineering	3	0	0	3	VII	EE
20CEE16	Urban Transportation Planning	3	0	0	3	VII	TE
20CEE17	Rock Mechanics	3	0	0	3	VII	GE
20CEE18	Finite Element Methods	3	0	0	3	VII	BG
	Fundamentals of research	3	0	0	3	VII	
Elective IV-7 SEM							
20CEE19	Earthquake Engineering and Design	3	0	0	3	VII	SE
20CEE20	Sustainable Engineering	3	0	0	3	VII	CEM
20CEE21	Industrial Waste Management	3	0	0	3	VII	EE
20CEE22	Traffic Engineering and Management	3	0	0	3	VII	TE
20CEE23	Site Investigation and Soil Exploration	3	0	0	3	VII	GE
20CEE24	Green Building	3	0	0	3	VII	BG
20CEE25	Total Quality Management	3	0	0	3	VII	

Elective V-7 SEM							
20CEE26	Design of Prefabricated Structures	3	0	0	3	VII	SE
20CEE27	Construction Equipment and Management	3	0	0	3	VII	CEM
20CEE28	Surface Hydrology	3	0	0	3	VII	WRE
20CEE29	Intelligent Transport Engineering	3	0	0	3	VII	TE
20CEE30	Reinforced Soil Structures	3	0	0	3	VII	GE
20CEE31	Safety in Construction Practices	3	0	0	3	VII	BG
Elective VI-8 SEM							
20CEE32	Design of Bridges	3	0	0	3	VIII	SE
20CEE33	Distress Monitoring and Rehabilitation of Structures	3	0	0	3	VIII	CEM
20CEE34	Water Power Engineering	3	0	0	3	VIII	WRE
20CEE35	Transportation Economics	3	0	0	3	VIII	TE
20CEE36	Geotechnical Earthquake Engineering	3	0	0	3	VIII	GE
20CEE37	Disaster Preparedness and Planning	3	0	0	3	VIII	BG
20MBE49	Entrepreneurship development	3	0	0	3	VIII	

LIST OF OPEN ELECTIVES OFFERED TO OTHER DEPARTMENTS

Course Code	Course Title	Hours/Week			Credit	Sem
		L	T	P		
20CEO01	Remote Sensing and its Applications	3	0	2	4	V
20CEO02	Disaster Management	3	1	0	4	VI
20CEO03	Introduction to Smart Cities	3	0	0	3	VII
20CEO04	Environmental Health and Safety	3	0	0	3	VII
20CEO05	Infrastructure Planning and Management	3	0	0	3	VIII
20CEO06	Environmental Laws and Policy	3	0	0	3	VIII

20EGT11 ENGLISH LANGUAGE SKILLS

(Common to all Engineering and Technology Branches)

Programme & Branch	All BE/BTech branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	HS	3	0	0	3

Preamble	This course is designed to impart required levels of fluency in using the English Language at A2/B1 Level in the Common European Framework (CEFR).	
Unit - I	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – I**	**9**
Listening - Talking about past experiences - listening to descriptions - Speaking - Exchanging personal information - Talking about cities and transportation - Reading - Life and achievements of a famous personality - Global transport systems - Writing - Childhood experiences - Process Description – Grammar & Vocabulary – Past tense – Expressions of quantity – Indirect questions.		
Unit - II	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – II**	**9**
Listening - Information about hotels and accommodation - Recipes and food items - Speaking - Life style changes and making comparisons - Talking about food - Reading - Habit formation and changing habits - International cuisine - Writing - Personal email - emails about food and recipes – Grammar & Vocabulary – Evaluations and Comparisons with adjectives – Simple past and present perfect tenses.		
Unit - III	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – III**	**9**
Listening - Information about travel - descriptions / conversations about family life - Speaking - Vacations and Holidays - Requests, complaints and offering explanations - Reading - Tourist places and travel experiences - Group behaviour and politeness - Writing - Personal letter about travelling - Writing guidelines and checklists – Grammar & Vocabulary – Future tense – Modals – Two-part verbs.		
Unit - IV	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – IV**	**9**
Listening - Descriptions about festivals - Presentations on technology - Speaking - About technology - festivals, special events and traditions - Reading - Sports, hobbies and past time - About different cultures - Writing - Product Description - Writing web content – Grammar & Vocabulary – Infinitives and Gerunds for uses and purposes – Imperatives for giving suggestions – Relative clauses of time.		
Unit - V	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – V**	**9**
Listening - Talking about changes - Job preferences - Speaking - Comparing different periods or phases in life – Changes that happen - Skills and abilities, Personality Development - Employability Skills – Reading - Reading about life experiences - Emotions and feelings – Job preferences – Jobs and Personality – Writing - Writing about one's past, present and future – Researching job options – Choosing the right job – Grammar & Vocabulary – Time contrasts – Conditional sentences with "if clauses" – Gerunds – short responses.		

Total: 45

TEXT BOOK:

1. Jack C. Richards, Jonathan Hull, and Susan Proctor, "Interchange - Student's Book 2", 4th Edition, Cambridge University Press, New York, 2017.

REFERENCES:

1. Sanjay Kumar and Pushp Lata, "Communication Skills", 2nd Edition, Oxford University Press, New Delhi, 2015.
2. Pamela Hartmann and Brenda Wegmann, "New Interactions English Language Learning and Assessment Platform (Level Intro - Level IV)", McGraw Hill India, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	use language effectively and accurately acquiring vocabulary from real-life context	Applying (K3)
CO2	listen/view and comprehend different spoken discourses / excerpts in different accents	Applying (K3)
CO3	read different genres of texts adopting various reading strategies	Analyzing (K4)
CO4	write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide range of vocabulary, organizing their ideas logically on a topic	Creating (K6)
CO5	speak clearly, confidently, comprehensibly and communicate with others using appropriate communicative strategies	Creating (K6)

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	2	2		
CO2									2	3		1		
CO3						1				3	1	1		
CO4										3		1		
CO5									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		16	30	37		17	100
CAT2		17	30	37		16	100
CAT3		13	33	37		17	100
ESE		7	21	37		35	100

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

20MAC11 - MATRICES AND 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 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.		
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.		
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} – cosax / sinax – x^n – $e^{ax}x^n$, e^{ax}sinbx and e^{ax}cosbx – x^nsinax and x^ncosax – 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** & **Inverse 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) – Solution of linear ODE of second order with constant coefficients.		

List of Exercises / Experiments:

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

***Alternate week**

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

TEXT BOOK:

1.	Ravish R. Singh, Mukul Bhatt "Engineering Mathematics", 1st Edition, McGraw Hill Education, New Delhi, 2016.

REFERENCES:

1.	Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley Sons, 2011.
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.	MATLAB 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	know the basics of MATLAB and computing eigen values and eigen vectors of real matrix by MATLAB.	Understanding (K2), Manipulation (S2)
CO7	solve ordinary differential equations with constant and variable coefficients and simultaneous first order ordinary differential equations using MATLAB.	Applying (K3), Manipulation (S2)
CO8	compute Laplace and inverse Laplace Transform of basic functions and solve Second Order ODE by using Laplace Transform with 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	1										
CO2	3	3	2	1										
CO3	3	3	2	1										
CO4	3	3	2											
CO5	3	3	2	1										
CO6					3									
CO7					3									
CO8					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)**

20PHT11 - APPLIED PHYSICS

(Common to All Engineering and Technology Branches)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	BS	3	0	0	3

Preamble	This course aims to impart the essential concepts of propagation of elastic waves, acoustics, ultrasonics, laser and fiber optics, quantum physics, crystal structure and crystal defects. It also describes the physical phenomena related to the aforementioned concepts and their applications in engineering and provides motivation towards innovations	
Unit - I	**Propagation of Elastic Waves:**	**9**
Oscillatory Motion: Introduction to simple harmonic motion - Damping velocity - Damping coefficient - Differential equation of simple harmonic motion - Velocity and acceleration - Restoring force - Vibration of a spring and mass system - Frequency response - Phase response - Resonance - Wave motion: Definition of a plane progressive wave - Attenuation of waves - Differential equation of a plane progressive wave - Phase velocity - Phase and phase difference - Solution of the differential equation of a plane progressive wave.		
Unit - II	**Acoustics and Ultrasonics:**	**9**
Acoustics: Introduction - Reverberation and reverberation time - Growth and decay of sound - Sabine's formula for reverberation time – Determination of sound absorption coefficient – Design of an auditorium: Factors affecting acoustics of buildings and the remedies. Ultrasonics: Introduction – Properties of ultrasonic waves – Generation of ultrasonic waves: Magnetostrictive generator and Piezoelectric generator - Determination of velocity of ultrasonics in a liquid: Acoustic grating – Industrial application: Non-destructive testing - Other applications of ultrasonic waves (qualitative).		
Unit - III	**Laser and Fiber Optics:**	**9**
Laser and Applications: Introduction – Interaction of light with matter - Three quantum process: Stimulated absorption, spontaneous emission and stimulated emission - Population inversion - Einstein's coefficients and their relations - Pumping methods - Nd:YAG laser - CO_2 laser - Holography. Fiber Optics and Applications: Introduction - Numerical aperture and acceptance angle - Classification of optical fibers based on refractive index, modes and materials - Fiber optics communication system (qualitative) - Fiber optic sensors: Temperature and displacement sensors.		
Unit - IV	**Quantum Physics:**	**9**
Introduction - Blackbody radiation - Planck's quantum hypothesis - Compton scattering (qualitative) - de Broglie's hypothesis - Properties of matter waves - Application of Heisenberg uncertainty principle - Schrodinger's time independent and time dependent wave equations - Physical significance of wave function - The free particle - Potential energy step - Infinite potential well (one - dimensional).		
Unit - V	**Crystal Physics:**	**9**
Introduction - Classification of solids - Space lattice - Crystal structure - Unit cell - Bravais lattice - Single and polycrystalline materials - Lattice planes - Miller indices - Indices of crystal direction - Interplanar spacing in cubic system - Hexagonal close packed crystal structure and c/a ratio - Symmetry -Symmetry elements in cubic crystal - Crystal imperfections: line, surface and volume imperfections - Features of crystal imperfections (qualitative).		

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.

REFERENCES:

1. Purnima Khare and Swarup A.,"Engineering Physics: Fundamentals and Modern Applications", 1st Edition, Jones and Bartlett Publishers, Sudbury, Massachusetts, 2009.
2. Gaur R.K. and Gupta S.L., "Engineering Physics", 8th Edition, Dhanpat Rai and Sons, New Delhi, 2009.
3. Tamilarasan K. and Prabu K., "Engineering Physics – I", 3rd Edition, McGraw Hill Education Pvt. Ltd., New Delhi, 2014.

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 to recognize the requirements of acoustically good buildings, and to describe the production of ultrasonic wave, working of acoustic grating & non-destructive testing using ultrasonic waves.	Applying (K3)
CO3	apply the concepts of stimulated emission to explain the working and the applications of laser in engineering and technology, and to apply the principle of propagation of light through optical fiber to compute acceptance angle and numerical aperture to comprehend the loss in optical fiber, fiber optic communication system and working of fiber optic sensors.	Applying (K3)
CO4	use the concepts of quantum mechanics to describe the behavior of electrons in a metal by solving Schrodinger's wave equation for particle motion in infinite potential well.	Applying (K3)
CO5	utilize the concepts of the seven crystal systems to obtain interplanar spacing in cubic lattice and c/a ratio of HCP crystal structure, and to comprehend symmetry elements, reciprocal lattice and the types of crystal imperfections and their impacts.	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	20	40	40				100
CAT2	20	35	45				100
CAT3	25	35	40				100
ESE	20	40	40				100

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

20CYT11 - APPLIED CHEMISTRY

(Common to All Engineering and Technology Branches)

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	BS	3	0	0	3

Preamble	Applied Chemistry course explores the basic principles and advancements of chemistry in the field of engineering and technology. It aims to impart the fundamentals of chemistry towards innovations in science and technology and also for societal applications.	
Unit - I	**Water Technology:**	**9**
Introduction - sources of water - impurities in water - types of water - hardness of water- expression of hardness (simple problems) - units of hardness –estimation of hardness of water by EDTA method – determination of alkalinity - disadvantages of using hard water in Industries - boiler troubles - scale and sludge, boiler corrosion, caustic embrittlement, priming and foaming - softening of water: i) Internal treatment process - carbonate and calgon conditioning ii) External treatment method -demineralization process iii) Treatment of water for municipal water supply (Removal of suspended particles and disinfection methods, Break-point of chlorination).		
Unit - II	**Electrochemistry:**	**9**
Introduction – electrochemical cells - applications of electrochemical series - reference electrode - standard calomel electrode - ion selective electrode - glass electrode - concentration cells - electrode and electrolyte concentration cells (simple problems) - applications- potentiometric titrations - acid-base, redox, precipitation titrations - advantages- conductometric titrations - strong acid vs strong base, weak acid vs strong base, mixture of weak and strong acid vs strong base- advantages of conductometric titrations.		
Unit - III	**Corrosion and its Control:**	**9**
Introduction – causes and effects of corrosion - types of corrosion - chemical corrosion – Pilling Bed-worth rule - electrochemical corrosion –types **-** galvanic corrosion, concentration cell corrosion – other types of corrosion -stress, intergranular and microbiological corrosion- galvanic series - factors influencing rate of corrosion – corrosion control methods - design and material selection, anodic protection, corrosion inhibitors, protective coatings - i) metallic coatings : hot dipping (tinning and galvanizing) ii) non-metallic coating : anodizing iii) organic coating : paints – constituents and their functions.		
Unit - IV	**Fuels and Combustion:**	**9**
Introduction – classification of fuels - characteristics of a good fuel - combustion - calorific values – gross and net calorific values - Dulong's formula (simple problems) - Flue gas analysis by Orsat's method - ignition temperature - spontaneous ignition temperature - explosive range - solid fuels - coal and its varieties – proximate and ultimate analysis – significance – metallurgical coke - Otto-Hoffman byproduct method - liquid fuel - refining of petroleum – manufacture of synthetic petrol - hydrogenation of coal - Bergius process - knocking - octane number – cetane number - gaseous fuel - water gas.		
Unit - V	**Polymers:**	**9**
Introduction – terminology - classification - polymerization - types of polymerization (definition only)- polymerisation techniques- bulk, solution, suspension and emulsion polymerisation - plastics- difference between thermoplastics and thermosetting plastics - compounding of plastics- plastic moulding methods - compression, injection, extrusion and blow moulding methods - industrial polymers: preparation, properties and applications of PVC, PAN, polyurethane, polyesters –biodegradable polymers-classification and applications.		

Total: 45

TEXT BOOK:

1. Wiley Editorial Board, "Wiley Engineering Chemistry", 2nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019.

REFERENCES:

1. Palanisamy P.N., Manikandan P., Geetha A.& Manjula Rani K., "Applied Chemistry", 6th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2019.
2. Payal B. Joshi, Shashank Deep, "Engineering Chemistry", Oxford University Press, New Delhi, 2019.
3. Palanna O., "Engineering Chemistry", McGraw Hill Education, New Delhi, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply the suitable water softening methods to avoid boiler troubles.	Applying (K3)
CO2	apply the principle of electrochemistry for various applications.	Applying (K3)
CO3	make use of corrosion control methods to solve corrosion related problems.	Applying (K3)
CO4	illustrate the quality of fuels from its characteristics.	Understanding (K2)
CO5	explain the types of polymers, plastics and fabrication methods.	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										
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)**

20MEC11 – ENGINEERING DRAWING

(Common to Civil, Mechanical, Mechatronics, Automobile Engineering, Chemical & Food Technology Branches)

Programme & Branch	BE(Civil, Mech, MTS, Auto) &BTech(Chem, FT)	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	ES	2	0	2	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:**	**9**
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:**	**9**
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:**	**9**
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:**	**9**
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:**	**9**
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, Practical:30, Total:60

TEXT BOOK:

1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", 15th Edition, New Age International Pvt. Ltd., New Delhi, 2018.

REFERENCES:

1. Basant Agrawal, Agrawal C.M., "Engineering Drawing", 2nd Edition, McGraw Hill Education, 2019.
2. Gopalakrishnana K.R. "Engineering Drawing", Volume. I & II, Subhas Publications, Bengaluru, 2014.
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.	Understanding (K2)
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 in to 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								3	2	2	2	3
CO2	3	2	1	1						3	2	3	2	3
CO3	3	2	1	1						3	2	3	2	3
CO4	3	2	1	1						3	2	3	2	3
CO5	3	2	1	1						3	2	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	20	40	40				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	25	35	40				100

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

20CET11 - CONSTRUCTION MATERIALS AND PRACTICES

Programme & Branch	BE – 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 bricks - Classification – Uses. Cement: Ingredients – Qualities of good cement - Types & Uses of cement.		
Unit - II	**Mortar, Concrete and Steel:**	**9**
Mortar: Definition – 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- bonds - Stone Masonry - Classification of stone masonry – Comparison of brick and stone masonry.		
Unit - V	**Construction Practices:**	**9**
Structural elements **-** Beams – Columns – Lintels - Roofing – types - Flooring – types and finishes – selection of floorings - Damp proofing – causes and effect of dampness – materials and methods - Weather Proof Course – Materials and methods – Plastering – types – requirements – methods.		

Total: 45

TEXT BOOK:

1. Palanichamy M.S., “Basic Civil Engineering”, 4th Edition, McGraw-Hill Education, New Delhi, 2017.

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, 2019.

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 aggregates in construction	Understanding (K2)
CO2	infer the properties of concrete, steel and timber as construction materials	Understanding (K2)
CO3	discuss the usage of plastics and other modern materials used in building	Understanding (K2)
CO4	classify and compare the types of foundations and masonry structures in buildings	Understanding (K2)
CO5	interpret the various construction practices and techniques used in 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	1				2							3	2
CO2	2	1				2							3	2
CO3	2	1				2							3	2
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	30	70					100
CAT2	30	70					100
CAT3	30	70					100
ESE	30	70					100

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

20PHL11 – PHYSICAL SCIENCES LABORATORY I
(Common to All Engineering and Technology Branches)

Programme & Branch	All BE/BTech Branches	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 the physical parameters such as Young's modulus, rigidity modulus, frequency of vibration, velocity of ultrasonic waves, compressibility of water, wavelength of laser, acceptance angle and the numerical aperture of an optical fiber, and to develop the skills in handling different basic instruments and also aims to impart the basic concepts of volumetric, conductometric and pH meter experiments and thereby, to improve the analytical capability.

List of Exercises / Experiments:

1.	Determination of the Young's modulus of the material of a given beam using uniform bending method.
2.	Determination of the rigidity modulus of the material of a given wire using torsional pendulum.
3.	Determination of frequency of electrically vibrating rod by forming standing waves using Melde's apparatus.
4.	Determination of the velocity of ultrasonic waves in a liquid and the compressibility of a liquid using ultrasonic interferometer.
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.	Estimation of total, temporary and permanent hardness of water by EDTA method.
7.	Estimation of $Ca^{2+}$and Mg^{2+}hardness separately by EDTA method.
8.	Estimation of alkalinity of the given water sample.
9.	Conductometric titration -Mixture of acids.
10.	Estimation of hydrochloric acid using pH meter.

Total: 30

REFERENCES:

1.	Tamilarasan K. and Prabu K.,"Physics Laboratory Manual', 1st Edition, SCM Publishers, Erode, 2020.
2.	Palanisamy P.N., Manikandan P., Geetha A. and Manjula Rani K., "Chemistry Laboratory Manual", 1st Edition, Rajaganapathy Publishers, Erode, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	determine the Young's modulus of a material using the concepts of elasticity and bending moment of a beam and to determine the rigidity modulus of a wire using the concepts of twisting couple and to compute the frequency of electrically vibrating rod using the concept of standing waves formed in fixed vibrating string.	Applying (K3), Precision (S3)
CO2	determine the wavelength of a semiconductor laser beam using the concept of diffraction of light, and 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 and estimate the amount of hardness for the given water sample by EDTA method, and the amount of alkalinity for the given water sample.	Applying (K3), Precision (S3)
CO3	demonstrate the conductivity meter and pH meter to estimate the amount of the given solution.	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										
CO2				3										
CO3				3										

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

20MEL11 – ENGINEERING PRACTICES LABORATORY

(Common to Civil, Mechanical, Mechatronics, Automobile Engineering, Chemical & Food Technology Branches)

Programme & Branch	BE (Civil, Mech, MTS, Auto) & BTech (Chem, FT)	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	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 Exercises / Experiments:

	PART A – MECHANICAL ENGINEERING
1.	To prepare square or rectangular shaped MS plates using power tools for cutting, polishing and shaping to the required dimensions.
2.	To carryout drilling, tapping and assembly on the given MS plates.
3.	To carryout thread forming on a GI/PVC pipes and prepare water leak proof water line from overhead tank.
4.	To prepare a wood or plywood box/tray/any innovative models using modern power tools like cutting machine, router, jigsaw, power screw driver etc.
5.	Welding practice through arc welding / simulator
	PART B – ELECTRICAL AND ELECTRONICS ENGINEERING
1.	Safety Aspects of Electrical Engineering, Electrical Symbols, Components Identification, Fuse selection and installation, Circuit Breakers selection
2.	Wiring circuit for fluorescent lamp and Stair case wiring
3.	Measurement of Earth resistance
4.	Soldering of Simple Circuits and trouble shooting
5.	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), Precision (S3)
CO2	identify and use appropriate modern power tools and complete the exercises/models accurately	Applying (K3), Precision (S3)
CO3	select fuses and Circuit breakers	Understanding (K2), Manipulation (S2)
CO4	perform house wiring and realize the importance of earthing	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	2		3	3	2	1			3	3		3		
CO2	2		3	3	2				3	3		3		
CO3	3		3	3	1				2	2		3		
CO4	3		3	3	1				2	3		3		
CO5	3		3	3	1				2	2		3		

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

20VEC11 – YOGA AND VALUES FOR HOLISTIC DEVELOPMENT

Programme & Branch	All BE/BTech Branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	1	HS	1	0	1	1

Preamble	Providing Value Education to improve the Students' character - understanding yogic life and physical health - maintaining youthfulness - Measure and method in five aspects of life	
Unit - I	**Physical Health:**	**2**
Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment. **Simplified Physical Exercises:** Need and Objectives of Simplified Physical Exercise - Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits. **Yogasanas:** Pranamasana - Hastha Uttanasana - Pada Hasthasana - Aswa Sanjalana Asana - Thuvipatha asva Sanjalana asana - Astanga Namaskara - Bhujangasana - Atha Muktha Savasana - Aswa Sanjalana Asana - Pada Hasthasana - Hastha Uttanasana - Pranamasana. **Pranayama:** Naddi suddi - Clearance Practice - Benefits.		
Unit - II	**Life Force:**	**2**
Reasons for Diseases: Body Function - Reason for Diseases and Prevention - Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds). **Philosophy of Kaya kalpa:** Enriching Bio-Magnetism - Physical body - Sexual vital fluid - Life force - Bio-Magnetism - Mind. **Maintaining youthfulness:** Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid - Measure and method in five aspects of life - Controlling undue Passion. **Kayakalpa practice:** Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.		
Unit - III	**Mental Health:**	**2**
Mental Frequencies: Beta, Apha, Theta and Delta wave - Agna Meditation explanation - benefits. **Shanti meditation:** Shanthi Meditation explanation – benefits. **Thuriya Meditation:** Thuriya Meditation explanation – benefits. **Benefits of Blessing:** Self blessing (Auto suggestion) - Family blessing - Blessing the others - World blessing - Divine protection.		
Unit - IV	**Values:**	**2**
Human Values: Self control - Self confidence - Honesty Contentment - Humility – Modesty - Tolerance - Adjustment - Sacrifice – Forgiveness - Purity (Body, Dress, Environment) - Physical purity - Mental purity - Spiritual purity. **Social Values:** Non violence – Service. Patriotism – Equality. Respect for parents and elders - care and protection - Respect for teacher. Punctuality - Time Management.		
Unit - V	**Morality (Virtues):**	**2**
Importance of Introspection: I - Mine (Ego, Possessiveness). Six Evil Temperaments - Greed - Anger - Miserliness - Immoral sexual passion - Inferiority and superiority Complex – Vengeance. Maneuvering of Six Temperaments: Contentment - Tolerance - Charity - Chastity - Equality - Pardon (Forgiveness). Five essential Qualities acquired through Meditation: Perspicacity - Magnanimity - Receptivity - Adaptability - Creativity (Improved Memory Power).		

Lecture:10, Practical:10, Total:20

TEXT BOOK:

1. Thathuvagnani Vethathiri Maharishi, "Yoga for Youth Empowerment", Vethathiri Publications, 2019.

REFERENCES:

1. Thathuvagnani Vethathiri Maharishi, "Yoga for Modern Age", Vethathiri Publications, 2019.
2. Thathuvagnani Vethathiri Maharishi, "Simplified Physical Exercises", Vethathiri Publications, 2019.
3. Neelam Sharma, "Holistic Education and Yoga", Shipra Publications, 2017.
4. Dr. Joseph Murphy, "The Power of Your Subconscious Mind", Pushpak Publication, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	understand the importance of physical health and practice simplified physical yoga exercise.	Applying (K3)
CO2	understand the importance of Kayakalpa exercise to enrich Bio-Magnetism and practice it.	Applying (K3)
CO3	understand the significance of meditation and do meditation to get sound mind.	Applying (K3)
CO4	understand the human and social values to provide service to society.	Applying (K3)
CO5	understand the evil temperaments and five essential qualities acquired through meditation	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		
CO3						3		3				1		
CO4						3		2	1			1		
CO5						3		3				1		

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

ASSESSMENT PATTERN

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

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

20EGT21 ADVANCED COMMUNICATION SKILLS

(Common to all Engineering and Technology Branches)

Programme & Branch	All BE/BTech branches	Sem.	Category	L	T	P	Credit
Prerequisites	20EGT11 – English Language Skills	2	HS	3	0	0	3

Preamble	This course is designed to impart required levels of fluency in using the English Language at B1Level in the Common European Framework (CEFR).	
Unit - I	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase –VI**	**9**
Listening – Job and career related descriptions and conversations – requests of different kinds and the responses – **Speaking -** Career choices and professional skills – making requests and responding to requests – **Reading** – Using texts about jobs and careers – about different societies and cultural differences – **Writing** – Resumes, CVs and job oriented advertisements – business and career related emails – **Grammar &Vocabulary** – Gerunds and elements of comparison – requests and indirect requests.		
Unit - II	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – VII**	**9**
Listening – Expository and narrative descriptions – information about different cultures, nations and societies. **Speaking** – Narrating and describing – talking about other countries and other cultures – **Reading** – Using texts about media and information technology – living abroad and experiencing different cultures – **Writing** – Blog writing – brochures and tourist pamphlets – **Grammar & Vocabulary** – The past tense forms - noun phrases and relative clauses.		
Unit - III	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – VIII**	**9**
Listening – Consumerism – product description – complaints and redressal – environmental issues – ecology – saving the planet – **Speaking** – Talking about problems, issues, complaints – solutions and redressal – talking about environmental issues – **Reading** – Using texts on segregating wastes – recycling and reusing – texts on environmental issues – **Writing** – Online reviews, articles and writing web content – **Grammar & Vocabulary** – Phrases and sentences used for describing problems – passives – prepositions and infinitives.		
Unit - IV	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – IX**	**9**
Listening – Education, learning and the choice of courses – various services needed in daily life – self-improvement for success in life – **Speaking** - Discussions about educational and career oriented issues – talking about everyday services – giving advice and self improvement – **Reading** – Reading about learning strategies and learning styles – using texts about personality development – **Writing** – Writing about hobbies – pastime and individual skills – writing short articles on everyday life and personality development – **Grammar & Vocabulary** – Using of "would" and certain gerund forms – use of modals, verbs, gerunds, negative questions and infinitives.		
Unit - V	**Listening, Speaking, Reading, Writing and Grammar & Vocabulary. Activity Based Learning – Phase – X**	**9**
Listening – Historical narratives – biographies and learning about the future – important life events, milestones and happenings of the past – **Speaking** – Talking about the past, present and the future – talking about important events in life – **Reading** – Texts about new technologies and future science – using texts about social organization, culture and social practices – **Writing** – Biographical sketches – historical events – famous personalities, stages of life and getting along with people – **Grammar & Vocabulary** – Future tense forms – time clauses and certain "if clauses".		

Total: 45

TEXT BOOK:

1. Jack C. Richards, Jonathan Hull, and Susan Proctor, "Interchange - Student's Book 3", 4th Edition, Cambridge University Press, New York, 2017.

REFERENCES:

1. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook based on AICTE Syllabus", Oxford University Press, 2018.
2. Board of Editors, "Skills Annexe: Functional English for Success", Orient BlackSwan, Hyderabad, 2013.

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 spoken excerpts critically and infer Unspoken and implied meanings.	Applying (K3)
CO3	read different genres of texts, infer implied meanings and critically analyze and evaluate them for ideas as well as for method of presentation.	Analyzing (K4)
CO4	write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.	Creating (K6)
CO5	speak effectively, to express opinions clearly, initiate and sustain a discussion and also negotiate using appropriate communicative strategies.	Creating (K6)

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									2	3		1		
CO3						1				3	1	1		
CO4										3		2		
CO5									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		13	30	33	-	17	100
CAT2		13	33	37	-	17	100
CAT3		20	30	33	-	17	100
ESE		6	40	36	-	18	100

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

20MAC21 - MULTIVARIABLE CALCULUS AND COMPLEX ANALYSIS

(Common to All Engineering and Technology Branches)

Programme & Branch	All BE/BTech 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 – 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 – 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 – 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 Exercises / Experiments:

1.	Finding ordinary and partial derivatives
2.	Computing extremes of a single variable function
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

***Alternate week**

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

TEXT BOOK:

1. Ravish R. Singh, Mukul Bhatt "Engineering Mathematics", 1st Edition, McGraw Hill Education, New Delhi, 2016.

REFERENCES:

1. Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley Sons, 2011.
2. Dass H K, "Higher Engineering Mathematics", 3rd Revised Edition, S.Chand and Co., New Delhi, 2014.
3. Duraisamy C., Vengataasalam S., Arun Prakash K. and Suresh M., "Engineering Mathematics – I", 2nd Edition, Pearson India Education, New Delhi, 2018.
4. MATLAB Manual.

	COURSE OUTCOMES: On completion of the course, the students will be able to	**BT Mapped (Highest Level)**
CO1	compute extremal values which arise in function of several variables.	Applying (K3)
CO2	solve Problems involving Double and Triple integrals.	Understanding (K2)
CO3	apply the concept of vectors in engineering problems.	Applying (K3)
CO4	identify, construct and apply analytic functions in electrostatics and fluid flow problems.	Applying (K3)
CO5	evaluate complex integrals which are extensively applied in engineering.	Applying (K3)
CO6	compute maxima and minima of a single variable function, gradient, curl and divergence of a vector function using MATLAB.	Understanding (K2), Manipulation (S2)
CO7	evaluate Double, Triple integrals and determine area between two curves using MATLAB	Applying (K3), Manipulation (S2)
CO8	construct analytic function, find bilinear transformation and compute poles and residues 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												
CO2	3	3	2											
CO3	3	3												
CO4	3	3												
CO5	3	3	2											
CO6					3									
CO7					3									
CO8					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)**

20PHT21 - MATERIALS SCIENCE

(Common to Civil Engineering & Mechanical Engineering Branches)

Programme & Branch	BE-Civil Engineering & BE- Mechanical Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Applied Physics	2	BS	3	0	0	3

Preamble	This course aims to impart the knowledge on the physics of conductors, semiconductors, magnetic materials, superconductors, dielectrics, smart and nano materials. It also describes the select characterization techniques and the applications of aforementioned materials in Civil and Mechanical Engineering and provides motivation towards innovations.	
Unit - I	**Conducting Materials:**	**9**
Conductors - Classical free electron theory of metals - Electrical conductivity - Thermal conductivity - Wiedemann-Franz law - Lorentz number - Draw backs of classical free electron theory - Quantum free electron theory - Quantum statistics: Fermi distribution function and Effect of temperature on Fermi function and Fermi energy - Density of energy states - Carrier concentration in metals.		
Unit - II	**Semiconducting Materials:**	**9**
Intrinsic semiconductor: Intrinsic carrier concentration, Fermi level in intrinsic semiconductor, Variation of intrinsic conductivity with temperature and Determination of band gap - Extrinsic semiconductors: Carrier concentration in N-type and P-type semiconductors, Fermi level in extrinsic semiconductors, Variation of Fermi level with temperature and impurity concentration - Homojunction laser: Construction and working - Hall effect: Theory and experimental determination of Hall coefficient and Applications.		
Unit - III	**Magnetic, Superconducting and Dielectric Materials:**	**9**
Magnetic Materials: Introduction - Domain theory of ferromagnetism - Hysteresis loss - Soft and hard magnetic materials - Application of magnetic materials: Transformer core - Superconductors: Properties of superconductors - Type I and Type II superconductors - Application of superconductors: Magnetic levitation - Dielectric materials: Dielectric constant – Types of polarization (qualitative) - Dielectric loss – Dielectric breakdown – Applications of dielectric materials.		
Unit - IV	**Smart and Nano Materials:**	**9**
Smart Materials: Metallic glasses: Preparation by melt spinning, properties and applications - Shape memory alloys: Characteristics and applications. Nanomaterials: Properties of nanomaterials – Quantum confinement: Zero dimensional, one dimensional and two dimensional nanostructures - Production techniques: Electron beam lithography, Nano imprint lithography, Nano pen lithography, Physical vapor deposition methods and sol-gel method - Applications of nano materials.		
Unit - V	**Materials Characterization:**	**9**
Importance of materials characterization - X-ray diffraction (qualitative) - X-ray photoelectron spectroscopy - Scanning electron microscopes and Energy dispersive X-ray analysis: principle, construction and working - Transmission electron microscope: principle, construction and working - Raman spectroscopy (qualitative) - Thermal analysis: Thermo gravimetric analysis – Differential scanning calorimetry.		

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 for Unit I – Unit IV.
2. Sam Zhang, Lin Li and Ashok Kumar, "Materials Characterization Techniques", 1st Edition, CRC Press, Boca Raton, 2008, for Unit V.

REFERENCES:

1. Pillai S.O. and Sivakami Pillai, "Rudiments of Materials Science", 3rd Edition, New Age International Publishers, New Delhi, 2012.
2. Charles Kittel, "Introduction to Solid State Physics", 8th Edition, John Wiley & Sons, New Jersey, 2004.
3. 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	apply the concepts of classical and quantum free electron theory of metals to compute the electrical conductivity, thermal conductivity and carrier concentration in metals.	Applying (K3)
CO2	use the concepts of density of states to compute the carrier concentration, electrical conductivity and band gap of intrinsic semiconductor and to compute the carrier concentration of extrinsic semiconductors and to explain the working of semiconductor laser, Hall effect and its applications.	Applying (K3)
CO3	apply the domain theory of ferromagnetism to explain hysteresis, to apply the concept of formation copper pair to comprehend the properties and applications of superconductors, and to apply the concept of electric dipole moment and electric polarization to comprehend the select polarization mechanisms in dielectrics and to describe the related phenomenon.	Applying (K3)
CO4	utilize appropriate methods to prepare select smart materials (metallic glasses and shape memory alloys) and nano-materials, and to comprehend their properties and applications.	Applying (K3)
CO5	apply the concepts of X-ray diffraction, matter waves, Raman effect and thermograph 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	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	20	40	40				100
CAT2	20	35	45				100
CAT3	30	30	40				100
ESE	20	40	40				100

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

20CYT21- CHEMISTRY OF BUILDING MATERIALS

Programme & Branch	BE- Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Applied Chemistry	2	BS	3	0	0	3

Preamble	This course aims to impart a sound chemistry knowledge on the ingredients and properties of concrete, building, polymeric, composite and engineering materials towards applications in civil engineering.	
Unit - I	**Cement:**	**9**
Introduction - types of building materials used for different construction works - general uses of building materials – cement – classification of cement - functions of the ingredients of cement - Hydraulic cements (Portland cement) – chemical composition - manufacturing – dry and wet process- differences between dry and wet process- properties of cement- setting and hardening of cement – heat of hydration of cement – applications of cement in civil engineering.		
Unit - II	**Miscellaneous Materials:**	**9**
Ceramics- components of ceramics – classification of ceramic materials –general methods of fabricating ceramic wares - Refractory bricks - criteria of a good refractory material - Classification (according to chemical nature and refractoriness) - properties - general method of manufacturing of refractories - common refractories: fire clay bricks, magnesite bricks and zirconia bricks - causes for the failure of a refractory material - Insulators- definition - classification with examples: thermal insulators and electrical insulators - characteristics of insulating materials - Green building materials.		
Unit - III	**Polymeric and Composite Materials:**	**9**
Introduction - structure and property relationship of polymers - plastics - properties and uses of plastics as engineering materials - rubbers (elastomers) - natural rubber- processing of latex- vulcanization of rubber - synthetic rubbers- preparation, properties and uses of thiokol and butyl rubber- polymer blends and alloys - fibres-physical properties-types-spinning processes- composites - classification of composites - fibre reinforced plastics-processing , properties and uses of fiber reinforced plastics.		
Unit - IV	**Engineering Materials:**	**9**
Abrasives – 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 – requisites of a good adhesive- advantages and disadvantages of adhesive bonding – adhesive action – classification of adhesives - industrial applications of adhesives. Lubricants – functions - requirements – classification with examples - properties : viscosity, viscosity index, flash and fire point, cloud and pour point, oiliness, aniline point and carbon residue(Definition and significance only). Alloys - need for making alloys -classification of alloys - alloys of steel- heat treatment of steel.		
Unit - V	**Corrosion of Steel in Concrete:**	**9**
Introduction- concrete- types of concrete- RCC (rebar)- concrete acts as an environment for steel- decay of concrete - causes of corrosion - corrosion mechanism in concrete: carbonation, chloride attack and sulphate attack- Delayed Ettirngite 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 Units I,II,III,IV.
2. Palanisamy P.N., Manikandan P., Geetha A., Manjula Rani K.& Kowshalya V.N. "Chemistry for Civil Engineering". Revised Edition, Pearson Education, New Delhi, 2019 for Unit V.

REFERENCES:

1. ArnonBentur. **"**Steel Corrosion in Concrete.-Fundamentals and civil engineering practice", Modern Concrete Technology, 1st Edition, CRC Press, Boca Raton, Florida, 1997 for UNIT V.
2. Shikha Agarwal. **"**Engineering Chemistry: Fundamentals and Applications",2nd Edition, Cambridge University Press, Cambridge, England, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply the knowledge of chemistry of cement in construction	Applying (K3)
CO2	summarize the properties and applications of various building materials in construction	Understanding (K2)
CO3	utilize the polymeric and composite materials for various applications	Applying (K3)
CO4	explain the chemical concepts to develop abrasive, adhesive, lubricant and alloys	Understanding (K2)
CO5	utilize the concepts of corrosion of steel in concrete and its control 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	1	1										
CO2	3	1	-	-										
CO3	3	2	1	1										
CO4	3	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)**

20CET21 - SURVEYING AND GEOMATICS

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

Preamble	This course is designed to impart knowledge about to prepare the topographical map, area and volume calculation and to locate the points	
Unit - I	**Chain and Compass Surveying:**	**9**
Definition - Principles - Classification – Plans and maps - Scales - Ranging and chaining - well conditioned triangle –Corrections - Prismatic compass – Surveyors compass - Bearing - Systems and conversions – True and magnetic bearings – Dip and declination - Local attraction - Adjustment of errors.		
Unit - II	**Leveling and Contouring:**	**9**
Level line - Horizontal line - Spirit level – Mean sea level - Sensitiveness - Bench marks – Leveling instruments - Types of leveling - 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 - Analectic lens - Triangulation - Corrections - Satellite station - Reduction to centre - Trigonometric leveling - Single and reciprocal observations.		
Unit - V	**Digital Surveying:**	**9**
Introduction, basic concepts, aerial photogrammetry, terrestrial photogrammetry, stereoscopy, types of EDM instruments. Total station – Fundamental measurements, Advantages and applications - Principles of remote sensing and its applications. Basics of GIS & GPS.		

Total:45

TEXT BOOK:

1	Duggal S.K., "Surveying", Volume I and II, 4th Edition, Tata McGraw-Hill Publications, New Delhi, 2013.

REFERENCES:

1	Subramanian R., "Surveying and Levelling", 2nd Edition, Oxford University Press, Noida, 2013.
2	Roy S.K., "Fundamentals of Surveying", 2nd Edition, PHI Learning Pvt. Ltd., Delhi, 2011.

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)
CO2	compute the levels, calculate the area and volume	Applying (K3)
CO3	carry out the adjustments of closed traverse for errors and setting out the simple curves	Applying (K3)
CO4	execute the tacheometric and triangulation Survey	Applying (K3)
CO5	apply the principles, concepts and applications of digital surveying	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			2						1	3	3
CO3	3	2	1			3						2	3	3
CO4	3	2	1			2						1	3	3
CO5	3	2	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	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)**

20CET22 ENGINEERING MECHANICS

Programme & Branch	B.E.- CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	2/3	PC	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 – Coplanar Forces – Resolution and Composition of force -Free body diagram–Equilibrium of a particle in plane – Forces in space - Vectorial representation of forces–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 component of moments – Varignon's theorem– Equivalent systems of forces – Single equivalent force. Types of supports and their reactions – Requirements of stable equilibrium – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions. Trusses: Method of joints- Method of sections. Principle of virtual work.		
Unit - III	**Properties of Surfaces and Solids:**	**9**
Determination of Areas and Volumes – First moment of area and Centroid of sections – T section- I section- Angle section- Hollow section from primary simpler sections – Second moment of plane areas – Parallel axis theorem and Perpendicular axis theorem - T section - I section- Angle section- Hollow section – Polar moment of Inertia – Product of Inertia- Principal Moment of Inertia of plane area- Mass moment of inertia – Relation to area moments of inertia.		
Unit - IV	**Friction:**	**9**
Surface Friction – Laws of dry friction – Sliding friction – Static and Kinetic friction– Ladder friction – Wedge friction – Belt friction. Rectilinear motion of particles: Displacement- velocity and acceleration and their relationship – Relative motion- Curvilinear motion – Projectile motion.		
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–General plane motion. Kinetics of rigid body.		

Total:45

TEXT BOOK:

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

REFERENCES:

1	Beer Ferdinand P., Russel Johnston Jr., David F. Mazure, Philip J. Cornwell, 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 equations for rigid body system	Analyzing (K4)
CO3	compute the centroid, centre of gravity and moment of inertia of geometrical shapes and solids respectively	Applying (K3)
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	2	1	1								1		3
CO2	3	2	1	1								1		3
CO3	3	2	1	1								1		3
CO4	3	2	1	1								1		3
CO5	3	2	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	10	20	50	20			100
CAT2	10	20	50	20			100
CAT3	10	20	50	20			100
ESE	10	20	50	20			100

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

20PHL20 - PHYSICAL SCIENCES LABORATORY II

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

Preamble	This course aims to impart hands on training in the determination of physical parameters such as specific resistance, band gap, thermal conductivity, thickness of a thin film and particle size and to develop the skills in handling different basic instruments. This course also aims to impart the basic knowledge of materials for building construction and thereby, to improve the analytical capability.

List of Exercises / Experiments:

1.	Determination of the specific resistance of a conductor using Carey Foster's Bridge.
2.	Determination of the band gap of a semiconductor using post office box.
3.	Determination of the thermal conductivity of a dielectric material using Lee's disc arrangement.
4.	Determination of the thickness of a nano crystalline thin film using Air-wedge arrangement.
5.	Determination of the particle size of given powder using a Laser.
6.	Determination of calcium in cement by complexometric titration.
7.	Estimation of molecular weight of the polymer using viscometer.
8.	Estimation of iron in steel using permanganometry.
9.	Estimation of chromium (Cr^{6+}) in wastewater sample.
10.	Determination of dissolved oxygen in the given wastewater sample.

Total: 30

REFERENCES:

1. Tamilarasan K. and Prabu K., "Physics Laboratory Manual", 1st Edition, SCM Publishers, Erode, 2020.
2. Palanisamy P.N., Manikandan P., Geetha A. and Manjula Rani K., "Chemistry Laboratory Manual", 1st Edition, Kalaikathir Publishers, Coimbatore, 2020.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	determine the specific resistance of conducting materials and the band gap of semiconducting materials using the concept of electrical conductivity and determine the thermal conductivity of dielectrics using the concept of heat conduction through materials.	Applying (K3), Precision (S3)
CO2	determine the thickness of nano-crystalline thin films using the concept of interference of light, and to determine the particle size of powder material using the concept of diffraction of light. Demonstrate the viscometer to estimate the molecular weight of the polymer, and determine the amount of calcium in cement and iron in steel.	Applying (K3), Precision (S3)
CO3	estimate the amount of chromium and DO in the given wastewater.	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											
CO2			3											
CO3			3											

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

20CEL21 SURVEYING LABORATORY

Programme & Branch	B.E.- CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Surveying and Geomatics	2	PC	0	0	2	1

List of Exercises / Experiments :

1	Ranging, chain and compass traversing: Measurement of distance, bearings and setting the perpendiculars
2	Levelling: Determination of elevation of given points
3	Levelling: Determination of height difference between the points by conducting differential and reciprocal levelling
4	Theodolite: Determination of distance and elevation by stadia method
5	Theodolite: Determination of distance and elevation by tangential method
6	Determination of distance and elevation of points by trigonometric levelling – same vertical plane method
7	Determination of distance and elevation of points by trigonometric levelling – double vertical plane method
8	Measurement of distance, elevation using advanced total station
9	Measurement of area using advanced total station
10	Setting out works using advanced total station – foundation, column marking
11	Contouring using advanced total station
12	Study on plotting the graph by using the output from advanced total station
13	Co-ordinate marking with GPS

Total:30

REFERENCES:

1	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	conduct chain, compass and tape survey in the field	Applying (K3), Manipulation (S2)
CO2	find the level differences and distances between the points	Applying (K3), Manipulation (S2)
CO3	analyse the various topography using total station	Analyzing (K4), Manipulation (S2)

Mapping of COs with POs and PSOs

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

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

20MAT31 - PROBABILITY AND PARTIAL DIFFERENTIAL EQUATIONS

(Common to AUTO, CIVIL, MECH, MTS, CHEM & FT branches)

Programme & Branch	B.E. & Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3	BS	3	1	0	4

Preamble	To provide the skills for solving the real time engineering problems involving partial differential equations and impart knowledge in applying probability concepts in their respective fields and express functions in terms of Fourier series.	
Unit - I	**Random Variables:**	**9+3**
Introduction to Probability – Definition of random variable – Discrete and Continuous random variables – Probability Mass and Probability density functions – Mathematical expectation and Variance – Moments – Moment generating functions.		
Unit - II	**Standard Probability Distributions:**	**9+3**
Discrete Distributions: Binomial distribution – Poisson distribution – Geometric distribution – Continuous Distributions: Uniform distribution – Exponential distribution – Normal distribution.		
Unit - III	**Fourier Series:**	**9+3**
Dirichlet's conditions – General Fourier series – Change of interval – Odd and even functions – Half range Sine series – Half range Cosine series – Harmonic analysis.		
Unit - IV	**Partial Differential Equations:**	**9+3**
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Lagrange's linear equation – Solution of homogeneous linear partial differential equations of higher order with constant coefficients.		
Unit - V	**Applications of Partial Differential Equations:**	**9+3**
Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two dimensional heat equation (excluding insulated edges).		

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1. Ravish R Singh, Mukul Bhatt "Engineering Mathematics", 1st Edition, McGraw Hill Education, New Delhi, 2016.

REFERENCES:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, Limited, 2019.
2. Veerarajan T., "Transforms and Partial Differential Equations", 3rd Reprint, Tata Mc Graw Hill Education Pvt. Ltd., New Delhi, 2013.
3. Jay L. Devore., "Probability and Statistics for Engineering and the Sciences", 9th Edition, Cengage Learning, USA, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	interpret the concept of random variables.	Applying (K3)
CO2	implement the exact distribution for solving engineering problems.	Applying (K3)
CO3	express the given function or data in terms of Fourier series.	Applying (K3)
CO4	formulate and solve higher order partial differential equations	Applying (K3)
CO5	apply Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave 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	3	1											
CO2	3	3	2											
CO3	3	2												
CO4	3	3	1											
CO5	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	10	10	80	-	-	-	100
CAT2	10	10	80	-	-	-	100
CAT3	10	10	80	-	-	-	100
ESE	10	20	70	-	-	-	100

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

20CSC31 - PROGRAMMING IN C

(Common to all BE/BTech Engineering & Technology branches except CSE, IT)

Programme & Branch	All BE/BTech Engineering & Technology branches except CSE, IT	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	ES	3	0	2	4

Preamble	The course is designed for use by freshmen students taking their first course in programming. It deals with the techniques needed to practice computational thinking, the art of using computers to solve problems and the ways the computers can be used to solve problems. This course also focuses on developing programming skills using C language.	
Unit - I	**Introduction to Computer and Problem Solving:**	**9**
Overview of computers : Types, Generations, Characteristics, Basic computer Organization – Problem solving techniques: Algorithms - Flowcharts – Pseudo codes – Structuring the logic: Sequential, selection and repetitive structure		
Unit - II	**Introduction to C and Control Statements:**	**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 - decision making and looping statements		
Unit - III	**Arrays and Functions:**	**9**
Declaring, initializing and accessing arrays – operations on arrays – Two dimensional arrays and their operations. 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, passing arguments to function using pointers -pointers and 1D arrays –arrays vs pointers , 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 Exercises:

1.	Writing algorithms and drawing flowcharts using Raptor Tool for problems involving sequential, Selection and repetition structures
2.	Programs for demonstrating the use of different types of operators like arithmetic, logical, relational and ternary operators
3.	Programs using decision making and repetitive statements
4.	Programs for demonstrating one-dimensional and two-dimensional numeric array
5.	Programs to demonstrate modular programming concepts using functions and strings (Using built-in and user-defined functions)
6.	Programs to illustrate the use of structures and pointers
7.	Programs to implement file operations

Lecture:45, Practical : 30, Total:75

TEXT BOOK:

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

REFERENCES:

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.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	outline the basics of computers and apply problem solving techniques to express the solution for the given problem	Applying (K3)
CO2:	identify the appropriate looping and control statements in C and develop applications using these statements	Applying (K3)
CO3:	develop simple C programs using the concepts of arrays and modular programming	Applying (K3)
CO4:	apply the concepts of pointers and develop C programs using strings and pointers	Applying (K3)
CO5:	make use of user defined data types and file concept to solve given problems	Applying (K3)
CO6:	demonstrate the execution of flowcharts for the given problem using Raptor	Applying (K3), Precision (S3)
CO7:	demonstrate the application of sequential, selective and repetitive control structures	Applying (K3), Precision (S3)
CO8:	develop solutions to the given problem using derived /user defined data types and functions and also using file concepts	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											
CO2	3	2	2											
CO3	3	2	2											
CO4	3	2	2											
CO5	3	2	2											
CO6	3	2	2	2	1					1				
CO7	3	2	2	2	1					1				
CO8	3	2	2	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	20	30	50				100
CAT2	10	30	60				100
CAT3	10	30	60				100
ESE	20	30	50				100

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

20CET31 MECHANICS OF MATERIALS

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Engineering Mechanics	3/4	ES	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 – 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 – 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 -– Application's of bending equation - Shear stress distribution in beam.		
Unit - IV	**Deflection of Beams andThin Cylinder:**	**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. Thin cylinder – Circumferential stress – Longitudinal stress – Maximum shear stress – Change in dimension of thin cylinder.		
Unit - V	**Theory of column and Torsion:**	**9+3**
Column and strut – Classification of columns - Slenderness ratio – Buckling factor - Effective length – Various end conditions - Euler's theory, assumptions, formula and limitations - Rankine's formula – Crippling load and Safe load. Simple torsion – Torsional loads – Torsion equation for circular shafts and hollow circular shafts – Assumptions -Torsional rigidity - Power transmission – Modulus of rupture.		

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", 2nd Edition, Oxford University Press, 2014.
2. Ferdinand Pierre Beer, Elwood Russell Johnston, John T. De Wolf and David Francis Mazurek, "Mechanics of Materials", 7th Edition, McGraw-Hill Education, 2015.

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	analyse the bending and shear stresses in beams	Analyzing (K4)
CO4	asses the slope and deflection in beams	Analyzing (K4)
CO5	analyse the torsional behaviour 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	1			3						1	3	3
CO2	3	3	2			3				1		1	3	3
CO3	3	3	2			3						1	3	3
CO4	3	3	2			3						1	3	3
CO5	3	3	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	10	20	70				100
CAT2	10	10	40	40			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)**

20CET32 - CONCRETE TECHNOLOGY

(IS 10262: 2019 (Page No: 1 to 23) & IS 456: 2000 Code Books are Permitted)

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

Preamble	This course imparts knowledge about the various ingredients and properties of concrete along with mix proportioning of concrete.	
Unit - I	**Ingredients of Concrete:**	**9**
Cement - ASTM classification of cement - Chemical composition - Hydration of cement - Field and laboratory tests for Cement. Aggregates: Coarse and Fine Aggregates – Tests for 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**
Statistical Quality Control of Concrete- Methods of Mix design - IS method of mix design for normal 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- SIMCON - Shotcrete - Basalt Fiber Concrete- Ready Mix Concrete – Reactive Powder Concrete– Geo-Polymer Concrete– Roller Compacted Concrete - Smart Concrete-Stamped Concrete- ECC - Sustainability of concrete.		

Total: 45

TEXT BOOK:

1. Shetty M.S., “Concrete Technology Theory and Practice”, 8th Edition, S.Chand & Company Ltd., New Delhi, 2018.

REFERENCES:

1. Neville A.M., “Concrete Technology”, 27th Edition, Pearson India Education Services, 2019.
2. Santhakumar A.R., “Concrete Technology”, 2nd Edition, Oxford University Press, India, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the properties of various ingredients of concrete	Understanding (K2)
CO2	perform mix design as per IS codal provisions	Applying (K3)
CO3	assess the fresh and hardened properties of concrete	Understanding (K2)
CO4	assess the durability performance of concrete	Understanding (K2)
CO5	infer the types of special concrete with its features and applications	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						1	3	2
CO2	3	2	1			3	2					2	3	2
CO3	2	1				2						1	3	2
CO4	2	1				3	1					1	3	2
CO5	2	1				3						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	10	40	50				100
CAT3	30	70					100
ESE	20	30	50				100

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

20CET33 - GEOTECHNICAL ENGINEERING I

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	III	PC	3	0	0	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:**	**9**
Formation of soil - Soil description – Particle behavior –Soil structure – Phase relationship – Index properties – Significance – Indian Standard Classification system – Unified classification systems – Compaction of Soils – Theory and Factors influencing compaction of Soils – Field Compaction methods		
Unit - II	**Permeability and Effective Stress:**	**9**
Flow of water through soils – Capillary phenomena - Darcy 's law – permeability – Factors affecting permeability – coefficient of permeability – Effective stress concepts in soils – quick sand conditions – Seepage – seepage velocity- discharge velocity – Introduction to flow nets – uplift pressure – properties and uses		
Unit - III	**Stress Distribution and Settlement:**	**9**
Stress distribution in homogeneous and isotropic medium – Boussinesq theory – Westergaard's theory – Use of New marks influence chart – Components of settlement – Immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – Computation of rate of settlement. - $\sqrt{t}$ and log t methods– e-log p relationship		
Unit - IV	**Shear Strength:**	**9**
Shear strength of cohesive and cohesion less soils – 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		
Unit - V	**Slope Stability:**	**9**
Stability Analysis - Infinite slopes and finite slopes – Total stress analysis for saturated clay – Friction circle method – Use of stability number – Method of slices –Mechanism of landslides and remedial measures - soil nailing – Methods of slope protection		

Total: 45

TEXT BOOK:

1. Gopal Ranjan and Rao A.S.R., "Basic and Applied Soil Mechanics",3rd Edition, New Age International Pvt. Ltd, 2020.

REFERENCES:

1. Arora K.R., "Soil Mechanics and Foundation Engineering", 7th Edition, Standard Publishers and Distributors, New Delhi, 2019.
2. Punmia B.C., "Soil Mechanics and Foundation Engineering", 17th Edition, Laxmi Publications, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	classify the soil and solve three phase system problems	Understanding (K2)
CO2	solve the problems related to effective stress, permeability and seepage	Applying (K3)
CO3	determine vertical stress distribution and settlement in soil	Applying (K3)
CO4	calculate the shear strength parameters for various soil conditions	Analyzing (K4)
CO5	analyse the stability of slopes	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	2	1				3						1	3	2
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	3	2			3						1	3	3
CO5	3	3	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	40	40				100
CAT2	15	40	45				100
CAT3	10	40	35	15			100
ESE	10	35	40	15			100

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

20CET34 - WATER RESOURCES AND IRRIGATION ENGINEERING

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

Preamble	This course aims to expose the civil engineering students with the clear knowledge on Water Resources, Irrigation Engineering concepts and National Water Policy. Further they will be imparted 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 master plan – Idea of basin as a unit for development – Water budget – Conjunctive use of surface and ground water.		
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 Head works – Canal drop – Cross drainage works – Canal regulations – Canal outlets – Canal classifications – Alignment of canals – River Training works – Kennedy's and Lacey's Regime 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 – Participatory irrigation management with a case study – On farm development works– Participatory irrigation management – Case study.		

Total: 45

TEXT BOOK:

1. Asawa G.L., "Irrigation and Water Resources Engineering", 1st Edition, New Age International Publishers, New Delhi, 2005.

REFERENCES:

1. Garg S.K., "Water Resources Engineering Vol. II Irrigation Engineering & Hydraulic Structures", 34th Edition, Khanna Publishers, New Delhi, 2016.
2. Suresh Ukarande, "Irrigation Engineering and Hydraulic Structures", 3rd Edition, Ane Books Pvt. Ltd., New Delhi, 2015.

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	1			3						1	3	3
CO2	2	1				3							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	20	50	30				100
CAT2	15	55	30				100
CAT3	10	50	40				100
ESE	20	40	40				100

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

20CEL31 - STRENGTH OF MATERIALS LABORATORY

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Mechanics of Materials	3	PC	0	0	2	1
Preamble	This course illustrates the test methods to determine the various behaviours of materials used in construction						

List of Exercises / Experiments:

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.	Tests on open coil helical springs
10.	Tests on closed coil helical springs
11.	Study on mechanical and electrical strain gauges
12.	Study on fatigue test

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	IS 432-1 (1982) and IS 1810-38 (1984)

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	determine the behavior of materials under tension, compression, shear and torsion	Analyzing (K4), Manipulation (S2)
CO2	examine the impact strength and hardness of the material	Analyzing (K4), Manipulation (S2)
CO3	investigate the strength of materials under bending and stiffness	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	2		3		1	1			2	3	3
CO2	3	3	2	2		3		1	1			2	3	3
CO3	3	3	2	2		3		1	1			2	3	3

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

20CEL32 - CONCRETE TECHNOLOGY LABORATORY

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Construction Materials and Practices	3	PC	0	0	2	1
Preamble	This course demonstrates how to determine the properties of materials used for concrete and the properties of fresh and hardened concrete.						

List of Exercises / Experiments:

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.	Compressive Strength of Cement
6.	Workability of fresh concrete -Slump Value, Compaction factor and Vee Bee Consistometer
7.	Compressive Strength of Concrete
8.	Split Tensile Strength of Concrete
9.	Flexural Strength of Concrete
10.	Tests on Concrete Blocks (Hollow blocks & Paver blocks)
11.	NDT on Concrete (Rebound Hammer and UPV test)
12.	Durability on Concrete - Permeability and RCPT (Demo only)

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual
2.	Gambhir M.L “Concrete Testing Manual” Dhanpat Rai & Sons, New Delhi,2010

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	test the properties of materials used in concrete	Applying(K3), Manipulation (S2)
CO2	determine the mechanical properties of hardened concrete	Applying (K3) , Manipulation (S2)
CO3	conduct non-destructive testing to analyze the quality of concrete	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	2	1	1				2	3
CO2	3	2	1	2		3	2	1	1				2	3
CO3	3	3	2	2		3	2	1	1				2	3

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

20MNT31 - ENVIRONMENTAL SCIENCE

Programme & Branch	All BE/BTech Engineering & Technology branches	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	3 / 4	MC	2	0	0	0

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- Value 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.
2. Lodish. H., Berk A., Zipurursky S.L., Matsudaria P., Baltimore D. and Darnell J., “Molecular Cell Biology”, 4th Edition, Freeman Press, 2000.

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. Satyanarayan, U.,& Chakrapani, U., “Textbook of Biochemistry”,1999 Ed. June 2017

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	40	35				100
CAT2	25	40	35				100
CAT3	NA						100
ESE	NA						100

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

20MAT41 – STATISTICS AND NUMERICAL METHODS

(Common to all Engineering and Technology Branches except ECE, CSE and IT)

Programme & Branch	B.E – Civil Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	4	BS	3	1	0	4

Preamble	To impart knowledge in testing of samples, ANOVA and interpolation. Also develop skills to apply numerical algorithms to identify roots of algebraic and transcendental equations and solve linear and ordinary differential equations.	
Unit - I	**Testing of Hypothesis:**	**9+3**
Introduction – Critical region and level of significance – Types of Errors – Large sample tests: Z-test for single proportion and difference of two sample proportions – Z-test for single mean and difference of means – Small sample tests: Student's t-test for testing significance of single mean and difference of means – F-test for comparison of variances – Chi-square test: Test of goodness of fit – Test of independence of attributes.		
Unit - II	**Design of Experiments:**	**9+3**
Introduction – Analysis of variance – One way classification: Completely Randomized Design – Two way classification: Randomized Block Design – Three way classification: Latin Square Design.		
Unit - III	**Solution to Algebraic and Transcendental Equations:**	**9+3**
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 - IV	**Interpolation, Numerical Differentiation and Integration:**	**9+3**
Interpolation: Interpolation with equal intervals: Newton's forward and backward difference formulae – Interpolation with unequal intervals: Lagrange's interpolation formula – Newton's divided difference formula. Numerical Differentiation and Integration: Differentiation using Newton's forward, backward and divided difference formulae – Numerical integration: Trapezoidal rule – Simpsons 1/3rd rule.		
Unit - V	**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.		

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

1. Veerarajan T, Ramachandran T., "Statistics and Numerical Methods", 1st Edition, Tata McGraw Hill Publishing Company, New Delhi, 2018.

REFERENCES:

1. Walpole R.E., Myers R.H., Myers S.L. and Ye K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2012.
2. Jay L. Devore., "Probability and Statistics for Engineering and the Sciences", 9th Edition, Cengage Learning, USA, 2016.
3. Steven C. Chapra, Raymond P. Canale., "Numerical Methods for Engineers", 7th Edition, McGraw-Hill Education, 2014.
4. Ravish R.Singh, Mukul Bhatt "Engineering Mathematics", 1st Edition, McGraw Hill Education, New Delhi, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply statistical tests for solving engineering problems involving small and large sample tests.	Applying (K3)
CO2	handle experimental data with the knowledge of ANOVA.	Applying (K3)
CO3	apply various numerical techniques to solve algebraic and transcendental equations	Applying (K3)
CO4	compute intermediate values of given data, numerical derivatives and integral values	Applying (K3)
CO5	obtain the solution of first ordinary differential equations by numerical 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	3	2	3										
CO2	3	2	1	3										
CO3	3	3	2											
CO4	3	2												
CO5	3	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	10	20	70				100
CAT2	10	20	70				100
CAT3	10	20	70				100
ESE	10	30	60				100

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

20CSC41 – PYTHON PROGRAMMING

(Common to all BE/BTech Engineering & Technology branches except CSE, IT)

Programme & Branch	All BE/BTech Engineering & Technology branches except CSE, IT	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3/4	ES	3	0	2	4

Preamble	This course introduces the core python programming. It emphasizes on developing python programs with all data types, functions, classes, objects and numpy	
Unit - I	**Introduction:**	**9**
Introduction: 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,Tuples and Dictionary: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 and Regular Expressions: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 and Modules: 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, NumPy and Matplotlib:**	**9**
Object Orientation: 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 Exercises / Experiments :

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 Edition, Oxford University Press, 2017.

REFERENCES:

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", 1st Edition, O'Reilly Media, , 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	make use of basic python constructs to write simple programs.	Applying (K3)
CO2	apply list, tuple and dictionary to handle variety of data.	Applying (K3)
CO3	apply strings and regular expression for searching in a string.	Applying (K3)
CO4	solve the problems using functions and modules.	Applying (K3)
CO5	understand the class and object and apply inheritance in programming.	Applying (K3)
CO6	implement the basic data types and control statements.	Applying (K3), Manipulation (S2)
CO7	demonstrate functions, regular expressions and object oriented concepts.	Applying (K3), Manipulation (S2)
CO8	perform numpy operations and analyse results using matplotlib	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	1										
CO2	3	2	1	1										
CO3	3	2	1	1										
CO4	3	2	1	1										
CO5	3	2	1	1										
CO6	3	2	1	1										
CO7	3	2	1	1										
CO8	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	25	50				100
CAT2	20	20	60				100
CAT3	20	20	60				100
ESE	25	25	50				100

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

20CEC41 GEOTECHNICAL ENGINEERING II

(IS6403-1981 code is permitted)

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	GEOTECHNICAL ENGINEERING I	4	PC	2	0	2	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:**	**6**
Soil exploration – planning – test pits – boring – sampling – standard penetration test – static and dynamic cone penetration tests – geophysical methods (seismic, electrical resistivity) – preparation of soil investigation report-Types of foundation – Choice of foundations based on soil profile.		
Unit - II	**Bearing Capacity :**	**6**
Terms and definitions – Types of bearing capacity failure – Terzaghi's method - IS code method – Teng's method - Factors affecting bearing capacity - Methods of improving bearing capacity		
Unit - III	**Settlement Analysis and Design of Shallow Foundation:**	**6**
Causes of settlement – Elastic settlement– primary settlement– differential settlement – estimation of settlement from SPT – codal provisions – methods of minimizing settlement – Plate load test for bearing capacity -Design principles of isolated and spread footing – combined rectangular and trapezoidal footing		
Unit - IV	**Deep Foundation:**	**6**
Classifications – construction of piles - load carrying capacity – static and dynamic analysis – Pile load tests – negative skin friction - Group action of piles – load carrying capacity of pile groups– Settlement of pile groups		
Unit - V	**Earth Pressure Analysis:**	**6**
Introduction- Plastic equilibrium in soils – active and passive earth pressure – Rankine's theory – Coulomb's wedge theory - Graphical method (Rebhann and Culmann).		

List of Exercises / Experiments:

1.	Determination of Specific Gravity
2.	Determination of Grain size distribution-sieve analysis
3.	Determination of Atterberg limits
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:

1.	Varghese P.C., "Foundation Engineering", 2nd Edition, PHI Learning, New Delhi. 2011.
2.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	summarize soil exploration techniques and foundation systems	Understanding (K2)
CO2	determine bearing capacity and settlement of shallow foundations	Applying (K3)
CO3	design shallow foundations	Applying (K3)
CO4	calculate the load carrying capacity and settlement of pile foundation	Applying (K3)
CO5	analyse the earth retaining structures	Analyzing (K4)
CO6	characterize the given soil based on the index properties	Analyzing (K4), Manipulation (S2)
CO7	determine the drainage characteristics and rate of consolidation	Applying (K3), Manipulation (S2)
CO8	evaluate the shear strength parameters of cohesive and cohesionless soil	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	2	1				2				1		1	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	3	2			3						1	3	3
CO6	3	3	2	2		3			1			2	3	3
CO7	3	2	1	2		3			1			2	3	3
CO8	3	2	1	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	20	70				100
CAT2	10	30	60				100
CAT3	10	20	40	30			100
ESE	10	20	50	20			100

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

20CET41 - FLUID MECHANICS AND HYDRAULICS ENGINEERING

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Applied Physics	IV	PC	3	1	0	4

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, Statics and Kinematics:**	**9+3**
Properties of fluids – Types of fluids- Hydrostatic law – Pascal's law- Types and measurement of pressure – Hydrostatic pressure on plane and curved surfaces -Total pressure - Centre of pressure – Buoyancy – Metacentre – Equilibrium conditions of floating and submerged bodies.		
Unit - II	**Fluid Dynamics:**	**9+3**
Classification and types of flow –flow lines and Path lines – Stream tube - Continuity equation – Velocity potential function and Stream function– Flow net - Euler's equation of motion - Bernoulli's equation and its applications – Darcy Weisbach's formula – Flow through pipes– Hagen Poiseuille's' equation - Moody diagram.		
Unit - III	**Open Channel Flow:**	**9+3**
Types of flow- Specific energy – Energy- depth relationship - Critical flow – Velocity measurements by Manning's and Chezy' formula - Most economical sections (Rectangular, Trapezoidal and Circular sections).		
Unit - IV	**Flow through Pipes & Boundary Layer:**	**9+3**
Characteristics and types of flow profiles- back water and draw down curves – surface profile calculations- Hydraulic Jumps – Surges. Boundary layer concept, thickness and classification.		
Unit - V	**Dimensional and Model Analysis:**	**9+3**
Dimensional analysis - Dimensional parameters – Rayleigh's method and Buckingham's Pi theorem -Model analysis - Hydraulic Similitude- Scale effect – Distorted and undistorted models.		

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

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

REFERENCES:

1. Douglas J.F., Gasirock J.M. and Swaffield J.A., "Fluid Mechanics", 14th Edition, Pearson Education Publishers, 2002.
2. Victor L. Streeter, Benjamin E. Wylie and Bedford K.W., "Fluid Mechanics", 9th Edition, McGraw-Hill, India, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	predict the properties and characteristics of fluids	Applying (K3)
CO2	classify different types of flow and compute the components related to various flows.	Applying (K3)
CO3	design economical sections for open channel flow	Applying (K3)
CO4	classify the various flow profiles and calculate the boundary layer thickness	Applying (K3)
CO5	evaluate the dimensional and model parameters to solve complex fluid problems	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	1			3						1	3	3
CO2	3	2	1			3						1	3	3
CO3	3	2	1			3						1	3	3
CO4	3	3	2			3						1	3	3
CO5	3	3	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	70				100
CAT2	10	30	60				100
CAT3	10	20	40	30			100
ESE	10	20	50	20			100

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

20CEL41 - FLUID MECHANICS AND MACHINERIES LABORATORYRY

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	**Physics**	**4**	**PC**	**0**	**0**	**2**	**1**
Preamble	This course helps the students to determine various flow and hydraulic machine characteristics.						

List of Exercises / Experiments:

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

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

20CEL42 COMPUTER AIDED BUILDING DRAWING LABORATORY

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisites	Engineering Drawing	4	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 Exercises / Experiments:

1.	Building Planning - NBC provisions & Bye-laws -Terminologies, Orientation, Ventilation & Lighting
2.	Introduction to Building Elements-Foundations, Super structure, Roof, Staircase, Doors and Windows
3.	Introduction to AutoCAD and basic drafting tools /commands
4.	Drawing the Plan, Elevation & Section of a residential Building with Load Bearing Wall
5.	Drawing the Plan, Elevation & Section of an Industrial Building
6.	Drawing the Plan, Elevation & Section of a Residential Building with Framed structure
7.	Drawing the Plan, Elevation & Section of a School Building with Framed structure
8.	Drawing the Plan, Elevation & Section of a Residential Building with Pitched Roof
9.	Preparation of approval plan for a Residential Building
10.	Preparation of approval plan for a Commercial 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.	S.S Bhavikatti & M.V. Chitawadagi., “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	Applying (K3), Manipulation (S2)
CO3	prepare approval plan for buildings	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	3								3	3
CO2	3	2	2	3	3								3	3
CO3	3	3	3	3	3								3	3

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

20EGL31 ENGLISH FOR WORKPLACE COMMUNICATION LABORATORY

(Common to all BE/BTech Engineering and Technology branches)

Prog. & Branch	All BE/BTech Engineering & Technology branches	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	III / IV	HS	0	0	2	1

Preamble:	This course is designed to impart required levels of fluency in using the English Language at B1/B2 level in the CEFR through activities, hands-on training and application.	
Unit -I	**Listening:**	**6**
Techniques for effective listening and note taking; listening to audio scripts, podcasts and TED talks; listening to discourse samples of native speakers and imitating; improving pronunciation; introduction to the basics of phonetics and understanding different accents.		
Unit -II	**Reading:**	**6**
Speed reading skills; reading to gain knowledge; reading newspaper articles to improve writing; academic journals to enrich vocabulary and word power; reading aloud with proper stress and intonation; reading to draw inferences.		
Unit -III	**Soft Skills:**	**6**
Importance of soft skills at workplace - understanding soft skills through case studies - developing positive attitude; goal setting; time management; team work; telephone etiquette; developing professionalism, interpersonal skills and work ethics.		
Unit -IV	**Writing:**	**6**
Introduction to pre-writing, style and mechanics of writing; mind mapping; creating content from an outline; paragraph and resume writing; nuances of academic writing; writing Statement of Purpose (SOP), editing, revising and proof reading for clarity and readability; structural and grammatical accuracy.		
Unit -V	**Speaking:**	**6**
Verbal and non-verbal communication; fluency and spoken English; introducing oneself and others; making presentations on topics using prepared material; mock interviews; dynamics of Group Discussion.		

List of Exercises / Experiments :

1. Mock Interview
2. Presentation
3. Reading Aloud
4. Group Discussion
5. Soft Skills through Case Studies
6. Listening Test

Total: 30

REFERENCES/MANUAL/SOFTWARE:

1. Jeff Butterfield, “Soft Skills for Everyone”, 1st Edition, Cengage Learning, New Delhi, 2011.
2. Bob Dignen, Steve Flinders and Simon Sweeney, “Professional English for Work and Life, English 365, Student’s Book 2”, 1st Edition, Cambridge University Press, New Delhi, 2004.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1:	acquire effective listening and reading skills	Understanding (K2), Imitation (S1)
CO2:	acquire and demonstrate appropriate professional skills for the workplace	Applying (K3), Naturalization (S5)
CO3:	speak fluently and write meaningfully in English in the given context	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	PSO1	PSO2
CO1									2	3		2		
CO2									2	3		2		
CO3									3	3		3		

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

20GET31 - UNIVERSAL HUMAN VALUES
(Common to All BE/BTech branches)

Programme & Branch	All BE/BTech Engineeirng & Technology branches	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	HS	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 Begin 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 Profes sional 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.	Understanding (K2)
CO2	distinguish between the Self and the Body, understand the meaning of Harmony in the Self, the Co–existence of Self and Body.	Understanding (K2)
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.	Understanding (K2)
CO4	transform themselves to co-exist with nature by realizing interconnectedness and four orders of nature.	Understanding (K2)
CO5	distinguish between ethical and unethical practices, and stand ethical and moral practices for a better living.	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	3	2	2				
CO2						2	2	3	2	2				
CO3						2	2	3	2	2				
CO4						2	2	3	2	2				
CO5						2	2	3	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	75					100
CAT2	25	75					100
CAT3	NA						
ESE	NA						

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

20CEC51 ENVIRONMENTAL ENGINEERING

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	5	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 – Principles of Flocculators – 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 – Eutrophication – Sanitary fixtures – One pipe and Two pipes systems – Rural sanitation system – Environmental Protection Acts.		

List of Exercises / Experiments:

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:

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 and analyze the water demand	Applying (K3)
CO2	classify the water purification methods	Applying (K3)
CO3	calculate the quantity of waste water generated from various sources	Applying (K3)
CO4	design the principal components of sewage treatment plant	Applying (K3)
CO5	suggest appropriate sludge treatment methods and sanitary fixtures	Applying (K3)
CO6	analyze the physical and chemical parameters present in the water	Analyzing (K4) Manipulation (S2)
CO7	determine the amount of oxygen required for self-purification of a stream	Applying (K3) Manipulation (S2)
CO8	recommend the type of coagulants required for potable supplies	Understanding (K2) 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	2									2	2
CO2	3	3	3	3									3	3
CO3	3	3	3	2									3	3
CO4	3	3	3	3									3	3
CO5	3	3	2	2									3	3
CO6	3	2	2	3		3	2						3	3
CO7	3	2	2	3		2	3						2	2
CO8	3	2	2	3		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	30	25	45				100
CAT2	20	40	40				100
CAT3	25	35	40				100
ESE	20	40	40				100

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

20CET51 - STRUCTURAL ANALYSIS

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

Preamble	This course offers the various methods for the analysis of 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	**Energy Methods:**	**9+3**
Basic energy concepts – Strain energy – Linear system – Load potential energy – Energy principles based on displacement field – Castigliano's theorem (I & II) – Stiffness coefficients – Energy principles based on force field – Flexibility coefficients – Theorem of least work.		
Unit - II	**Slope Deflection and Moment Distribution Methods:**	**9+3**
Introduction to displacement method of analysis – Slope deflection equations – Analysis of continuous beams and frames – Introduction to moment distribution method – Stiffness factor – Carryover factor and distribution Factor – Analysis of 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 compatability 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 – Displacement and force transformation matrices – Element and global stiffness matrix – Applications – Analysis of indeterminate beams, frames and 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, Arun K. Jain, "Theory Of Structures", 13th Edition, Laxmi Publications, New Delhi, 2017.

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

20CET52 DESIGN OF RC ELEMENTS

(IS 456 -2000 & SP 16 codes are permitted)

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

Preamble	This course gives the detailed design philosophies for reinforcement concrete design, design of different types of conventional slabs, determinate beams for various forces, short columns, long columns and isolated Footing.	
UNIT – I	**Fundamental Concepts:**	**9+3**
Objective of structural design – Grades of concrete – Type of loads on structures and load combinations –Basic structural elements – Steps in RCC structural design process – Design considerations – 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) – Advantages of Limit State Method over other methods – Permissible stress – Characteristic strength and Characteristic load – Factor of safety and Partial safety factors – Various limit states		
Unit - II	**Limit State Design of Slabs:**	**9+3**
Types of slabs – Behaviour of one-way slab – Design considerations – Design of one-way slab – cantilever, simply supported and continuous. Behaviour of two-way slab – Design of two-way slab – restrained, non-restrained and continuous. Types of staircases – design of dog-legged staircase.		
Unit - III	**Limit State Design of Beams:**	**9+3**
Assumptions – Design of singly and doubly reinforced rectangular and flanged beams for flexure, shear and combined bending, shear and torsion – Design of shear reinforcement – Design requirement for bond and anchorage as per IS code		
Unit - IV	**Limit State Design of Columns**:	**9+3**
Classification of columns – Assumptions – Unsupported and effective length of a column – Failure of columns – Codal specifications on slenderness limits, Minimum eccentricities and reinforcement – Design of short rectangular, square and circular 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 footings – Design principles of combined rectangular footings for two columns – Introduction to strap footing and raft/mat foundation.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Unnikrishna Pillai S. and Devdas Menon, Reinforced Concrete Design, 3rd Edition, Tata McGraw-Hill, New Delhi, 2009

REFERENCES:

1.	Subramanian N., Design of Reinforced Concrete Structures, 1st Edition, Oxford University Press, 2014
2.	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 different types of slabs and dog-legged staircase	Applying (K3)
CO3	design beams for flexure, shear & torsion	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	2	1				2							3	2
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

20CEL51 - 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
Prerequisite	Structural Analysis & Design of RC Elements	5	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 Exercises / Experiments:

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
2.	Lab Manual
3.	S.N.Sinha, reinforced concrete design, Tata Mcgraw hill education, 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	1	3	1	3		1	1			2	3	3
CO2	3	3	1	3	1	3		1	1			2	3	3
CO3	3	3	1	3	1	3		1	1			2	3	3

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

20CEL52 - Computer Aided Building Information Modelling Lab

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	5	PC	0	0	2	1
Preamble	To impart knowledge about modelling software in construction						

List of Exercises / Experiments:

1.	Introduction and general features in BIM
2.	Building Components – Walls, Doors, Windows and Roofs
3.	Building Components – Floors, Staircase and Ramp
4.	3-D elevation for single storied building (output with Plan, Section and elevation rendering)
5.	3-D elevation for multi storied building (output with Plan, Section and elevation rendering)
6.	3-D Framed Structure (with Foundation, Columns, Beams, Slabs and Wall)
7.	Building walk through model
8.	Single storied building documentation and quantity take off
9.	Multi storied building documentation and quantity take off
10.	Construction schedule for a multi storied building
11.	Slab and Beam Detailing
12.	Column and Footing Detailing

Total:30

REFERENCES/MANUAL/SOFTWARE:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	apply the building components effectively in 3D modelling for a building system	Applying (K3), Manipulation (S2)
CO2	prepare the 3-D elevation and framed structure detailing for a building system	Analyzing (K4), Manipulation (S2)
CO3	compute material quantity and construction duration for a building system	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	1	3			1	2		2	3	3
CO2	3	3	2	2	2	3			1	2		2	3	3
CO3	3	3	2	2	2	3			1	2		2	3	3

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

20CEL53 - Computational Laboratory for Construction Management

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	5	PC	0	0	2	1
Preamble	To impart knowledge about modelling software in construction						

List of Exercises / Experiments:

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.	Defining and Assigning of Resources
6.	Levelling and Resource Management
7.	Cost analysis of a Construction Project
8.	Tracking of a Construction Project (Include the application of BIM in construction Management)
9.	Management of Multiple Construction Projects
10.	Report Preparation

Total:30

REFERENCES/MANUAL/SOFTWARE:

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

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 resources for construction projects	Applying (K3), Manipulation (S2)
CO3	prepare various reports for a building system	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	2	1	3			1	2		2	3	3
CO2	3	3	2	2	2	3			1	2		2	3	3
CO3	3	3	2	2	2	3			1	2		2	3	3

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

20GEL51 - PROFESSIONAL SKILLS TRAINING I
(Common to all BE/ BTech / MSc / MCA /BSc Branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	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 upgradation-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 & 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	**Written Communication & Verbal Aptitude**	**30**
Writing Skills: Writing strategies and formats – Importance of Résumés – Writing a Cover letter – Writing a fresher's CV / Résumés – Responding to Job Advertisements – Professional e-mail Writing – Responding to e-mails and business letters – Technical Report writing – Interpretation of Technical Data (Transcoding) – Writing One-page Essays. Verbal Aptitude – Synonyms – Antonyms – Homonyms – One word substitution – Idioms and Phrases – Paired words – Analogies – Spelling test – Cloze test – using suitable verb forms – using appropriate articles and prepositions; Spotting Errors – Sentence Correction and Formation – Grammar Based questions (Transformation : Active-Passive & Direct-Indirect); Rearranging Jumbled Sentences & Jumbled paragraphs, Identifying Facts, Inferences and Judgements statements.		

Total: 80

TEXT BOOK:

1	Thorpe, Showick and Edgar Thorpe, "Objective English For Competitive Examination", 6th Edition, Pearson India Education Services Pvt Ltd, 2017.

REFERENCES:

1	Bailey Stephen, "Academic Writing: A practical guide for students", Routledge, New York, 2011.
2	Raman, Meenakshi and Sharma, Sangeeta**,** "Technical Communication - Principles and Practice", 3rd Edition, Oxford University Press, New Delhi, 2015.

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 individual and as a team	Applying (K3), Precision (S3)
CO2	solve real time problems using numerical ability and logical reasoning	Applying (K3), Precision (S3)
CO3	apply communication skills effectively to understand and deliver information in various written discourses grammatically with accuracy	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
ESE	**NA**						

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

20CEC61 TRANSPORTATION ENGINEERING

(IRC : 37-2012 & IRC : 58-2002 permitted)

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	NIL	6	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 control quality 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: 58-2002 - Construction Procedure and Distresses 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 Exercises / Experiments:

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, 2015**.**

REFERENCES:

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)
CO2	analyze the geometric design elements of highway	Applying (K3)
CO3	apply the design procedure of flexible and rigid pavement	Applying (K3)
CO4	analyze the characteristics of traffic and accident data	Applying (K3)
CO5	design traffic signals and elaborate intersections with traffic control	Applying (K3)
CO6	determine physical properties of aggregates and bitumen	Applying (K3) Manipulation (S2)
CO7	design a mix ratio for required grade of bitumen	Applying (K3) Manipulation (S2)
CO8	determine the sub grade strength of the soil and to assess the surface condition of the pavement	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											3	2
CO2	3	3	2										3	3
CO3	3	2	1										3	3
CO4	3	3	2										3	3
CO5	3	2	1										3	3
CO6	3	2	1	3									3	3
CO7	3	2	1	3									3	3
CO8	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	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)**

20CET61 DESIGN OF STEEL STRUCTURES

(IS 800:2007, Steel Tables, IS 875 (Part-3) and SP 06 are permitted)

Prog. & Branch	B.E & Civil Engineering	Sem.	Category	L	T	P	Credit
Pre requisite	Mechanics of Materials and Structural Analysis	6	PC	3	1	0	4

Preamble	This course offers the design of steel structures as per limit state method. This course follows the recommendation of IS: 800 – 2007. It aims at determination of safe as well as economical steel section for various industrial and framed structures	
Unit - I	**Introduction:**	**9**
Structural form: Classification of structures based on function, material and shape - different structural systems –Load combinations – Concepts of Working Stress Method and Limit State Method of Design - load and resistance factor design - Material - properties of steel - behavior - partial safety for materials - load safety. Other properties: durability - fatigue - fire protection.		
Unit - II	**Connections:**	**9**
Metal joining methods using welding, bolting - Design of bolted and welded joints — weld symbols - strength of fillet and butt welds - Efficiency of joints – High Tension bolts.		
Unit - III	**Tension Members:**	**9**
Types of sections – Net area – Net effective sections for angle and Tee in tension – Design of connections in tension members – Design of tension splice – Concept of shear lag – Use of lug angles		
Unit - IV	**Compression members:**	**9**
Types of compression members – Theory of columns – Buckling class - Slenderness ratio – Strength of simple compression member - Design of built-up compression members – Design of laced columns - Design procedure of battened column		
Unit - V	**Beams:**	**9**
Classification of sections - simple and compound sections – calculation of plastic modulus of section –flexural strength of beams - design considerations – behavior of web under shear – shear check – deflection check- bearing strength of web –buckling strength of web - web buckling –web crippling.		

Lecture:45, Total:45

TEXT BOOK:

1. Subramanian N., “Design of Steel Structures Limit States Method”, 2nd Edition, Oxford University Press, New Delhi, 2016.

REFERENCES:

1. Bhavikatti S.S., “Design of Steel Structures”, 5th Edition, I.K. International Publishing House Pvt. Ltd., New Delhi, 2017.
2. 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	discriminate the various connection methods	Analysing (K4)
CO2	analyse and design the various profiles of tension members	Analysing (K4)
CO3	analyse and design the forms of compression members	Analysing (K4)
CO4	discriminate and design the flexural members	Analysing (K4)
CO5	examine and design the roof truss	Analysing (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	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	20	30	40	-	-	100
CAT2	-	15	35	50	-	-	100
CAT3	-	15	40	45	-	-	100
ESE	10	20	30	40	-	-	100

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

20CET62 - 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
Prerequisite	Structural Analysis and Design of RC Elements	6	PC	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 and Shear Wall**	**9**
Introduction – 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 counter fort retaining wall.		
Unit - IV	**Design of Flat Slabs and Yield Line Theory**	**9**
Introduction – 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.		

Lecture:45, Total:45

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

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)**

20CEL61 - 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
Prerequisite	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 Exercises / Experiments:

1.	Introduction & Modelling of 2D & 3D structures
2.	Load & Load combination
3.	Analysis and design of beam
4.	Analysis of single storey RCC building
5.	Design of single- storey RCC building elements
6.	Analysis of Multi- storey RCC building
7.	Design of Multi- storey RCC building elements
8.	Analysis and Design of RCC water tank
9.	Analysis and design of an Industrial building
10.	Analysis and design of transmission line tower

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 for seismic forces	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

20CEL62 STRUCTURAL ENGINEERING LABORATORY

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Concrete Technology Laboratory	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 Exercises / Experiments:

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

20CEL63 - 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
Prerequisite	Design of RC elements & Design of Steel Structures	5	PC	0	0	2	1
Preamble	This course gives knowledge about how to detailing the various components of the structure using TEKLA STRUCTURES software						

List of Exercises / Experiments:

1.	Detailing of one-way simply supported slab & one-way continuous slab
2.	Detailing of two-way simply supported slab & two-way continuous slab
3.	Detailing of flat slab
4.	Detailing of beams & columns
5.	Detailing of isolated footing
6.	Detailing of combined footing
7.	Detailing of simple steel connections
8.	Detailing of steel beam to beam connection
9.	Detailing of steel beam to column connection
10.	Detailing of steel column base
11.	Detailing of steel seated connection
12.	Detailing of simple steel truss connections

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Tekla structures
2.	Krishnaraju N., Structural Design & Drawing - Reinforced Concrete and Steelll, 3 rd Edition, University Press (India) Ltd., Hyderabad, 2014.
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	detailing the flexural members	Analyzing (K4), Manipulation (S2)
CO2	detailing the column and footings	Analyzing (K4), Manipulation (S2)
CO3	detailing the various 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

20GEL61 PROFESSIONAL SKILLS TRAINING II
(Common to all BE/ BTech / MSc/ MCA /BSc Branches)

Programme & Branch	B.E. & Computer Science and Engineering	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	EC	0	0	80	2

Preamble	This subject is to enhance the employability skills and to develop career competency	
Unit - I	**Soft Skills – I**I	**20**
Group discussions: Advantages of group discussions-Structured GD- Team work: Value of team work in organizations- Definition of a team, why team-Elements of leadership, disadvantages of a team, stages of team formation- Group development activities. Facing an interview: Foundation in core subject- industry orientation / knowledge about the company- professional personality-Communication skills-Activities before Interview, upon entering interview room, during the interview and at the end Mock interviews.		
Unit - II	**Quantitative Aptitude & Logical Reasoning - II**	**30**
Problem solving level II: Money related problems-Mixtures-Symbol base problem-Clocks and calendars-Simple-linear-quadratic and polynomial equations-Special, equations-Inequalities-Sequence and series-Set theory-Permutations and combinations-Probability-Statistics-Data sufficiency- Geometry-Trigonometry-Heights and distances-Co-ordinate geometry-Mensuration. Logical reasoning: Conditionality and grouping-Sequencing and scheduling- Selections-Networks:-Codes; Cubes-Venn diagram in logical reasoning-Quant based reasoning-Flaw detection- Puzzles-Cryptarithms.		
Unit - III	**Reading & Speaking Skills**	**30**
Reading: Reading comprehension– Effective Reading strategies – Descriptive, Inferential, & Argumentative reading passages – Identifying and locating factual information within a text – global reading/skimming for general understanding – selective comprehension / scanning for specific information – detailed comprehension / intensive reading – understanding the development of an argument – identifying the writer's attitude and opinions – Reading news articles in business magazines, newspapers – Reading notices and book reviews –Interpreting graphic data & Advertisements. Speaking: Mock Interviews –Self-Introduction – Sharing of Real Time Experience; Conversational Practices –Role Play – Short Talks / TED Talks –Extempore; Giving a Presentation on Various Topics – Technical / Non-Technical Topics – Project Review Presentation – Oratory and Effective Public Speaking; Pair Discussion – Group Discussion – The process of Group Discussion – Strategies to be adopted – Skills Assessed – Telephonic Conversations & Skills – Negotiating Skills.		

Total: 80

TEXT BOOK:

1	Thorpe, Showick and Edgar Thorpe, "Objective English For Competitive Examination", 6th Edition, Pearson India Education Services Pvt Ltd, 2017.

REFERENCES:

1	Aruna Koneru, "Professional Speaking Skills," Oxford University Press India, 2015.
2	Thorpe, Showick and Edgar Thorpe, "Winning at Interviews," 5th edition, Pearson Education, India, 2013.
3	Rizvi, Ashraf M, "Effective Technical Communication," 2nd Edition, McGraw Hill Education India, 2017.

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 individual and as a team	Applying (K3), Precision (S3)
CO2	Solve real time problems using numerical ability and logical reasoning	Applying (K3), Precision (S3)
CO3	Apply reading and speaking skills effectively 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	0	0	0	3	3	0	3	0	3	2		
CO2	3	2	0	0	0	3	3	0	3	0	3	2		
CO3	0	2	0	0	0	3	3	0	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	40	40				100
CAT2		50	50				100
CAT3		50	50				100
ESE							

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

20CET71 – ESTIMATION AND QUANTITY SURVEYING

(PWD Schedule of rates are permitted)

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Construction Material & Practices, Computer Aided Building Drawing Laboratory	7	PC	3	0	0	3

Preamble	To estimate the quantities and rate analysis for the various types of 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 - Steel requirement and bar bending schedule – Types of arches - Calculation of brick work in arches.		
Unit - II	**Estimation of other Structures and Specifications:**	**9**
Doors and windows (panelled and glazed) - septic tank - soak pit - bituminous and cement concrete roads – retaining walls – culverts - 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.		
Unit - IV	**Valuation:**	**9**
Basics of valuation – Capitalized value – Factors affecting the value of plot and building - depreciation - Valuation of residential building – Escalation – Calculation of standard rent – Mortgage – Lease.		
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, 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	calculate the rates for various items of works	Applying (K3)
CO4	prepare valuation report for plots and buildings	Applying (K3)
CO5	prepare tenders, contract documents and reports as per norms	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	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	40	50				100
CAT2	10	30	60				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)**

PROFESSIONAL ELECTIVES

20CEE01 DESIGN OF PRE-STRESSED CONCRETE STRUCTURES

(Use of IS 1343:2012, IS 2090-1983 & IS 3370 (Part III) 2009 are permitted)

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Concrete Technology	VI	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 – Historical development – Requirements for high strength steel and concrete – Partial prestressing – Moderate prestressing – Bonded & unbounded prestressing - Terminology – Degree of prestressing - Advantages of Prestressed Concrete - Applications of prestressed concrete - 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.		
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 - Types of Flexural Failure.		
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 – Types of failures - Design of Prestressed Sections for Shear and Torsion (design concepts only) – Anchorage Zone - Guyon's theorem - Concept of Magnel's method - Assembly of prestressing and reinforcing steel - Instability during erection.		
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 – 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", 5th Edition, Tata McGraw Hill Publishing Co, India, 2012.

REFERENCES:

1. Praveen Nagarajan, "Prestressed Concrete", 1st Edition, Dorling Kindersley (I) Pvt. Ltd., 2011.
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	calculate the losses in prestress	Analyzing (K4)
CO2	calculate the deflections in prestressed concrete structural elements	Analyzing (K4)
CO3	design the prestressed concrete structural elements	Analyzing (K4)
CO4	design the shear connectors	Analyzing (K4)
CO5	design the prestressed circular tanks and concrete poles	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	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)**

20CEE02 CONSTRUCTION ENGINEERING AND MANAGEMENT

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	V	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	interpret the importance of planning and scheduling in construction projects	Understanding (K2)
CO2	estimate the resource requirement for construction projects	Applying (K3)
CO3	assess quality elements and its importance for construction materials	Applying (K3)
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				2				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	20	40	40				100
ESE	20	35	45				100

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

20CEE03 SOLID AND HAZARDOUS WASTE MANAGEMENT

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Environmental Engineering	V	PE	3	0	0	3

Preamble	This course helps to interpret the nature and characteristics of solid and hazardous wastes for providing appropriate treatment method.	
Unit - I	**Solid Waste and Its Perspectives:**	**9**
Sources – Types – Composition – Properties – Characteristics – Quantities – Generation rates – Types of Sampling – Functional elements – Legislative measures – 3R concept – Participatory waste management.		
Unit - II	**On-Site and Off-Site Processing:**	**9**
Importance of onsite and offsite handling- storage methods – Effect of storage methods at site 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 – Analysis of collection system – Collection routes – Guidelines – Transfer station –Site selection – Types – Manpower requirement.		
Unit - IV	**Hazardous Wastes:**	**9**
Sources and Impacts – Classification – Handling of wastes – Selection and design of storage facilities – Physical, Chemical and Biological treatment technologies – 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, McGraw-Hill, Inc., 2002.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	illustrate the sources, types and characteristics of solid waste	Understanding (K2)
CO2	Identify and suggest suitable on-site and offsite processing methods	Understanding (K2)
CO3	explain 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	Identify and suggest appropriate disposal methods for solid and hazardous wastes	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						3	2
CO2	2	1				3	1						3	2
CO3	3	2	1			3	1					1	3	3
CO4	3	2	1			3	1					1	3	3
CO5	2	1				3	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	25	75					100
CAT2	20	40	40				100
CAT3	20	50	30				100
ESE	20	60	20				100

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

20CEE04 RAILWAY, AIRPORT AND HARBOUR ENGINEERING

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	NIL	V	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 – Construction and 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, Case Studies – 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., New Delhi, 2013
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)**

20CEE05 GROUND IMPROVEMENT TECHNIQUES

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Geotechnical Engineering - I & II	V	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”, 2nd Edition, Laxmi Publications (P) Ltd, 2016.

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” 7th edition, Cengage learning, 2010.

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)**

20CEE06 REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEMS

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	V	PE	3	0	0	3

Preamble	This course gives knowledge on remote sensing and its working principles. It also describes the image processing techniques using GIS for real time applications.	
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 – Platforms and Sensors: Evolution of different types of satellites and their characteristics – Sensor types and properties – Resolution concepts.		
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- Open source software.		
Unit - III	**Image processing:**	**9**
Digital Image – Characteristics – Image pre-processing techniques – Image Enhancements 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 Interpretation:**	**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 – 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 Regional planning – Natural resources management – Climate studies and Disaster monitoring – Ocean studies.		

Total:45

TEXT BOOK:

1. Basudeb Bhatta, “Remote Sensing and GIS”, 2nd Edition, Oxford University Press, 2011.

REFERENCES:

1. M. Anji Reddy, ”Remote sensing and Geographical Information Systems”, 4th Edition, 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	relate the earth features in satellite imagery and the sensor properties in the field of remote sensing	Applying (K3)
CO2	apply suitable GIS tools for storing and analysing different remote sensing datasets	Applying (K3)
CO3	select suitable GIS database for different remote sensing imageries using pre-processing techniques	Applying (K3)
CO4	apply raster and vector data analyses on different remote sensing images	Applying (K3)
CO5	explain the fields of applications of remote sensing and GIS with the recent advancement 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	1		1	3						1	3	3
CO2	3	2	1		1	3						1	3	3
CO3	3	2	1		1	3						1	3	3
CO4	3	2	1		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	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)**

20CEE07 ADVANCED STRUCTURAL ANALYSIS

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Structural Analysis	VII	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**	**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	**Space and Cable Structures**	**9**
Analysis of space trusses using method of tension coefficients – Beams curved in plan – Suspension Cables – Cables with two and three hinged stiffening girders – Analysis of Portal frames by Substitute frame method.		
Unit – IV	**Arches**	**9**
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.		

Lecture:45, Total:45

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. Stephen Timoshenko, Theory of Plates & Shells, 2nd Edition, Tata McGraw Hill Education, Noida, 2017.

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 forces acting in space and cable structures	Analyzing (K4)
CO4	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			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)**

20CEE08 CONTRACT MANAGEMENT

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	VII	PE	3	0	0	3

Preamble	This course create awareness on contracts for construction industry, impart knowledge on tender preparation, tendering process, arbitration procedure and laws, Legal requirements and Labour Regulations.	
Unit - I	**Contracts:**	**9**
Indian Contract Act – Need – Provisions - Scope for modifications / improvement - Contract Specifications - Types of contract documents used for 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	**Legal Requirements:**	**9**
Introduction –Intellectual property - Main forms of IP- Copyright - Trademarks, Patents and designs - Secrets - Law relating to copyright in India – 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 - IV	**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 - V	**Laws applicable to Construction Industry:**	**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 from 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	prepare contract documents including standard and international norms.	Applying (K3)
CO2	infer the procedures of bidding and accepting of tenders.	Understanding (K2)
CO3	explain the different types of property rights and patents	Understanding (K2)
CO4	summarize the duties and powers of arbitrators.	Understanding (K2)
CO5	choose the laws related to 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	3	2	1			3						1	3	3
CO2	2	1				2							3	2
CO3	2	1				2							3	2
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	17	66	17	-	-	-	100
CAT2	50	50	-	-	-	-	100
CAT3	17	66	17	-	-	-	100
ESE	44	44	12	-	-	-	100

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

20CEE09 ENVIRONMENTAL IMPACT ASSESSMENT

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Environmental Engineering	VII	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- Hierarchy in EIA-Initial environmental examination (IEE)- Environmental Impact Statement (EIS) – Environmental appraisal - Rapid and Comprehensive EIA, EIS, FONSI and NDS-Need for EIA studies-Advantages and limitation of EIA.		
Unit - II	**Methodologies and clearance procedure:**	**9**
Application forms - category of projects-Formation of EIA study team Methods of EIA - Criteria for selection of EIA methodology-Check lists – Matrices-Networks-Overlay - Cost-benefit analysis –EIS format- Terms of Reference (ToR).		
Unit - III	**Assessment and Prediction:**	**9**
Baseline data-Assessment of Impact on land, water, air, noise, social, cultural, flora and fauna –Mathematical Models-Predictive measures- resettlement & rehabilitation-Public participation in EIA-EIA case studies for selected projects.		
Unit - IV	**Environmental Management Plan:**	**9**
Environmental audit- Types of audit-definitions and concepts-stage of environmental audit- compliance schedule- Contents of EA reports-preparation of audit report- Introduction to ISO 14000- Environmental monitoring plan.		
Unit - V	**Legislation:**	**9**
The Environmental Protection Act-The water Act- The Air (Prevention & Control of pollution Act)- Motor Act-Wild life Act- Case studies and preparation of environmental impact assessment statement for various Industries.		

Total: 45

TEXT BOOK:

1. Charles H. Eccleston., "Environmental Impact Assessment: A Guide to Best professional practices", 1st Edition, CRC Press., United States, 2017.

REFERENCES:

1. Y.Anjaneyulu and Valli Manikam, “Environmental Impact Assessment Methodologies”, 2nd Edition, B.S Publications., Hyderabad, 2011.
2. Barthwal R.R., “Environmental Impact Assessment”, 2nd Edition, New Age International Publishers, New Delhi, 2019.

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 prepare EIA reports.	Understanding (K2)
CO3	interpret the importance of public participation in EIA studies.	Applying (K3)
CO4	illustrate the compliance schedule for the developmental projects.	Applying (K3)
CO5	discuss the key steps involved in the EIA legislations.	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	1						3	2
CO2	2	1				2	1						3	2
CO3	3	2	1			3	1					1	3	3
CO4	3	2	1			3	1					1	3	3
CO5	2	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	30	70		-	-	-	100
CAT2	20	40	40	-	-	-	100
CAT3	20	30	50	-	-	-	100
ESE	20	40	40	-	-	-	100

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

20CEE10 PUBLIC TRANSPORTATION SYSTEMS

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Transportation Engineering	VII	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 - Suburban 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**
Transittystem 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 - Intermodal transfer – Parking problems – Impact of parking – Parking space requirements – Parking standards		

Lecture: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	1				2							3	2
CO2	2	1				2							3	2
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	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)**

20CEE11 ENVIRONMENTAL GEO-TECHNOLOGY

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Geotechnical Engineering - I	VII	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 – soil remediation – soil vapour extraction, soil waste stabilization, solidification of soils, electrokinetic remediation, soil heating, vitrification, bio remediation, phytoremediation – 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 Waste Management Technologies", 1st Edition, John Wiley & Sons, USA, 2004.
2. Reddi L.N. and Inyang, H. I., "Geo-environmental Engineering, Principles and Applications", 3rd Edition, Marcel Dekker, New York, 2004.

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				2							3	2
CO2	2	1				2							3	2
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	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)**

20CEE12 ENGINEERING GEOLOGY

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	VII	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 - Geological work of rivers - Wind –– Groundwater – Hydrologic cycle – Origin and occurrence - Vertical distributions and types of aquifers.		
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	**Rock studies:**	**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 outcrops – Folds - Faults and Joints - causes and types – bearing on engineering construction – unconformities- Electrical and seismic methods – Geotechnical considerations for Dam and reservoir - Tunnels – Road cuts - 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”, 5th Edition, McGraw Hill Education (India)Pvt. Ltd., New Delhi, 2017.

REFERENCES:

1. Subinoy Gangopadhyay, “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	identity different earth surface process	Understanding (K2)
CO2	classify the minerals with reference to their properties	Understanding (K2)
CO3	distinguish the different types of rocks	Analyzing (K4)
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	30			100
CAT3	20	40	40				100
ESE	10	30	40	20			100

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

20CEE13 ADVANCED STEEL DESIGN

(IS 800:2007, Steel Tables, IS 875 (Part-3), IS 801: 1975, IS811:1987and SP 06 are permitted)

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Structural Analysis and Design of Steel Structures	VII	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.	
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 the design of steel structures for fire loads.		
Unit - II	**Design of Connections**:	**9**
Introduction – Bolted Flexural connections – Bolted Shear connections – Welded Flexural connections - Welded shear connections.		
Unit - III	**Light Gauge Steel Structures and Pre-Engineered Buildings:**	**9**
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 the web plate – Proportioning of the web plate and flanges – Design of welded plate girder.		
Unit - V	**Gantry girder:**	**9**
Introduction - Load considerations - Max load effects - Determination of maximum bending moment and shear force due to vertical component of crane wheel load - Horizontal component of crane wheel load - Longitudinal effect of wheel load - Design of gantry girder**.**		

Total:45

TEXT BOOK:

1. Subramanian N., “Design of Steel Structures Limit States Method”, 2nd Edition, Oxford University Press, New Delhi, 2016.

REFERENCES:

1. Bhavikatti S.S., —Design of Steel Structures, 5th Edition, I.K. International Publishing House Pvt. Ltd., New Delhi, 2017.
2. 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	analyze and design various components of truss	Analyzing (K4)
CO2	design welded and bolted connections	Analyzing (K4)
CO3	analyze and design the components of a pre-engineered steel building	Analyzing (K4)
CO4	design welded plate girder	Analyzing (K4)
CO5	analyze and design different gantry girders	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	20	30	40	-	-	100
CAT2	10	20	30	40	-	-	100
CAT3	10	20	30	40	-	-	100
ESE	10	20	30	40	-	-	100

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

20CEE14 ARCHITECTURE AND TOWN PLANNING

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	VII	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- Principles and necessity of planning- Town planning in ancient India-Types of survey - Uses of survey - Methods adopted to collect data - Aerial photo and remote sensing techniques in planning - Master plan-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 - Traffic management.		
Unit - IV	**Climate and Environmental Responsive Design:**	**9**
Man and environment interaction with climatic factors– Characteristics of climate types – Design adopting 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- Neighbourhood planning.		

Total:45

TEXT BOOK:

1. Rangwala. S., “Town Planning”, 29th Edition, Charotar Publishers, 2016.

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 its 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)**

20CEE15 AIR AND NOISE POLLUTION CONTROL ENGINEERING

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Environmental Engineering	VII	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, animals-global warming-ozone layer depletion-Basic Principles of Sampling-Source and ambient sampling-Analysis of pollutants.		
Unit - II	**Dispersion of Air Pollutants:**	**9**
Elements of atmosphere - Meteorological factors –source Monitoring of gaseous and particulate matter - Wind rose diagram - Lapse rate - Atmospheric stability and turbulence-Plume rise - Dispersion of pollutants - Dispersion models – Kyoto Protocol - 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 – Noise scales – Decibels and Levels - 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, Tata-McGraw-Hill., New Delhi, 2017.

REFERENCES:

1. Keshav Kant and Er.RajniKant., “Air Pollution and Control Engineering”, 1st Edition, Khanna Book Publishing., New Delhi,2019.
2. Eugene Roberto Nicchi., “Noise Pollution: sources, Effects on workplace Productivity and health Implications (Pollution Science, Technology and Abatement)”, 2nd Edition, Nova Science Publishers Inc., United Kingdom, 2014.

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.	Understanding (K2)
CO2	sketch wind rose diagram based on the plume behaviour.	Applying (K3)
CO3	suggest air pollution control methods for different pollutants.	Applying (K3)
CO4	Select suitable control method for noise pollution.	Applying (K3)
CO5	apply 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	2	1				2	1						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	30	50	20	-	-	-	100
CAT2	20	60	20	-	-	-	100
CAT3	20	70	10	-	-	-	100
ESE	20	50	30	-	-	-	100

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

20CEE16 URBAN TRANSPORTATION PLANNING

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Transportation Engineering	VII	PE	3	0	0	3

Preamble	This course imparts knowledge on the principles of urban transportation planning and its components	
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:**	**9**
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”, Prentice Hall, 3rd Edition, India, 2002.

REFERENCES:

1. Papacostas, C S, and Prevedouros. P. D, “Transportation Engineering and Planning”, Prentice Hall, 3 rd Edition,2009.
2. Hutchinson B. G., “Principles of Urban Transportation System Planning”, McGraw Hill,1 st Edition 1974

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	infer the transportation survey, trip attraction, generation and distribution	Applying(K3)
CO3	summarize the modal choice and the transportation network	Understanding(K2)
CO4	illustrate 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				2							3	2
CO2	3	2	1			3						1	3	3
CO3	2	1				2							3	2
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	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)**

20CEE17 ROCK MECHANICS

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	VII	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		
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		
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 anchors.		

Total:45

TEXT BOOK:

1. Ramamurthy T. 'Engineering in Rocks for Slopes Foundations and Tunnels', PHI Learning Pvt. Ltd, 3rd Edition, 2014.

REFERENCES:

1. Debasis & Verma Abhiram 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', CRC press, 1st edition, 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	use a 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	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	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)**

20CEE18 FINITE ELEMENT METHOD

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Structural Analysis	VII	PE	3	0	0	3

Preamble	This course deals with various modeling techniques and uses different numerical methods for solving a system of governing equations over the domain of a continuous physical system.	
Unit - I	**Introduction**	**9**
Historical Background-Mathematical Modeling of field problems in Engineering-Governing Equations - Stresses and equilibrium-boundary conditions-Strain displacement relations -potential energy and equilibrium - Variational method -Concepts of potential energy- Rayleigh Ritz method- weighted residual method- Point collocation method, Sub domain collocation method, Least squares method, Galerkin's method.		
Unit - II	**One Dimensional Problems**	**9**
Discretization of domain -Coordinate types, shape function using natural coordinates and generalized coordinates-stiffness matrix of a 1-D bar and beam element-Stiffness matrix and finite element equation for a two noded Truss element- Basic equations of heat transfer - Shape function and thermal stiffness matrix for 1-D heat conduction.		
Unit - III	**Two Dimensional Problems**	**9**
Derivation of shape functions for CST and LST triangular and rectangular elements-Stiffness matrices and force vectors for CST and LST triangular and rectangular elements- concept of plane stress and plain strain and axi-symmetry- Beam bending-Governing differential equation for beam bending- Two node beam element-Exact solution for uniform beams subjected to distributed loads using superposition.		
Unit - IV	**Analysis of Framed Structures**	**9**
Stiffness of Truss Member - Analysis of Truss - Stiffness of Beam Member - Finite Element Analysis of Continuous Beam - Plane Frame Analysis - Numerical Evaluation of Element Stiffness - Formulation for 3 Dimensional Elements - Solution for simple frames.		
Unit - V	**Iso-parametric Formulation**	**9**
Natural co-ordinate systems – Iso-parametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems – Matrix solution techniques – Solutions Techniques to Dynamic problems.		

Total:45

TEXT BOOK:

1. J.N.Reddy, "An Introduction to the Finite Element Method", Third Edition, McGrawHill Mechanical Engineering, Reprint, 2015

REFERENCES:

1. Singuresu S. Rao, "Finite Element method in Engineering", Fourth edition, Elsevier Science & Technology Books, Reprint 2015.
2. Tirupathi R. Chandrupatla, Ashok D. Belagundu, "Introduction to Finite Elements in Engineering", Third Edition, Reprint, Prentice Hall, 2012

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	Explain different approximation techniques	Understanding (K2)
CO2	Solve one-dimensional problems	Applying (K3)
CO3	solve two-dimensional problems	Applying (K3)
CO4	apply FEM concept in linear 2D structural beams and frames problems	Applying (K3)
CO5	explain iso-parametric elements and its formulations	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	20	50	30				100
CAT2	20	40	40				100
CAT3	20	50	30				100
ESE	20	40	40				100

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

20CEE19 EARTHQUAKE ENGINEERING AND DESIGN

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	NIL	VII	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	**Elements of Seismology**	**9**
Interior of Earth, plate tectonics, faults, consequences of earthquake, Basic parameters of earthquake, magnitude & intensity, scales, Seismic zones of India, damages caused during past earthquakes		
Unit - II	**Basics & Causes of Earthquake**	**9**
Earthquake causes and its effect on built structures - EQ resistant provisions in masonry building - Single degree freedom system - Free and forced vibration - Forced vibration using Duhamel integral and Laplace transform - Multi degree of freedom system		
Unit - III	**Response Spectrum and Dynamic Analysis**	**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 - IV	**Design and Detailing**	**9**
Earthquake resistant design of RCC buildings – Material properties – lateral load analysis – Capacity based design and Detailing – Rigid frames – Shear walls.		
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, 2013.

REFERENCES:

1. Ray W Clough & Joseph Penzien., "Dynamics of Structures",2ndEdition, CBS Publishers & Distributors Pvt. Ltd, New Delhi, 2019
2. Paz M. & Young Hoon Him, "Structural Dynamics –Theory & Computation", Springer International Publishing, 2018

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	interpret response spectrum presented in various formats	Applying (K3)
CO4	design the earthquake resistant rcc structures	Understanding (K2)
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	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	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	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)**

20CEE20 SUSTAINABLE ENGINEERING

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	VII	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**
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,2015

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				2							3	2
CO2	3	2	1			3						1	3	3
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	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)**

20CEE21 INDUSTRIAL WASTE MANAGEMENT

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Environmental Engineering	VII	PE	3	0	0	3

Preamble	This course imparts knowledge on the significance of industrial wastewater 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 wastewater-Industrial wastewater 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 bye-product 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 - Wastewater 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 management.		
Unit - V	**Wastewater Reuse and Residual Management:**	**9**
Zero effluent discharge Systems-Residue management - Quality requirements for wastewater reuse and industrial reuse-Disposal on water and land- Quantification and characteristics 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, 2016

REFERENCES:

1. Stanley N Barton “Industrial Waste: Management, Assessment & Environmental Issues (Waste and Waste Management)”, 1 st Edition, Sara Books Pvt Ltd, New Delhi, 2016.
2. G N Pandey, “Environmental Management”, 1st Edition, Vikas Publishing, Noida, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	outline the sources and effects of industrial contaminants.	Understanding (K2)
CO2	identify rigid preventive measures to overcome environmental pollution	Applying (K3)
CO3	identify the causes and effects of pollution from various industries	Applying (K3)
CO4	choose appropriate industrial waste treatment technique	Applying (K3)
CO5	Select suitable waste 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	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	30	45	25				100
CAT2	25	45	30				100
CAT3	30	40	30				100
ESE	25	45	30				100

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

20CEE22 TRAFFIC ENGINEERING AND MANAGEMENT

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Transportation Engineering	VII	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							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	60	20				100
ESE	10	60	30				100

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

20CEE23 SITE INVESTIGATION AND SOIL EXPLORATION

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Geotechnical Engineering I & II	VII	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	**Scope and Objectives of Site Investigation and Subsurface Exploration:**	**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 Techniques:**	**9**
Different type of samples – sample disturbance – measurement of sample disturbance – Area and recovery ratio – RQD – Types of samplers – Undisturbed sampling technique – Drive sampling – Design criteria for drive samplers – Methods for preventing loss of samples – Surface and control sampling in site testing – Advanced sampling techniques – Offshore sampling – 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							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	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	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)**

20CEE24 GREEN BUILDING

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	VII	PE	3	0	0	3

Preamble	This course signifies eco-friendly building concepts and building certification systems as per Indian and International Standards	
Unit - I	**Introduction to Green Building Concept and Rating System**	**9**
Green Building Concept- Introduction to IGBC - Green Building Rating Tools - Green Project Management, Certification and Documentation. History of green Rating systems - Need and use of green rating systems - Structure of the rating systems - Selection of the appropriate rating system, ZEB- ZEB-ZCB ratings		
Unit - II	**Green Building Planning and Design**	**9**
Construction Operation – Maintenance – Renovation – Demolition –Global Energy Release – Harmful Impact om Nature – Fresh Water Depletion – Ozone Depletion – Sick Building Syndrome – Solid Waste Disposal – HVAC system – Alternative Building Materials		
Unit - III	**Green Building Materials & Methods:**	**9**
Building and Material Reuse - Salvaged Materials - Material Content - Manufactured Materials - Recycled Content – Eco Block - Volatile Organic Compounds (VOC's) Natural Non-Petroleum Based Materials - Alternative Construction Methods - Waste Management and Recycling - Design for Deconstruction.		
Unit - IV	**Performance Analysis & Testing:**	**9**
Cost and Performance Comparisons and Benchmarking - Building Modelling & Energy Analysis - Cost Benefit Analysis - Energy, Shell and Systems Installation Testing - Blower Door - Duct Tightness - Thermal Imagery - Moisture Testing - Commissioning, Metering, Monitoring - Weatherization - Air Sealing - Moisture Control - Energy Retrofits and Green Remodels.		
Unit - V	**Evaluation of Green Building and Certification**	**9**
Role of Green building consultant – GEM, LEED, GRIHA, BREEAM, IGBC - Determination of green points - Green Accreditation examinations - 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 – Service life span.		

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 and rating system	Understanding (K2)
CO2	make use of efficient resources for the planning of green buildings	Applying (K3)
CO3	compare alternate construction materials and methods	Understanding (K2)
CO4	choose appropriate performance testing technique	Applying (K3)
CO5	apply various codes for certification of green 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	1				2							3	2
CO2	3	2	1			3						1	3	3
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	33	67	-	-	-	-	100
CAT3	17	50	33	-	-	-	100
ESE	11	50	39	-	-	-	100

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

20CEE26 DESIGN OF PREFABRICATED STRUCTURES

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Design of RC Elements	VII	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**
General principles of fabrication – need for prefabrication – general principles of prefabrication – comparison with monolithic construction, types of prefabrication, site and plant prefabrication, economy of prefabrication, modular coordination, standardization – materials – modular coordination – 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, 2016.
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, manufacture 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)**

20CEE27 CONSTRUCTION EQUIPMENT AND MANAGEMENT

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

Preamble	This course imparts knowledge in selection strategies of various equipment based on the requirement of the project at optimum cost and time.	
Unit - I	**Earthwork Equipment:**	**9**
Tractors - Motor Graders - Scrapers - Front end Loaders - Earth Movers -Equipment for Dredging and Trenching- Tunnelling methods and equipment's- Compaction Equipment - Diaphragm wall equipment- Pile Driving Equipment - Drilling and Blasting- Safety measures		
Unit - II	**Equipment's for Screening and Transporting:**	**9**
Forklifts and related equipment - Portable Material Bins - Tower crane - Conveyors - Aggregate Crushers - Feeders - Screening Equipment - General Crane - Gantry girder.		
Unit - III	**Concreting Equipment:**	**9**
Batching and Mixing Equipment - Hauling equipment - RMC- Modern Formwork Techniques- MIVAN Construction - Shuttering - Types of pumps used for Construction - Boom placer- Equipment for Grouting and Dewatering - 3D Concrete Printing.		
Unit - IV	**Equipment Management:**	**9**
Role of heavy construction equipment – Factors in Selection of Equipment – Cost of Owning – Cost of Operating – Equipment Life Cycle – Replacement of Equipment.		
Unit - V	**Equipment Maintenance:**	**9**
Rent and Lease Considerations – Construction Equipment Maintenance – Construction Equipment Site Safety – Construction Equipment Security – insurance – Inventory procedures and practices.		

Total: 45

TEXT BOOK:

1. Sharma.S. C., "Construction Equipment and its Management", 1st Edition, Khanna Publishers, India, 2016.

REFERENCES:

1. Douglas D. Gransberg, "Construction Equipment Management for Engineers, Estimators, and Owners", 22nd Edition, CRC Press, 2020.
2. Peurifoy R.L., "Construction Planning, Equipment and Methods", 7th Edition, McGraw Hill, Singapore, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	identify the best earthwork equipment for different earth conditions	Understanding(K2)
CO2	infer equipment required for screening and transporting	Understanding(K2)
CO3	choose the best and effective equipment needed for concreting and its method	Understanding(K2)
CO4	select suitable equipment needed for building construction	Applying (K3)
CO5	adopt various maintenance techniques for equipment	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	2							3	2
CO2	2	1			3	2							3	3
CO3	2	1			3	2							3	3
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	50	50					100
CAT2	40	60					100
CAT3	25	50	25				100
ESE	25	50	25				100

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

20CEE28 SURFACE HYDROLOGY

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Water Resources & Irrigation Engineering	VII	PE	3	0	0	3

Preamble	This course imparts knowledge about various hydrological components and well hydraulics.	
Unit - I	**Hydrometeorology:**	**9**
Concept of hydrology-Hydrologic cycle- Components of hydrologic cycle - Annual water resources balance of 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 - Competition 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 equations – Blaney Criddle equation – Modified Penman equation – Reservoir evaporation and reduction methods – Transpiration – Evapotranspiration – Measurements of evapotranspiration – equations – 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 - Surface water resources in India – Hydrograph – Factors affecting flood hydrograph – components - Base flow separation – Effective rainfall – Unit hydrograph – Derivation, Uses, limitations, duration – Synthetic unit hydrograph.		
Unit - V	**Floods:**	**9**
Flood routing: Muskingum method of channel Routing – Reservoir routing – modified pulse method. Flood estimation and flood frequency: Rational method – Empirical formulae – Unit hydrograph method – Flood frequency studies – Gumbel's method – Log-Pearson type III distribution – Partial duration series – Regional flood frequency analysis – Design flood – storm – Risk reliability and safety factor.		

Total: 45

TEXT BOOK:

1. Subramanya K., "Engineering Hydrology", 4th Edition, McGraw Hill Publishing Company, New Delhi, 2013.

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-HillPublishing Company, New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	illustrate with 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	Analyzing (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)**

20CEE29 INTELLIGENT TRANSPORTATION SYSTEM

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Transportation Engineering	VII	PE	3	0	0	3

Preamble	This course imparts knowledge about the importance of Intelligent Transportation System in transportation engineering.	
Unit - I	**Introduction**	**9**
Definition of ITS and Identification of 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 the 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 – Commercial vehicle operations – 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 – ITS in developing countries – Smart car – Smart road		

Total:45

TEXT BOOK:

1. Pradip Kumar, Amit Kumar Jain, “Intelligent Transport Systems”, 1st Edition ,PHI Learning Pvt Ltd, New Delhi,2017.

REFERENCES:

1. Ignacio Julio, Enrique Onieva , “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)**

20CEE30 REINFORCED SOIL STRUCTURES

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Geotechnical Engineering I & II	VII	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:**	**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	**Materials and Material 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 Principles 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, liners	Applying (K3)
CO5	apply geosynthetics in environmental geotechnic.	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	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	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)**

20CEE31 SAFETY IN CONSTRUCTION PRACTICES

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Nil	VII	PE	3	0	0	3

Preamble	This course makes 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 – Safety thinking and Practices – Terminologies used in safety-types of injuries- safety pyramid-Accident patterns-theories of accidents -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 Act.		
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 – Fatalities and Injuries- Hazard and Prevention Act – Precautionary Measures -Hazard Management -Accident investigation- Accident indices – Violation – Penalty		
Unit - V	**Construction safety management:**	**9**
Introduction- Safety in construction operations -Project coordination and safety procedures Ergonomics – MSD (Musculoskeletal Disorders) – Causes and Remedies – preventive methods – Role of BIM in safety		

Total:45

TEXT BOOK:

1.	S.K.Bhatta charjee, "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 Wah Poon, "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	Understanding (K2)
CO3	make use of site safety programs at construction site	Applying (K3)
CO4	identify the hazards in construction projects	Applying (K3)
CO5	apply construction safety management at 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				2							3	2
CO2	2	1				2							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

ASSESSMENT PATTERN - THEORY

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	7	40	50				100

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

20CEE32 DESIGN OF BRIDGES

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Structural Analysis & Design of RC elements	VIII	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 bridge deck – Slab culverts – 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", 5thEdition, Oxford and IBH Publishing Company, New Delhi, 2019

REFERENCES:

1. Jagadeesh T.R., “Design of Bridge Structures”, 2ndEdition, Prentice Hall of India Pvt. Ltd, New Delhi, 2010.
2. Haifan X., “Conceptual Design of Bridges”, 1stEdition, 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				2							3	2
CO2	2	1				2							3	2
CO3	2	1				2							3	2
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	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)**

20CEE33 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
Pre requisite	Concrete Technology	VIII	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	**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 - IV	**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 - 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. Chakrabartiet.al.,Narosa 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				2							3	2
CO2	2	1				2							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)**

20CEE34 WATER POWER ENGINEERING

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Environmental Engineering, Fluid Mechanics and Hydraulics.	VIII	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 power house.	
Unit - I	**Water Power:**	**9**
Introduction - Sources of energy– Water Power - development and use - Statistics of power - estimation of hydro power potential - mini and pumped storage plant - cost and value of water power - Relation of water power 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 hydro power 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- Efficiency Problems - Pumps-Classifications –Centrifugal and Reciprocating pumps- Efficiency Problems.		
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	**Power House and Equipment:**	**9**
Surface power stations - Power House 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 economic analysis of Hydro power 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)**

20CEE35 TRANSPORTATION ECONOMICS

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Transportation Engineering	VIII	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 modeling 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, 10th edition, 2013

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, 10 th 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)**

20CEE36 GEOTECHNICAL EARTHQUAKE ENGINEERING

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	Geotechnical Engineering I & II	VIII	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- interior of earth- Theory of plate tectonics - Plate boundaries - Faults and their properties -Elastic Rebound Theory- Determination of epicentre - Intensity and Magnitude		
Unit - II	**Earthquake Hazards and Evaluation:**	**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 - Local site effects and Design ground motion:**	**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, 2004.

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	infer 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	utilize 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	plan 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)**

20CEE37 DISASTER PREPAREDNESS AND PLANNING

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	NIL	VIII	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, pandemics, 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: Management**	**9**
Landslides - Causes - principles of stability analysis – remedial and corrective measures for slope stabilization – mitigation – cause 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.	R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies, 1st Edition,New Royal book Company**,**2007.

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	identify 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	10	50	40				100
CAT2	10	40	50				100
CAT3	10	30	30	30			100
ESE	10	20	40	30			100

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

OPEN ELECTIVES

20CEO01 - REMOTE SENSING AND ITS APPLICATIONS

Programme & Branch	CIVIL	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	IV	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 Exercises / Experiments :

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:15, Total:60

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:

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)
CO2	classify the usage about different types of satellites and their orbits	Understanding (K2)
CO3	discuss the different types of remote sensors	Understanding (K2)
CO4	demonstrate the concepts of interpretation of satellite imagery	Applying (K3)
CO5	organize Remote Sensing procedure for Mapping of Urban Elements and their Processes	Applying (K3)
CO6	develop the knowledge in preparation of base map and thematic maps	Applying (K3) Precision (S3)
CO7	identify the data in the computer and prepare the Map Layout Design process	Applying (K3) Precision (S3)
CO8	interpret aerial photographs and the working of stereoscope with aerial images	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				2								
CO2	2	1				2								
CO3	2	1				2								
CO4	3	2	1			3						1		
CO5	3	2	1			3						1		
CO6	3	2	1	3		3			1			1		
CO7	3	2	1	3		3			1			1		
CO8	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)**

20CEO02 - DISASTER MANAGEMENT

Programme & Branch	CIVIL	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	V	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	2	1				3	1					1		
CO4	2	1				3	1					1		
CO5	3	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)**

20CEO03 - INTRODUCTION TO SMART CITIES

Programme & Branch	CIVIL	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	VI	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												
CO2	2	1												
CO3	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	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)**

20CEO04 - ENVIRONMENTAL HEALTH AND SAFETY

Programme & Branch	CIVIL	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	VI	OE	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	2	3	2	3										
CO2	3	2	3	2										
CO3	3	2	3	2										
CO4	3	2	2	3										
CO5	3	2	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)**

20CEO05 - INFRASTRUCTURE PLANNING AND MANAGEMENT

Programme & Branch	CIVIL	Sem.	Category	L	T	P	Credit
Prerequisites	NA	VIII	OE	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	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	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)**

20CEO06 - ENVIRONMENTAL LAWS AND POLICY

Programme & Branch	CIVIL	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	VIII	OE	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	3	3	2											
CO2	3	2	2	2										
CO3	3	2	2	2										
CO4	3	2	2	2										
CO5	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	40	40	20				100
CAT2	40	45	15				100
CAT3	35	40	25				100
ESE	35	40	25				100

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

BE Degree in Civil Engineering with Honours in Construction Technology

S. No	Course name	Hours/Week			Credit
01	Construction Project Planning Systems	3	1	0	4
02	Construction Cost Analysis	3	1	0	4
03	Sustainable Construction Methods	3	1	0	4
04	Project Formulation and Appraisal	3	0	0	3
05	Advanced Concrete Technology	3	0	0	3
	Total Credits				18

CONSTRUCTION PROJECT PLANNING SYSTEMS

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	NIL			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)**

CONSTRUCTION PROJECT PLANNING SYSTEMS

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	NIL			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”, 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	3	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)**

SUSTAINABLE CONSTRUCTION METHODS

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	NIL			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, ferro-cement 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, vermi composting, 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)**

PROJECT FORMULATION AND APPRAISAL

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	NIL			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.		

Lecture:45, 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	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)**

ADVANCED CONCRETE TECHNOLOGY

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	NIL			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 – Self-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.		

Lecture:45, 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)**

BE Degree in Civil Engineering with Honours in Smart Cities

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
	Fundamentals of Smart Cities	3	1	0	4	50	50	100	PC
	Strategic Planning for Infrastructure Sectors	3	1	0	4	50	50	100	PC
	Urban Planning and Design	3	1	0	4	50	50	100	PC
	Infrastructure Finance	3	0	0	3	50	50	100	PC
	Urban Environmental Management	3	0	0	3	50	50	100	PC
Total Credits					18				

FUNDAMENTALS OF SMART CITIES

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	NIL	6	PC	3	1	0	4

Preamble	This course imparts knowledge on national smart city mission of India, components, policies, challenges and future of smart city in India.	
UNIT – I	**Smart city planning and development**	**9+3**
Definitions – Evolution – Features and strategies – Challenges – India 100 smart cities policy and mission, smart city planning and development, Dimension of smart cities, global standards and performance benchmarks, practice codes, 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+3**
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+3**
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+3**
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+3**
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		

Lecture:45, Tutorial:15, Total:60

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	explain the concepts of smart city development and design	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											3	3
CO2	2	1											3	3
CO3	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	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)**

STRATEGIC PLANNING FOR INFRASTRUCTURE SECTORS

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	NIL			3	1	0	4

Preamble	This course imparts knowledge on the concepts and principles of planning and management applied to infrastructure industry	
UNIT – I	**An overview of basic concepts related to infrastructure:**	**9+3**
Introduction to infrastructure - An overview of the power sector- water supply and sanitation sector, road, rail, air and port transportation sectors- telecommunications sector- urban infrastructure- rural infrastructure in India - special economic zones.		
Unit - II	**Infrastructure project finance:**	**9+3**
Overview of infrastructure project finance – procurement process, concession- design and award, financial risk analysis, management and mitigation. Credit rating of infrastructure projects, credit allocation framework for infrastructure projects		
Unit - III	**Private involvement in infrastructure:**	**9+3**
Infrastructure privatization- benefits of infrastructure privatization- problems with infrastructure privatization-challenges in privatization of water supply- challenges in privatization of power privatization of infrastructure in India- Privatization of road transportation infrastructure in India		
Unit - IV	**Challenges to successful infrastructure planning and implementation:**	**9+3**
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 - risk management framework for infrastructure projects- shaping the planning phase of infrastructure projects to mitigate risks		
Unit - V	**Strategies for infrastructure project implementation:**	**9+3**
Innovative design and maintenance of infrastructure facilities- infrastructure modelling and life cycle analysis techniques Capacity building and improving the Governments role in infrastructure implementation. An integrated framework for successful infrastructure planning and management.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. David I. Cleland and Roland Gareis, “Global Project Management Handbook: Planning, Organization and Controlling International Projects”, 2nd edition, McGraw Hill Series, 2006

REFERENCES:

1. Jeffrey L. Beard, Edward C. Wundran, Michael C. Loulakis, “Design, Build: Planning through development”, McGraw Hill Series, 2001
2. Richard Lambeck, John Eschemuller, “Urban Construction Project Management”, McGraw Hill Series, 2009

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	discuss infrastructure project finance	Understanding (K2)
CO3	describe the benefits and problems with infrastructure privatization	Understanding (K2)
CO4	identify the challenges for successful planning and implementation of infrastructure	Applying (K3)
CO5	Apply different strategies for successful planning and implementation of infrastructure	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
CO2	2	2		2							3		3	3
CO3	2	2									3		3	3
CO4	3	3	3	3							3		3	3
CO5	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	20	80					100
CAT2	20	80					100
CAT3	20	50	30				100
ESE	20	60	20				100

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

URBAN PLANNING AND DESIGN

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	NIL			3	1	0	4

Preamble	This course imparts knowledge on Urban planning and design to improve the quality of the life of people living in complex urban conditions.	
UNIT – I	**Introduction to Urban settlements**	**9+3**
Settlements - rural and urban settlements – their characteristics ; basic components, factors influencing urban settlements and their interrelationships; anatomy & classification of human settlements based on configuration of shape, function, location, resource, population & occupational structure; structure and form of human settlements – linear, non-linear and circular –combinations; reasons for development – major growth factors – advantages and disadvantages – case studies – factors influencing development / decay		
Unit - II	**Urban Planning**	**9+3**
Planning process and monitoring; Planning machinery in India – levels of planning – town and country planning act; types of development plans - regional plan, master plan, structure plan, zonal development plan – their scope and content; urban development programmes like JNNURM, TNUDP, IDSMT etc; Regulations and legislation in India; Indicators of development and quality of life; role of infra structure in urban development		
Unit - III	**Infrastructure planning for urban development:**	**9+3**
Urban development strategies and initiatives in India; smart city – smart grid; National and International guidelines; planning norms and standards for zoning and sub division, physical (transport, water supply, drainage, solid waste management, power etc), social (educational, health, recreational, cultural etc) infrastructure, residential and commercial infrastructure		
Unit - IV	**Sustainable urban development:**	**9+3**
Ecological, environmental and social impact of urbanization and development; Policies and urban design guidelines for new developments; Environmental Impact assessment – need, process and issues; social and environmental cost benefit; Indicators of ecological analysis;		
Unit - V	**Case Studies**	**9+3**
Best practices in urban planning and design – inter-national and national case studies; Case studies of Planning of large scale residential, commercial, physical and social Infrastructure at urban level.		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1. Jayashri Ray Chaudhuri, “An Introduction to Development & Regional Planning” Orient Longman Ltd, 2001

REFERENCES:

1. Rangwala, "Town Planning" 18th edition, Charotar Publishing House, 2003.
2. Mercedes Gonzalez de la Rocha “Fundamentals of Town Planning”, Black well publishers, 2001

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the characteristics and types of urban settlements	Understanding (K2)
CO2	identify the role of urban planning in development	Understanding (K2)
CO3	discuss the theories and models of urban planning	Understanding (K2)
CO4	apply sustainable practices in urban development and planning	Applying (K3)
CO5	design infrastructure with an understanding of the urban context and development	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		3	3
CO2	2	2			2						2		3	3
CO3	2	2			2						2		3	3
CO4	3	3	2								3		3	3
CO5	3	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	20	80					100
CAT2	20	80					100
CAT3	20	50	30				100
ESE	20	60	20				100

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

INFRASTRUCTURE FINANCE

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	NIL			3	0	0	3

Preamble	This course imparts knowledge on financing technique that is widely used to finance infrastructure projects.	
UNIT – I	Introduction to Financial Management	**9**
Scope & Functions of Finance, Goals of Financial Management - Organization of the Finance Function. Accounting Principles - Preparation of journal, ledger, trial balance, Double Entry system, preparation of final account		
Unit - II	Statement of Changes in Financial Position	**9**
Preparation of Fund- Flow Statement, Preparation of Cash- Flow Statement, Analysis of Financial Statement– Profitability Turnover Ratios, Liquidity Ratios, Leverage Ratios, and Financial Ratios, Sensitivity Analysis		
Unit - III	Capital Budgeting	**9**
Concept and importance, factors influencing working capital requirements, Time Value of Money- Future value of a single cash flow, Annuity, Present value of a single cash flow, Annuity, Present value of an Uneven Cash Flow, Multi - Period Compounding. Capital Budgeting Decision.		
Unit - IV	Capital Structure	**9**
Capital structure, Relevance of Capital Structure, Theories of Capital Structure- Factors Influencing - EBIT Approach, EBT Approach, EBIT – EPS Analysis, Nature of Risk, Financial Leverage, Operating Leverage, Combined Leverage.		
Unit - V	Working Capital Management	**9**
Working capital – Components of working capital - Factors Influencing Working Capital Requirements - Operating Cycle and Cash Cycle - Determinants of Working Capital		

Lecture:45, Total:45

TEXT BOOK:

1. Khan M.Y., Jain P.K,"Financial Management", Tata Mcgraw Hill Publication, 2012

REFERENCES:

1. Narayanaswamy, "Financial Accounting – A Managerial Perspective", PHI, 2011
2. Michael Jones, "Accounting for Non-Specialists", Person Education, 2012

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain the various factors involved in financial management	Understanding (K2)
CO2	Apply statement of changes in financial accounting	Applying (K3)
CO3	Solve problems related to capital budgeting	Applying (K3)
CO4	Explain factors influencing capital structure	Understanding (K2)
CO5	Solve problems related to working capital management	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	3
CO3	3	2	1										3	3
CO4	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	60	20				100
CAT2	20	50	30				100
CAT3	20	60	20				100
ESE	20	50	30				100

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

URBAN ENVIRONMENTAL MANAGEMENT

Programme & Branch	B.E. & CIVIL ENGINEERING	Sem.	Category	L	T	P	Credit
Prerequisite	NIL			3	0	0	3

Preamble	This course imparts knowledge on various environmental issues in an urban scenario. It provides exposure to the urban water resources and its management.	
UNIT – I	Urban Environmental issues	**9**
Urbanization- Population growth scenario – migration – Pollution of surface water resources – rivers, tanks, channels – ground water exploitation – wastewater – characteristics – pollution problems – Solid waste – air pollution – CPCB norms		
Unit - II	Urban waste resources management	**9**
–Water in urban ecosystem – urban water resources planning and organization aspects – storm water management practices – types of storage – magnitude of storage – storage capacity of urban components – percolation ponds – temple tanks – rainwater harvesting		
Unit - III	Urban wastewater management	**9**
Sewage generation – storm drainage estimation – industry contribution – wastewater collection system – separate and combined system – hydraulic design of sewer and storm drain – wastewater treatment – disposal methods – concept of decentralization – 3R concepts		
Unit - IV	Municipal solid waste management	**9**
Sources of solid waste – characteristics – rate of generation – segregation at source – collection of solid waste – methods of collection – route analysis – transfer and transfer stations – processing and disposal of solid waste.		
Unit - V	Case Studies	**9**
Environmental economics- Social and Physiological aspects of pollution- Successful Urban Management – models- Urban Management-Case studies from Developed Nations – Softwares		

Lecture:45, Total:45

TEXT BOOK:

1. Josef Leitmann, “Sustaining Cities - Environmental Planning and Management in Urban Design”, McGraw-Hill, 1999

REFERENCES:

1. Gert de Roo, “Urban Environmental Planning”, Taylor & Francis, 2017.
2. Adrian Atkinson, Julio D. Dávila, Michael Mattingly, “The Challenge of Environmental Management in Urban Areas”, Taylor & Francis, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		**BT Mapped (Highest Level)**
CO1	explain various environmental related issues	Understanding (K2)
CO2	infer the importance of urban water resources management	Understanding (K2)
CO3	apply urban waste water management concepts	Applying (K3)
CO4	explain the methods of municipal solid waste management	Understanding (K2)
CO5	summarize the case studies related to urban waste management	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	2	1											3	3
CO3	3	2	1										3	3
CO4	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	30	70					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)**