

KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI ERODE – 638 060

TAMILNADU INDIA



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





INDEX

| Sl.No. | CONTENTS | Page No. |
|--------|--|----------|
| 1 | VISION AND MISSION OF THE INSTITUTE | 3 |
| 2 | QUALITY POLICY | 3 |
| 3 | VISION AND MISSION OF THE DEPARTMENT | 3 |
| 4 | PROGRAM EDUCATIONAL OBJECTIVES (PEOs) | 3 |
| 5 | PROGRAM OUTCOMES (POs) | 4 |
| 6 | PROGRAM SPECIFIC OUTCOMES (PSOs) | 5 |
| 7 | REGULATIONS 2020 | 6 |
| 8 | CURRICULUM BREAKDOWN STRUCTURE | 25 |
| 9 | CATEGORISATION OF COURSES | 25 |
| 10 | SCHEDULING OF COURSES | 35 |
| 11 | MAPPING OF COURSES WITH PROGRAM OUTCOMES | 36 |
| 12 | CURRICULUM OF BE – CIVIL ENGINEERING | 46 |
| 13 | DETAILED SYLLABUS | 52 |



**KONGU ENGINEERING COLLEGE
PERUNDURAI ERODE – 638 060
(Autonomous)**

INSTITUTE VISION

To be a centre of excellence for development and dissemination of knowledge in Applied Sciences, Technology, Engineering and Management for the Nation and beyond.

INSTITUTE MISSION

We are committed to value based Education, Research and Consultancy in Engineering and Management and to bring out technically competent, ethically strong and quality professionals to keep our Nation ahead in the competitive knowledge intensive world.

QUALITY POLICY

We are committed to

- Provide value based quality education for the development of students as competent and responsible citizens.
- Contribute to the nation and beyond through research and development
- Continuously improve our services

DEPARTMENT OF CIVIL ENGINEERING

VISION

To become a center of excellence to meet the global challenges in the diversified field of Civil Engineering.

MISSION

Department of Civil Engineering is committed to:

| | |
|------|--|
| MS1: | impart quality Education through effective teaching learning methods |
| MS2: | encourage students to pursue research activities and to collaborate with industries to promote consultancy activities. |
| MS3: | develop engineers who can participate in the technical advancement and social upliftment of the society |

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates of Civil Engineering will

| | |
|-------|---|
| PEO1: | Analyze, design and execute projects based on the fundamental knowledge of Civil Engineering |
| PEO2: | Implement feasible solution to overcome societal problems using professional knowledge which results in sustainability |
| PEO3: | Exhibit professional and ethical attitude, good communication skills and pursue life-long learning skills needed for a successful professional career |



MAPPING OF MISSION STATEMENTS (MS) WITH PEOs

| MS\PEO | PEO1 | PEO2 | PEO3 |
|--------|------|------|------|
| MS1 | 3 | 3 | 2 |
| MS2 | 2 | 3 | 3 |
| MS3 | 3 | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial

PROGRAM OUTCOMES (POs)

Graduates of Civil Engineering will:

- PO1 Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO2 Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO3 Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4 Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO5 Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO6 The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO7 Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO8 Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO9 Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10 Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO11 Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO12 Life-long learning:** Recognize the need for, and have the preparation and ability to engage in



PROGRAM SPECIFIC OUTCOMES (PSOs)

| Graduates of Civil Engineering will: | |
|--------------------------------------|--|
| PSO1 | Understand the requirement of the industry and perform effectively with professional skills. |
| PSO2 | Apply advanced and innovative techniques and methodologies in Civil Engineering Practices. |

MAPPING OF PEOs WITH POs AND PSOs

| PEO\ PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| PEO1 | 3 | 3 | 1 | 1 | | 3 | 3 | 3 | 3 | 1 | | | 3 | 2 |
| PEO2 | 3 | 3 | 3 | 3 | 2 | | 1 | 1 | 2 | 1 | 3 | 3 | 3 | 3 |
| PEO3 | | | | | | 3 | 2 | 3 | | 3 | | | 3 | 2 |

1 – Slight, 2 – Moderate, 3 – Substantial



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/industrial training, project work, internship, etc. that have been approved by the respective Board of Studies and Academic Council of the College. All the programmes have well defined Programme Outcomes (PO), Programme Specific Outcomes (PSO) and Programme Educational Objectives (PEOs) as per Outcome Based Education (OBE). The content of each course is designed based on the Course Outcomes (CO). The courses shall be categorized as follows:

- i. Humanities and Social Sciences (HS) including Management Courses
- 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 Training, Industrial Training, 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:

| SNo | Specializations for Honours degree in emerging areas | To be offered as Honours, Only for the following branches mentioned against the specialization |
|-----|--|--|
| 1. | Construction Technology | BE – Civil Engineering |
| 2. | Smart Cities | BE – Civil Engineering |
| 3. | Smart Manufacturing * | BE – Mechanical Engineering |
| 4. | Computational Product Design * | BE – Mechanical Engineering |
| 5. | Intelligent Autonomous Systems * | BE – Mechatronics Engineering |
| 6. | E-Mobility * | BE – Automobile Engineering |
| 7. | Artificial Intelligence and Machine Learning | BE – Electronics and Communication Engineering |
| 8. | System on Chip Design * | BE – Electronics and Communication Engineering |
| 9. | Electric Vehicles | BE – Electrical and Electronics Engineering |
| 10. | Microgrid Technologies | BE – Electrical and Electronics Engineering |
| 11. | Intelligent Sensors Technology * | BE – Electronics and Instrumentation Engineering |
| 12. | Smart Industrial Automation * | BE – Electronics and Instrumentation Engineering |
| 13. | Data Science | BE – Computer Science and Engineering |
| 14. | Cyber Security | BE – Computer Science and Engineering |
| 15. | Data Science | BTech – Information Technology |
| 16. | Cyber Security | BTech – Information Technology |
| 17. | Petroleum and Petrochemical Engineering * | BTech – Chemical Engineering |
| 18. | Waste Technology * | BTech – Chemical Engineering |
| 19. | Food Processing and Management * | BTech – Food Technology |
| 20. | Virtual and Augmented Reality | BE- Computer Science and Design |
| 21. | Data Science | BE- Computer Science and Design |
| 22. | Internet of Things (IoT) | BTech – Artificial Intelligence and Data Science |
| 23. | Blockchain | BTech – Artificial Intelligence and Data Science |
| 24. | Internet of Things (IoT) | BTech – Artificial Intelligence and Machine Learning |
| 25. | Blockchain | BTech – Artificial Intelligence and Machine Learning |

*Title by KEC

The courses specified under Honours degree in the emerging area may include theory, theory cum practical, practical, project work, etc. under the particular specialization. A



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

4.3 Employability Enhancement Courses

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

4.3.1 Professional Skills Training/ Industrial 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 Phase-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 / II or Industrial Training-I/ II respectively. 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 project through internship during a part of seventh semester and/or entire final semester and can earn credits vide clause 7.6 and clause 7.11.



A candidate is permitted to go for full time projects through internship in seventh semester with the following condition: The candidate shall complete a part of the seventh semester courses with a total credit of about 50% of the total credits of seventh semester including Project Work-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 the 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 - I / Industrial Training / Mandatory Course | 100 | --- |
| 4. | Project Work-II Phase-I / Project Work-II Phase-II / Internships | 50 | 50 |
| 5. | Value Added Course | The distribution of marks shall be decided based on the credit weightage assigned | --- |
| 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 entrepreneurship/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 Commi ttee | 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 Principal.



7.9 Comprehensive Test and Viva

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

7.10 Entrepreneurships/ Start ups

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

A review committee shall be formed by the Principal for reviewing the progress of the Start ups / Business models, innovativeness, etc. The review committee can recommend the appropriate grades for academic performance for the candidate(s) involved in the start ups. This course shall carry a maximum of two credits in fifth semester and 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 project through 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. 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 entrepreneurship/ 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.



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

10. PROVISION FOR WITHDRAWAL FROM EXAMINATIONS

- 10.1** A candidate may, for valid reasons, be granted permission to withdraw from appearing for the examination in any regular course or all regular courses registered in a particular semester. Application for withdrawal is permitted only once during the entire duration of the degree programme.
- 10.2** The withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination (vide clause 9) and has applied to the Principal for permission prior to the last examination of that semester after duly recommended by the Head of the Department.
- 10.3** The withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction/First Class.
- 10.4** If a candidate withdraws a course or courses from writing end semester examinations, he/she shall register the same in the subsequent semester and write the end semester examinations. A final semester candidate who has withdrawn shall be permitted to appear for supplementary examination to be conducted within reasonable time as per clause 14.
- 10.5** The final semester candidate who has withdrawn from appearing for project viva-voce for genuine reasons shall be permitted to appear for supplementary viva-voce examination within reasonable time with proper application to Controller of Examinations and on payment of prescribed fee.

11. PROVISION FOR BREAK OF STUDY

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



- 11.3** The candidates rejoining in new Regulations shall apply to the Principal in the prescribed format through Head of the Department at the beginning of the readmitted semester itself for prescribing additional/equivalent courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.
- 11.4** The total period of completion of the programme reckoned from the commencement of the semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5 irrespective of the period of break of study in order to qualify for the award of the degree.
- 11.5** If any candidate is prevented for want of required attendance, the period of prevention shall not be considered as authorized break of study.
- 11.6** If a candidate has not reported to the college for a period of two consecutive semesters without any intimation, the name of the candidate shall be deleted permanently from the college enrollment. Such candidates are not entitled to seek readmission under any circumstances.

12. PASSING REQUIREMENTS

- 12.1** A candidate who secures not less than 50 % of total marks (continuous assessment and end semester examination put together) prescribed for the course with a minimum of 45 % of the marks prescribed for the end semester examination in all category of courses vide clause 7.1 except for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course in the examination.
- 12.2** A candidate who secures not less than 50 % in continuous assessment marks prescribed for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course. If a candidate secures less than 50% in the continuous assessment marks, he / she shall have to re-enroll for the same in the subsequent semester and satisfy the attendance requirements.
- 12.3** For a candidate who does not satisfy the clause 12.1, the continuous assessment marks secured by the candidate in the first attempt shall be retained and considered valid for subsequent attempts. However, from the fourth attempt onwards the marks scored in the end semester examinations alone shall be considered, in which case the candidate shall secure minimum 50 % marks in the end semester examinations to satisfy the passing requirements.

13. REVALUATION OF ANSWER SCRIPTS

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



concerned. Revaluation is permitted only for Theory courses and Theory cum Practical courses where end semester examination is involved.

14. SUPPLEMENTARY EXAMINATION

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

15. AWARD OF LETTER GRADES

| 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.



| CURRICULUM BREAKDOWN STRUCTURE | | | | | | | | | | |
|--|----------|-------|-------|----|----|----|-----|------|-------------------------|--|
| Summary of Credit Distribution | | | | | | | | | | |
| Category | Semester | | | | | | | | Total number of credits | Curriculum Content (% of total number of credits of the program) |
| | I | II | III | IV | V | VI | VII | VIII | | |
| HS | 4 | 3 | | 3 | | | 3 | | 13 | 7.69 % |
| BS | 11 | 11 | 4 | 4 | | | | | 30 | 17.75 % |
| ES | 4 | 3/4 | 9/8 | 4 | | | | | 20 | 11.83 % |
| PC | 3 | 4 | 10 | 9 | 14 | 13 | 3 | | 56 | 33.13 % |
| PE | | | | | 3 | | 12 | 3 | 18 | 10.65 % |
| OE | | | | 4 | 4 | 3 | | 3 | 14 | 8.3 % |
| EC | | | | | 2 | 6 | 6 | 4 | 18 | 10.65 % |
| MC | | | -- | | | | | | --- | --- |
| Semester wise Total | 22 | 21/22 | 23/22 | 24 | 23 | 22 | 24 | 10 | 169 | 100.00 |
| Category | | | | | | | | | | Abbreviation |
| Lecture hours per week | | | | | | | | | | L |
| Tutorial hours per week | | | | | | | | | | T |
| Practical, Project work, Internship, Professional Skill Training, Industrial Training hours per week | | | | | | | | | | P |
| Credits | | | | | | | | | | C |

| CATEGORISATION OF COURSES | | | | | | | |
|---|-------------|--|---|---|---|----|-----|
| HUMANITIES AND SOCIAL SCIENCE INCLUDING MANAGEMENT (HS) | | | | | | | |
| S. No. | Course Code | Course Name | L | T | P | C | Sem |
| 1. | 20EGT11 | English Language Skills | 3 | 0 | 0 | 3 | I |
| 2. | 20VEC11 | Yoga and Values for Holistic Development | 1 | 0 | 1 | 1 | II |
| 3. | 20EGT21 | Advanced Communication Skills | 3 | 0 | 0 | 3 | II |
| 4. | 20EGL31 | English for Workplace Communication Laboratory | 0 | 0 | 2 | 1 | IV |
| 5. | 20GET31 | Universal Human Values | 2 | 0 | 0 | 2 | V |
| 6. | 20GET71 | Engineering Economics and Management | 3 | 0 | 0 | 3 | VII |
| Total Credits to be earned | | | | | | 13 | |
| BASIC SCIENCE (BS) | | | | | | | |



| S. No. | Course Code | Course Name | L | T | P | C | Sem |
|---|---------------------|---|----|-----|-----|-----------|-----|
| 1. | 20MAC11 | Matrices and Differential Equations | 3 | 1* | 2* | 4 | I |
| 2. | 20PHT11 | Applied Physics | 3 | 0 | 0 | 3 | I |
| 3. | 20CYT11 | Applied Chemistry | 3 | 0 | 0 | 3 | I |
| 4. | 20PHL11 | Physical Sciences Laboratory I | 0 | 0 | 2 | 1 | I |
| 5. | 20MAC21 | Multivariable Calculus and Complex Analysis | 3 | 1* | 2* | 4 | II |
| 6. | 20PHT21 | Materials Science | 3 | 0 | 0 | 3 | II |
| 7. | 20CYT21 | Chemistry of Building Materials | 3 | 0 | 0 | 3 | II |
| 8. | 20PHL20 | Physical Sciences Laboratory II | 0 | 0 | 2 | 1 | II |
| 9. | 20MAT31 | Probability and Partial Differential Equations | 3 | 1 | 0 | 4 | III |
| 10. | 20MAT41 | Statistics and Numerical Methods | 3 | 1 | 0 | 4 | IV |
| | | Total Credits to be earned | | | | 30 | |
| ENGINEERING SCIENCE (ES) | | | | | | | |
| S. No. | Course Code | Course Name | L | T | P | C | Sem |
| 1. | 20MEC11 | Engineering Drawing | 2 | 0 | 2 | 3 | I |
| 2. | 20MEL11 | Engineering Practices Laboratory | 0 | 0 | 2 | 1 | I |
| 3. | 20CET22/ 20CSC31 | Engineering Mechanics (2020-2021) / Programming in C (2021-2022) | 3 | 0 | 0/2 | 3/4 | II |
| 4. | 20CSC31/ 20CSC41 | Programming in C(2020-2021) / Python Programming (2021-2022) | 3 | 0 | 2 | 4 | II |
| 5. | 20CET31/ 20CET22 | Mechanics of Materials (2020-2021) / Engineering Mechanics (2021-2022) | 3 | 1/0 | 0 | 4/3 | III |
| 6. | 20CEL31 | Strength of Materials Laboratory | 0 | 0 | 2 | 1 | III |
| 7. | 20CSC41/ 20CET31 | Python Programming (2020-2021) / Mechanics of Materials (2021-2022) | 3 | 0/1 | 2/0 | 4 | IV |
| | | Total Credits to be earned | | | | 20 | |
| EMPLOYABILITY ENHANCEMENT COURSES (EC) | | | | | | | |
| S. No. | Course Code | Course Name | L | T | P | C | Sem |
| 1. | 20GEL51/ 20GEI51 | Professional Skills Training I / Industrial Training I | 0 | 0 | 80 | 2 | V |
| 2. | 20GEL61/ 20GEI61 | Professional Skills Training II / Industrial Training II | 0 | 0 | 80 | 2 | VI |
| 3. | 20GEP61 | Comprehensive Test and Viva | -- | -- | -- | 2 | VI |
| 4. | 20CEP61 | Project Work I | 0 | 0 | 4 | 2 | VI |



| | | | | | | | |
|----|---------|-----------------------------------|---|---|----|-----------|------|
| 5. | 20CEP71 | Project Work II Phase I | 0 | 0 | 12 | 6 | VII |
| 6. | 20CEP81 | Project Work II Phase II | 0 | 0 | 8 | 4 | VIII |
| | | Total Credits to be earned | | | | 18 | |

| PROFESSIONAL CORE (PC) | | | | | | | | |
|------------------------|-------------|--|---|---|---|---|-----|---------------|
| S. No. | Course Code | Course Name | L | T | P | C | Sem | Domain/Stream |
| 1. | 20CET11 | Construction Materials and Practices | 3 | 0 | 0 | 3 | I | BG |
| 2. | 20CET21 | Surveying and Geomatics | 3 | 0 | 0 | 3 | II | CEM |
| 3. | 20CEL21 | Surveying Laboratory | 0 | 0 | 2 | 1 | II | CEM |
| 4. | 20CET32 | Concrete Technology | 3 | 0 | 0 | 3 | III | CEM |
| 5. | 20CET33 | Geotechnical Engineering I | 3 | 0 | 0 | 3 | III | GTE |
| 6. | 20CET34 | Water Resources and Irrigation Engineering | 3 | 0 | 0 | 3 | III | EE |
| 7. | 20CEL32 | Concrete Technology Laboratory | 0 | 0 | 2 | 1 | III | CEM |
| 8. | 20CEC41 | Geotechnical Engineering II | 2 | 0 | 2 | 3 | IV | GTE |
| 9. | 20CET41 | Fluid Mechanics and Hydraulics Engineering | 3 | 1 | 0 | 4 | IV | EE |
| 10. | 20CEL41 | Fluid Mechanics and Machineries Laboratory | 0 | 0 | 2 | 1 | IV | EE |
| 11. | 20CEL42 | Computer Aided Building Drawing Laboratory | 0 | 0 | 2 | 1 | IV | CEM |
| 12. | 20CEC51 | Environmental Engineering | 2 | 0 | 2 | 3 | IV | EE |
| 13. | 20CET51 | Structural Analysis | 3 | 1 | 0 | 4 | V | SE |
| 14. | 20CET52 | Design of RC Elements | 3 | 1 | 0 | 4 | V | SE |
| 15. | 20CEL51 | Computer Aided Structural Design Laboratory - I | 0 | 0 | 2 | 1 | V | SE |
| 16. | 20CEL52 | Computer Aided Building Information Modelling Laboratory | 0 | 0 | 2 | 1 | V | CEM |
| 17. | 20CEL53 | Computational Laboratory for Construction Management | 0 | 0 | 2 | 1 | V | CEM |
| 18. | 20CEC61 | Transportation Engineering | 2 | 0 | 2 | 3 | VI | TE |
| 19. | 20CET61 | Design of Steel Structures | 3 | 1 | 0 | 4 | VI | SE |
| 20. | 20CET62 | Advanced Reinforced Concrete Design | 3 | 0 | 0 | 3 | VI | SE |
| 21. | 20CEL61 | Computer Aided Structural Design Laboratory - II | 0 | 0 | 2 | 1 | VI | SE |
| 22. | 20CEL62 | Structural Engineering Laboratory | 0 | 0 | 2 | 1 | VI | SE |
| 23. | 20CEL63 | Computer Aided Structural Detailing Laboratory | 0 | 0 | 2 | 1 | VI | SE |



| 24. | 20CET71 | Estimation and Quantity Surveying | 3 | 0 | 0 | 3 | VII | CEM |
|-----------------------------------|-------------|--|---|---|---|-----------|-----|---------------|
| Total Credits to be earned | | | | | | 56 | | |
| PROFESSIONAL ELECTIVE (PE) | | | | | | | | |
| S. No. | Course Code | Course Name | L | T | P | C | Sem | Domain/Stream |
| | | Elective - I | | | | | | |
| 1. | 20CEE01 | Design of Prestressed Concrete Structures | 3 | 0 | 0 | 3 | V | SE |
| 2. | 20CEE02 | Construction Engineering and Management | 3 | 0 | 0 | 3 | V | CEM |
| 3. | 20CEE03 | Solid and Hazardous Waste Management | 3 | 0 | 0 | 3 | V | EE |
| 4. | 20CEE04 | Railway, Airport and Harbour Engineering | 3 | 0 | 0 | 3 | V | TE |
| 5. | 20CEE05 | Ground Improvement Techniques | 3 | 0 | 0 | 3 | V | GTE |
| 6. | 20CEE06 | Remote Sensing and Geographical Information System | 3 | 0 | 0 | 3 | V | BG |
| | | Elective - II | | | | | | |
| 7. | 20CEE07 | Advanced Structural Analysis | 3 | 0 | 0 | 3 | VII | SE |
| 8. | 20CEE08 | Contract Management | 3 | 0 | 0 | 3 | VII | CEM |
| 9. | 20CEE09 | Environmental Impact Assessment | 3 | 0 | 0 | 3 | VII | EE |
| 10. | 20CEE10 | Public Transportation Systems | 3 | 0 | 0 | 3 | VII | TE |
| 11. | 20CEE11 | Environmental Geo-technology | 3 | 0 | 0 | 3 | VII | GTE |
| 12. | 20CEE12 | Engineering Geology | 3 | 0 | 0 | 3 | VII | BG |
| | | Elective - III | | | | | | |
| 13. | 20CEE13 | Advanced Steel Design | 3 | 0 | 0 | 3 | VII | SE |
| 14. | 20CEE14 | Architecture and Town Planning | 3 | 0 | 0 | 3 | VII | CEM |
| 15. | 20CEE15 | Air and Noise Pollution Control Engineering | 3 | 0 | 0 | 3 | VII | EE |
| 16. | 20CEE16 | Urban Transportation Planning | 3 | 0 | 0 | 3 | VII | TE |
| 17. | 20CEE17 | Rock Mechanics | 3 | 0 | 0 | 3 | VII | GTE |
| 18. | 20CEE18 | Finite Element Methods | 3 | 0 | 0 | 3 | VII | BG |
| 19. | 20GEE01 | Fundamentals of Research | 3 | 0 | 0 | 3 | VII | GE |
| | | Elective - IV | | | | | | |
| 20. | 20CEE19 | Earthquake Engineering and Design | 3 | 0 | 0 | 3 | VII | SE |
| 21. | 20CEE20 | Sustainable Engineering | 3 | 0 | 0 | 3 | VII | CEM |
| 22. | 20CEE21 | Industrial Waste Management | 3 | 0 | 0 | 3 | VII | EE |



| | | | | | | | | |
|-----------------------------------|---------|--|---|---|---|-----------|------|-----|
| 23. | 20CEE22 | Traffic Engineering and Management | 3 | 0 | 0 | 3 | VII | TE |
| 24. | 20CEE23 | Site Investigation and Soil Exploration | 3 | 0 | 0 | 3 | VII | GTE |
| 25. | 20CEE24 | Green Building | 3 | 0 | 0 | 3 | VII | BG |
| 26. | 20CEE25 | Total Quality Management | 3 | 0 | 0 | 3 | VII | BG |
| | | Elective - V | | | | | | |
| 27. | 20CEE26 | Design of Prefabricated Structures | 3 | 0 | 0 | 3 | VII | SE |
| 28. | 20CEE27 | Construction Equipment and Management | 3 | 0 | 0 | 3 | VII | CEM |
| 29. | 20CEE28 | Surface Hydrology | 3 | 0 | 0 | 3 | VII | WRE |
| 30. | 20CEE29 | Intelligent Transport Engineering | 3 | 0 | 0 | 3 | VII | TE |
| 31. | 20CEE30 | Reinforced Soil Structures | 3 | 0 | 0 | 3 | VII | GTE |
| 32. | 20CEE31 | Safety in Construction Practices | 3 | 0 | 0 | 3 | VII | BG |
| | | Elective - VI | | | | | | |
| 33. | 20CEE32 | Design of Bridges | 3 | 0 | 0 | 3 | VIII | SE |
| 34. | 20CEE33 | Distress Monitoring and Rehabilitation of Structures | 3 | 0 | 0 | 3 | VIII | CEM |
| 35. | 20CEE34 | Water Power Engineering | 3 | 0 | 0 | 3 | VIII | WRE |
| 36. | 20CEE35 | Transportation Economics | 3 | 0 | 0 | 3 | VIII | TE |
| 37. | 20CEE36 | Geotechnical Earthquake Engineering | 3 | 0 | 0 | 3 | VIII | GTE |
| 38. | 20CEE37 | Disaster Preparedness and Planning | 3 | 0 | 0 | 3 | VIII | BG |
| 39. | 20CEE38 | Advanced Reinforced Concrete Design | 3 | 0 | 0 | 3 | VIII | SE |
| Total Credits to be earned | | | | | | 18 | | |

* Domain/Stream Abbreviations: EE - Environmental Engineering, CT - Construction Technology, SY – Surveying, GTE - Geotechnical Engineering, TE - Transportation Engineering, SE - Structural Engineering, CEM - Construction Engineering and Management, WRE - Water Resources Engineering, BG – Branch General, GE – General Engineering.

OPEN ELECTIVE COURSES OFFERED TO OTHER DEPARTMENTS (OE)

| S. No. | Course Code | Course Name | L | T | P | C | Sem |
|--------|-------------|--|---|---|---|---|-----|
| 1. | 20CEO01 | Remote Sensing and its Applications | 3 | 0 | 2 | 4 | 4 |
| 2. | 20CEO02 | Disaster Management | 3 | 1 | 0 | 4 | 5 |
| 3. | 20CEO03 | Introduction to Smart Cities | 3 | 0 | 0 | 3 | 6 |
| 4. | 20CEO04 | Environmental Health and Safety | 3 | 0 | 0 | 3 | 6 |
| 5. | 20CEO05 | Infrastructure Planning and Management | 3 | 0 | 0 | 3 | 8 |
| 6. | 20CEO06 | Environmental Laws and Policy | 3 | 0 | 0 | 3 | 8 |

**OPEN ELECTIVE COURSES OFFERED BY OTHER DEPARTMENTS (OE)**

| S.No. | Course Code | Course Title | L | T | P | C | Offering Dept. |
|----------------------|-------------|--|---|---|---|---|----------------|
| SEMESTER - IV | | | | | | | |
| 1 | 20MEO01 | Renewable Energy Sources | 3 | 0 | 2 | 4 | MECH |
| 2 | 20MTO01 | Design of Mechatronics Systems | 3 | 1 | 0 | 4 | MTS |
| 3 | 20AUO01 | Automotive Engineering | 3 | 0 | 2 | 4 | AUTO |
| 4 | 20ECO01 | Wearable Technology | 3 | 1 | 0 | 4 | ECE |
| 5 | 20ECO02 | Basics of Electronics in Automation Appliances | 3 | 1 | 0 | 4 | ECE |
| 6 | 20ECO03 | Principles of Quantum Computing | 3 | 0 | 2 | 4 | ECE |
| 7 | 20EEO01 | Solar and Wind Energy Systems | 3 | 1 | 0 | 4 | EEE |
| 8 | 20EEO02 | Electrical Wiring and Lighting | 3 | 1 | 0 | 4 | EEE |
| 9 | 20EEO03 | Electrical Safety | 3 | 1 | 0 | 4 | EEE |
| 10 | 20EIO01 | Digital Image Processing and Its Applications | 3 | 1 | 0 | 4 | EIE |
| 11 | 20CSO01 | Fundamentals of Databases | 3 | 0 | 2 | 4 | CSE |
| 12 | 20CSO02 | Python Programming and Frameworks | 3 | 0 | 2 | 4 | CSE |
| 13 | 20ITO01 | Artificial Intelligence | 3 | 1 | 0 | 4 | IT |
| 14 | 20ITO02 | Web Technologies | 3 | 1 | 0 | 4 | IT |
| 15 | 20ITO03 | Introduction to Operating Systems | 3 | 1 | 0 | 4 | IT |
| 16 | 20ITO04 | Programming in Python | 3 | 1 | 0 | 4 | IT |
| 17 | 20CHO01 | Drugs and Pharmaceuticals Technology | 3 | 1 | 0 | 4 | CHEM |
| 18 | 20CHO02 | Process Automation | 3 | 1 | 0 | 4 | CHEM |
| 19 | 20FTO01 | Baking Technology | 3 | 0 | 2 | 4 | FT |
| 20 | 20FTO02 | Food Processing Technology | 3 | 1 | 0 | 4 | FT |
| 21 | 20CDO01 | Fundamentals of User Experience Design | 3 | 1 | 0 | 4 | CSD |
| 22 | 20ADO01 | Data Warehousing and Data Mining | 3 | 0 | 2 | 4 | AIDS |
| 23 | 20ALO01 | Business Intelligence | 3 | 1 | 0 | 4 | AIML |
| 24 | 20PHO01 | Thin Film Technology | 3 | 1 | 0 | 4 | PHY |
| 25 | 20CYO01 | Instrumental Methods of Analysis | 3 | 1 | 0 | 4 | CHEMIS |
| SEMESTER - V | | | | | | | |
| 26 | 20MEO02 | Design of Experiments | 3 | 0 | 2 | 4 | MECH |
| 27 | 20MTO02 | Factory Automation | 3 | 0 | 2 | 4 | MTS |
| 28 | 20MTO03 | Data Acquisition and Virtual Instrumentation | 3 | 0 | 2 | 4 | MTS |
| 29 | 20AUO02 | Automotive Electronics | 3 | 0 | 2 | 4 | AUTO |



| | | | | | | | |
|----|---------|--|---|---|---|---|--------|
| 30 | 20ECO04 | PCB Design and Fabrication | 3 | 0 | 2 | 4 | ECE |
| 31 | 20EE004 | Energy Conservation and Management | 3 | 1 | 0 | 4 | EEE |
| 32 | 20EIO02 | Industrial Automation | 3 | 1 | 0 | 4 | EIE |
| 33 | 20EIO03 | Measurements and Instrumentation | 3 | 1 | 0 | 4 | EIE |
| 34 | 20CSO03 | Computational Science for Engineers | 3 | 1 | 0 | 4 | CSE |
| 35 | 20CSO04 | Formal Languages and Automata | 3 | 1 | 0 | 4 | CSE |
| 36 | 20ITO05 | Data Science | 3 | 1 | 0 | 4 | IT |
| 37 | 20ITO06 | Advanced Java Programming | 3 | 1 | 0 | 4 | IT |
| 38 | 20CHO03 | Renewable Bioenergy Resources | 3 | 1 | 0 | 4 | CHEM |
| 39 | 20CHO04 | Intelligent Controllers | 3 | 1 | 0 | 4 | CHEM |
| 40 | 20FTO03 | Processing of Milk and Milk Products | 3 | 0 | 2 | 4 | FT |
| 41 | 20FTO04 | Processing of Fruits and Vegetables | 3 | 0 | 2 | 4 | FT |
| 42 | 20CDO02 | Fundamentals of User Interactive Design | 3 | 0 | 2 | 4 | CSD |
| 43 | 20ADO02 | Computer Vision | 3 | 0 | 2 | 4 | AIDS |
| 44 | 20ALO02 | Data Exploration and Visualization Techniques | 3 | 0 | 2 | 4 | AIML |
| 45 | 20PHO02 | High Energy Storage Devices | 3 | 0 | 0 | 3 | PHY |
| 46 | 20CYO02 | Corrosion Science and Engineering | 3 | 1 | 0 | 4 | CHEMIS |
| 47 | 20CYO03 | Chemistry of Cosmetics in Daily Life | 3 | 1 | 0 | 4 | CHEMIS |
| 48 | 20CYO04 | Chemistry of Nutrition for Women Health | 3 | 1 | 0 | 4 | CHEMIS |
| 49 | 20MAO01 | Mathematical Foundations for Machine Learning | 3 | 1 | 0 | 4 | MATHS |
| 50 | 20MAO02 | Graph Theory and its Applications | 3 | 1 | 0 | 4 | MATHS |
| | | SEMESTER - VI | | | | | |
| 51 | 20MEO03 | Fundamentals of Ergonomics | 3 | 0 | 0 | 3 | MECH |
| 52 | 20MEO04 | Principles of Management and Industrial Psychology | 3 | 0 | 0 | 3 | MECH |
| 53 | 20MTO04 | 3D Printing and Design | 3 | 0 | 0 | 3 | MTS |
| 54 | 20MTO05 | Drone System Technology | 3 | 0 | 0 | 3 | MTS |
| 55 | 20MTO06 | Virtual and Augmented Reality in Industry 4.0 | 3 | 0 | 0 | 3 | MTS |
| 56 | 20AUO03 | Vehicle Maintenance | 3 | 0 | 0 | 3 | AUTO |
| 57 | 20ECO05 | Electronic Hardware and Troubleshooting | 2 | 0 | 2 | 3 | ECE |
| 58 | 20ECO06 | Bioinspired Computing Technologies | 2 | 0 | 2 | 3 | ECE |
| 59 | 20EE005 | Micro Grid and Smart Grid | 3 | 0 | 0 | 3 | EEE |
| 60 | 20EE006 | E-Waste Management | 3 | 0 | 0 | 3 | EEE |
| 61 | 20EIO04 | Biomedical Instrumentation and Applications | 3 | 0 | 0 | 3 | EIE |
| 62 | 20EIO05 | PLC Programming and Its Applications | 3 | 0 | 0 | 3 | EIE |
| 63 | 20EIO06 | Instrumentation for Industry 4.0 | 3 | 0 | 0 | 3 | EIE |
| 64 | 20CSO05 | Java Programming | 2 | 0 | 2 | 3 | CSE |



| | | | | | | | |
|----|---------|--|---|---|---|---|--------|
| 65 | 20CSO06 | Web Engineering | 2 | 0 | 2 | 3 | CSE |
| 66 | 20CSO07 | Nature Inspired Optimization Techniques | 3 | 0 | 0 | 3 | CSE |
| 67 | 20ITO07 | Bio Natural Language Processing | 3 | 0 | 0 | 3 | IT |
| 68 | 20ITO08 | Disaster Management for Information Technology | 3 | 0 | 0 | 3 | IT |
| 69 | 20CHO05 | Food as Medicine | 3 | 0 | 0 | 3 | CHEM |
| 70 | 20CHO06 | Organic Farming | 3 | 0 | 0 | 3 | CHEM |
| 71 | 20FTO05 | Principles of Food Safety | 3 | 0 | 0 | 3 | FT |
| 72 | 20FTO06 | Fundamentals of Food Packaging and Storage | 3 | 0 | 0 | 3 | FT |
| 73 | 20CDO03 | Introduction to Mobile Game Design | 3 | 0 | 0 | 3 | CSD |
| 74 | 20ADO03 | Neural Networks and Deep Learning | 3 | 0 | 0 | 3 | AIDS |
| 75 | 20ALO03 | Industrial Machine Learning | 3 | 0 | 0 | 3 | AIML |
| 76 | 20PHO03 | Structural and Optical Characterization of Materials | 3 | 0 | 0 | 3 | PHY |
| 77 | 20CYO05 | Chemistry Concepts for Competitive Examinations | 3 | 0 | 0 | 3 | CHEMIS |
| 78 | 20CYO06 | Waste and Hazardous Waste Management | 3 | 0 | 0 | 3 | CHEMIS |
| 79 | 20MAO03 | Data Analytics using R Programming | 3 | 0 | 2 | 4 | MATHS |
| 80 | 20MAO04 | Number Theory and Cryptography | 3 | 1 | 0 | 4 | MATHS |
| | | SEMESTER - VIII | | | | | |
| 81 | 20MEO05 | Safety Measures for Engineers | 3 | 0 | 0 | 3 | MECH |
| 82 | 20MEO06 | Energy Conservation in Thermal Equipments | 3 | 0 | 0 | 3 | MECH |
| 83 | 20MTO06 | Robotics | 3 | 0 | 0 | 3 | MTS |
| 84 | 20MTO07 | Virtual and Augment Reality in Industry 4.0 | 3 | 0 | 0 | 3 | MTS |
| 85 | 20AUO04 | Public Transport Management | 3 | 0 | 0 | 3 | AUTO |
| 86 | 20AUO05 | Autonomous Vehicles | 3 | 0 | 0 | 3 | AUTO |
| 87 | 20ECO07 | Optical Engineering | 3 | 0 | 0 | 3 | ECE |
| 88 | 20EEO07 | Electric Vehicle | 3 | 0 | 0 | 3 | EEE |
| 89 | 20EIO07 | Graphical Programming using Virtual Instrumentation | 3 | 0 | 0 | 3 | EIE |
| 90 | 20EIO08 | Testing of Materials | 3 | 0 | 0 | 3 | EIE |
| 91 | 20CSO08 | Fundamentals of Internet of Things | 3 | 0 | 0 | 3 | CSE |
| 92 | 20CSO09 | Machine Translation | 3 | 0 | 0 | 3 | CSE |
| 93 | 20CSO10 | Fundamentals of Blockchain | 3 | 0 | 0 | 3 | CSE |
| 94 | 20ITO09 | Modern Application Development | 3 | 0 | 0 | 3 | IT |
| 95 | 20ITO10 | Object Oriented System Development using UML | 3 | 0 | 0 | 3 | IT |
| 96 | 20ITO11 | Reinforcement Learning | 3 | 0 | 0 | 3 | IT |
| 97 | 20CHO07 | Cosmetics and Personal Health Care Products | 3 | 0 | 0 | 3 | CHEM |
| 98 | 20CHO08 | Brewing and Alcohol Technology | 3 | 0 | 0 | 3 | CHEM |
| 99 | 20FTO07 | Food Ingredients | 3 | 0 | 0 | 3 | FT |



| | | | | | | | |
|-----|---------|-----------------------------------|---|---|---|---|-------|
| 100 | 20FTO08 | Food and Nutrition | 3 | 0 | 0 | 3 | FT |
| 101 | 20CDO04 | Introduction to Graphics Design | 3 | 0 | 0 | 3 | CSD |
| 102 | 20ADO04 | Business Analytics | 3 | 0 | 0 | 3 | AIDS |
| 103 | 20ALO04 | Machine Learning for Smart Cities | 3 | 0 | 0 | 3 | AIML |
| 104 | 20MAO05 | Advanced Linear Algebra | 3 | 0 | 0 | 3 | MATHS |
| 105 | 20MAO06 | Optimization Techniques | 3 | 0 | 0 | 3 | MATHS |

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

| S.No. | Course Code | Course Title | L | T | P | C | Semester | Offering Dept. |
|-------|-------------|---|---|---|---|---|---------------|----------------|
| 1 | 20GEO01 | German Language Level 1 | 4 | 0 | 0 | 4 | IV/V/VII/VIII | ECE |
| 2 | 20GEO02 | Japanese Language Level 1 | 4 | 0 | 0 | 4 | IV/V/VII/VIII | ECE |
| 3 | 20GEO03 | Design Thinking for Engineers | 3 | 1 | 0 | 4 | V | CSE |
| 4 | 20GEO04 | Innovation and Business Model Development | 3 | 1 | 0 | 4 | VI | MTS |
| 5 | 20GEO05 | German Language Level 2 | 4 | 0 | 0 | 4 | IV/V/VII/VIII | ECE |
| 6 | 20GEO06 | German Language Level 3 | 3 | 0 | 0 | 3 | IV/V/VII/VIII | ECE |
| 7 | 20GEO07 | German Language Level 4 | 3 | 0 | 0 | 3 | IV/V/VII/VIII | ECE |
| 8 | 20GEO08 | Japanese Language Level 2 | 4 | 0 | 0 | 4 | IV/V/VII/VIII | ECE |
| 9 | 20GEO09 | Japanese Language Level 3 | 3 | 0 | 0 | 3 | IV/V/VII/VIII | ECE |
| 10 | 20GEO10 | Japanese Language Level 4 | 3 | 0 | 0 | 3 | IV/V/VII/VIII | ECE |
| 11 | 20GEO11 | NCC Studies (Army Wing) - I | 3 | 0 | 2 | 4 | V/VI | EEE |
| 12 | 20GEO12 | NCC Studies (Air Wing) - I | 3 | 0 | 2 | 4 | V/VI | IT |
| 13 | 20GEO13 | French Language Level 1 | 4 | 0 | 0 | 4 | IV/V/VII/VIII | ECE |
| 14 | 20GEO14 | French Language Level 2 | 4 | 0 | 0 | 4 | IV/V/VII/VIII | ECE |
| 15 | 20GEO15 | French Language Level 3 | 3 | 0 | 0 | 3 | IV/V/VII/VIII | ECE |
| 16 | 20GEO16 | Spanish Language Level 1 | 4 | 0 | 0 | 4 | IV/V/VII/VIII | ECE |
| 17 | 20GEO17 | Spanish Language Level 2 | 4 | 0 | 0 | 4 | IV/V/VII/VIII | ECE |
| 18 | 20GEO18 | Spanish Language Level 3 | 3 | 0 | 0 | 3 | IV/V/VII/VIII | ECE |
| 19 | 20GEO19 | Entrepreneurship Development | 3 | 0 | 0 | 3 | VIII | MTS |

KEC R2020: SCHEDULING OF COURSES – B.E.(Civil Engineering)
Total Credits: 169

| Sem | Course1 | Course2 | Course3 | Course4 | Course5 | Course6 | Course7 | Course8 | Course9 | Course10 | Credits |
|------|---|--|---|---|---|---|---|--|--|--------------------------------------|---------|
| I | 20EGT11 English Language Skills (3-0-0-3) | 20MAC11 Matrices and Differential Equations (3-1*-2*-4) | 20PHT11 Applied Physics (3-0-0-3) | 20CYT11 Applied Chemistry (3-0-0-3) | 20MEC11 Engineering Drawing (2-0-2-3) | 20CET11 Construction Materials and Practices (3-0-0-3) | 20PHL11 Physical Sciences Laboratory I (0-0-2-1) | 20MEL11 Engineering Practices Laboratory (0-0-2-1) | 20VEC11 Yoga and Values for Holistic Development (1-0-1-1) | 20MNT11 Student Induction Program | 22 |
| II | 20EGT21 Advanced Communication Skills (3-0-0-3) | 20MAC21 Multivariable Calculus and Complex Analysis (3-1*-2*-4) | 20PHT21 Materials Science (3-0-0-3) | 20CYT21 Chemistry of Building Materials (3-0-0-3) | 20CET21 Surveying and Geomatics (3-0-0-3) | 20CET22/20CSC31 Engineering Mechanics (2020-2021) / Programming in C (2021-2022) (3-0-0/2-3/4) | 20PHL20 Physical Sciences Laboratory II (0-0-2-1) | 20CEL21 Surveying Laboratory (0-0-2-1) | | | 21/22 |
| III | 20MAT31 Probability and Partial Differential Equations (3-1-0-4) | 20CSC31/20CSC41 Programming in C (2020-2021) / Python Programming (2021-2022) (3-0-2-4) | 20CET31/20CET22 Mechanics of Materials (2020-2021) / Engineering Mechanics (2021-2022) (3-1/0-0-4/3) | 20CET32 Concrete Technology (3-0-0-3) | 20CET33 Geotechnical Engineering I (3-0-0-3) | 20CET34 Water Resources and Irrigation Engineering (3-0-0-3) | 20CEL31 Strength of Materials Laboratory (0-0-2-1) | 20CEL32 Concrete Technology Laboratory (0-0-2-1) | 20MNT31 Environmental Science (2-0-0-0) | | 23/22 |
| IV | 20MAT41 Statistics and Numerical Methods (3-1-0-4) | 20CSC41/20CET31 Python Programming (2020-2021) / Mechanics of Materials (2021-2022) (3-0/1-2/0-4) | 20CEC41 Geotechnical Engineering II (2-0-2-3) | 20CET41 Fluid Mechanics and Hydraulics Engineering (3-1-0-4) | 20CEL41 Fluid Mechanics and Machineries Laboratory (0-0-2-1) | 20CEL42 Computer Aided Building Drawing Laboratory (0-0-2-1) | 20EGL31 English for Workplace Communication Laboratory (0-0-2-1) | 20GET31 Universal Human Values (2-0-0-2) | | | 24 |
| V | 20CEC51 Environmental Engineering (2-0-2-3) | 20CET51 Structural Analysis I (3-1-0-4) | 20CET52 Design of RC Elements (3-1-0-4) | Professional Elective I (3-0-0-3) | Open Elective II (3-1/0-0/2-4) | 20CEL51 Computer Aided Structural Design Laboratory-I (0-0-2-1) | 20CEL52 Computer Aided Building Information Modelling Laboratory (0-0-2-1) | 20CEL53 Computational Laboratory for Construction Management (0-0-2-1) | 20GEL51/20GEI51 Professional Skills Training I / Industrial Training I (0-0-80-2) | | 23 |
| VI | 20CEC61 Transportation Engineering (2-0-2-3) | 20CET61 Design of Steel Structures (3-1-0-4) | 20CET62 Advanced Reinforced Concrete Design (3-0-0-3) | Open Elective III (3-0-0-3) | 20CEL61 Computer Aided Structural Design Laboratory-II (0-0-2-1) | 20CEL62 Structural Engineering Laboratory (0-0-2-1) | 20CEL63 Computer Aided Structural Detailing Laboratory (0-0-2-1) | 20GEL61/20GEI61 Professional Skills Training II / Industrial Training II (0-0-80-2) | 20GEP61 Comprehensive Test and Viva (0-0-0-2) | 20CEP61 Project Work I (0-0-4-2) | 22 |
| VII | 20GET71 Engineering Economics and Management (3-0-0-3) | 20CET71 Estimation and Quantity Surveying (3-0-0-3) | Professional Elective II (3-0-0-3) | Professional Elective III (3-0-0-3) | Professional Elective IV (3-0-0-3) | Professional Elective V (3-0-0-3) | 20CEP71 Project Work –II Phase-I (0-0-12-6) | | | | 21 |
| VIII | Open Elective IV (3-0-0-3) | Professional Elective VI (3-0-0-3) | 20CEP81 Project Work –II Phase-II (0-0-8-4) | | | | | | | | 13 |

**MAPPING OF COURSES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| 1 | 20EGT11 | English Language Skills | | | | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | | |
| 1 | 20MAC11 | Matrices and Differential Equations | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 1 | 20PHT11 | Applied Physics | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 1 | 20CYT11 | Applied Chemistry | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 1 | 20MEC11 | Engineering Drawing | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| 1 | 20CET11 | Construction Materials and Practices | ✓ | ✓ | | | | ✓ | | | | | | | ✓ | ✓ |
| 1 | 20VEC11 | Yoga and Values for Holistic Development | | | | | | ✓ | | ✓ | ✓ | | | ✓ | | |
| 1 | 20PHL11 | Physical Sciences Laboratory - I | | | | ✓ | | | | | | | | | | |
| 1 | 20MEL11 | Engineering Practices Laboratory | ✓ | | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | | |
| 2 | 20EGT21 | Advanced Communication Skills | | | | | | ✓ | | | ✓ | ✓ | ✓ | ✓ | | |
| 2 | 20MAC21 | Multivariable Calculus and Complex Analysis | ✓ | ✓ | ✓ | | ✓ | | | | | | | | | |
| 2 | 20PHT21 | Materials Science | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 2 | 20CYT21 | Chemistry of Building Materials | ✓ | ✓ | ✓ | ✓ | | | | | | | | | ✓ | ✓ |
| 2 | 20CET21 | Surveying and Geomatics | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 2 | 20CET22 | Engineering Mechanics | ✓ | ✓ | ✓ | ✓ | | | | | | | | ✓ | | ✓ |
| 2 | 20PHL20 | Physical Sciences Laboratory II | | | ✓ | | | | | | | | | | | |
| 2 | 20CEL21 | Surveying Laboratory | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 3 | 20MAT31 | Probability and Partial Differential Equations | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 3 | 20CSC31 | Programming in C | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | | |
| 3 | 20CET31 | Mechanics of Materials | ✓ | ✓ | ✓ | | | ✓ | | | | ✓ | | ✓ | ✓ | ✓ |
| 3 | 20CET32 | Concrete Technology | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | | ✓ | ✓ | ✓ |
| 3 | 20CET33 | Geotechnical Engineering I | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 3 | 20CET34 | Water Resources and Irrigation Engineering | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 3 | 20CEL31 | Strength of Materials Laboratory | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ |



| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|---------------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| 3 | 20CEL32 | Concrete Technology Laboratory | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ |
| 3 | 20MNT31 | Environmental Science | ✓ | ✓ | ✓ | | | | ✓ | | | | | ✓ | ✓ | ✓ |
| 4 | 20MAT41 | Statistics and Numerical Methods | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 4 | 20CSC41 | Python programming | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 4 | 20CEC41 | Geotechnical Engineering II | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 4 | 20CET41 | Fluid Mechanics and Hydraulics Engineering | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 4 | 20CEL41 | Fluid Mechanics and Machineries Laboratory | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ | | | ✓ | ✓ | ✓ |
| 4 | 20CEL42 | Computer Aided Building Drawing Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | ✓ | ✓ |
| 4 | 20EGL31 | English for Workplace Communication Laboratory | | | | | | | | | ✓ | ✓ | | ✓ | | |
| 4 | 20GET31 | Universal Human Values | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| 5 | 20CEC51 | Environmental Engineering | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | | ✓ | ✓ |
| 5 | 20CET51 | Structural Analysis | ✓ | ✓ | ✓ | | | ✓ | | | | ✓ | | ✓ | ✓ | ✓ |
| 5 | 20CET52 | Design of RC Elements | ✓ | ✓ | ✓ | | | ✓ | | | | ✓ | | ✓ | ✓ | ✓ |
| 5 | 20CEL51 | Computer Aided Structural Design Laboratory - I | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| 5 | 20CEL52 | Computer Aided Building Information Modelling Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 5 | 20CEL53 | Computational Laboratory for Construction Management | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 5 | 20GEL51/ 20GEI51 | Professional Skills Training I / Industrial Training I | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | |
| 6 | 20CEC61 | Transportation Engineering | ✓ | ✓ | ✓ | ✓ | | | | | | | | | ✓ | ✓ |
| 6 | 20CET61 | Design of Steel Structures | ✓ | ✓ | ✓ | | | ✓ | | | | ✓ | | ✓ | ✓ | ✓ |
| 6 | 20CET62 | Advanced Reinforced Concrete Design | ✓ | ✓ | ✓ | | | ✓ | | | | ✓ | | ✓ | ✓ | ✓ |
| 5 | 20CEL61 | Computer Aided Structural Design Laboratory - II | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| 6 | 20CEL62 | Structural Engineering Laboratory | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| 6 | 20CEL63 | Computer Aided Structural Detailing Laboratory | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | | | ✓ | ✓ | ✓ |
| 6 | 20GEL61/ 20GEI61 | Professional Skills Training II / Industrial Training II | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | |
| 6 | 20GEP61 | Comprehensive Test and Viva | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |



| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| 6 | 20CEP61 | Project Work I | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 7 | 20GET71 | Engineering Economics and Management | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 7 | 20CET71 | Estimation and Quantity Surveying | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | | | ✓ | ✓ | ✓ |
| 7 | 20CEP71 | Project Work II Phase I | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 8 | 20CEP81 | Project Work II Phase II | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | | Professional Elective Courses | | | | | | | | | | | | | | |
| 5 | 20CEE01 | Design of Prestressed Concrete Structures | ✓ | ✓ | ✓ | | | ✓ | | | | ✓ | | ✓ | ✓ | ✓ |
| 5 | 20CEE02 | Construction Engineering and Management | ✓ | ✓ | ✓ | | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| 5 | 20CEE03 | Solid and Hazardous Waste Management | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | | ✓ | ✓ | ✓ |
| 5 | 20CEE04 | Railway, Airport and Harbour Engineering | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 5 | 20CEE05 | Ground Improvement Techniques | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 5 | 20CEE06 | Remote Sensing and Geographical Information System | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE07 | Advanced Structural Analysis | ✓ | ✓ | ✓ | | | ✓ | | | | ✓ | | ✓ | ✓ | ✓ |
| 7 | 20CEE08 | Contract Management | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE09 | Environmental Impact Assessment | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE10 | Public Transportation Systems | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE11 | Environmental Geo-technology | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE12 | Engineering Geology | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE13 | Advanced Steel Design | ✓ | ✓ | ✓ | | | ✓ | | | | ✓ | | ✓ | ✓ | ✓ |
| 7 | 20CEE14 | Architecture and Town Planning | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE15 | Air and Noise Pollution Control Engineering | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE16 | Urban Transportation Planning | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE17 | Rock Mechanics | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE18 | Finite Element Methods | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE19 | Earthquake Engineering and Design | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |



| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| 7 | 20CEE20 | Sustainable Engineering | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE21 | Industrial Waste Management | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE22 | Traffic Engineering and Management | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE23 | Site Investigation and Soil Exploration | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 7 | 20CEE24 | Green Building | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 8 | 20CEE25 | Total Quality Management | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 8 | 20CEE26 | Design of Prefabricated Structures | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 8 | 20CEE27 | Construction Equipment and Management | ✓ | ✓ | ✓ | | ✓ | ✓ | | | | | | | ✓ | ✓ |
| 8 | 20CEE28 | Surface Hydrology | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 8 | 20CEE29 | Intelligent Transport Engineering | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 8 | 20CEE30 | Reinforced Soil Structures | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 8 | 20CEE31 | Safety in Construction Practices | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 8 | 20CEE32 | Design of Bridges | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 8 | 20CEE33 | Distress Monitoring and Rehabilitation of Structures | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 8 | 20CEE34 | Water Power Engineering | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 8 | 20CEE35 | Transportation Economics | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 8 | 20CEE36 | Geotechnical Earthquake Engineering | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | ✓ | ✓ |
| 8 | 20CEE37 | Disaster Preparedness and Planning | ✓ | ✓ | ✓ | | | ✓ | ✓ | | | | | ✓ | ✓ | ✓ |

| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-------------|--------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| | | OPEN ELECTIVE | | | | | | | | | | | | | | |
| 4 | 20MEO01 | Renewable Energy Sources | ✓ | ✓ | | ✓ | | | ✓ | | ✓ | ✓ | | | | |
| 4 | 20MTO01 | Design of Mechatronics Systems | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ | | |



| | | | | | | | | | | | | | | | | |
|---|---------|--|---|---|---|---|---|---|---|---|---|---|---|---|--|--|
| 4 | 20AUO01 | Automotive Engineering | ✓ | ✓ | ✓ | | ✓ | | | | ✓ | ✓ | | | | |
| 4 | 20ECO01 | Wearable Technology | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | | | | ✓ | | |
| 4 | 20ECO02 | Basics of Electronics in Automation Appliances | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | | ✓ | ✓ | | |
| 4 | 20ECO03 | Principles of Quantum Computing | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | | |
| 4 | 20EE001 | Solar and Wind Energy Systems | ✓ | ✓ | ✓ | | | | ✓ | | | | | | | |
| 4 | 20EE002 | Electrical Wiring and Lighting | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 4 | 20EE003 | Electrical Safety | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 4 | 20EIO01 | Digital Image Processing and Its Applications | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 4 | 20CSO01 | Fundamentals of Databases | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 4 | 20CSO02 | Python Programming and Frameworks | | | | | | | | | | | | | | |
| 4 | 20ITO01 | Artificial Intelligence | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 4 | 20ITO02 | Web Technologies | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 4 | 20ITO03 | Introduction to Operating Systems | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 4 | 20ITO04 | Programming in Python | | | ✓ | | ✓ | | | | | | | ✓ | | |
| 4 | 20CHO01 | Drugs and Pharmaceuticals Technology | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 4 | 20CHO02 | Process Automation | ✓ | ✓ | ✓ | | ✓ | | | | | | | | | |
| 4 | 20FTO01 | Baking Technology | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | | |
| 4 | 20FTO02 | Food Processing Technology | ✓ | ✓ | ✓ | ✓ | | | | | | | | ✓ | | |
| 4 | 20CDO01 | Fundamentals of User Experience Design | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | | | |
| 4 | 20ADO01 | Data Warehousing and Data Mining | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 4 | 20ALO01 | Business Intelligence | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 4 | 20PHO01 | Thin Film Technology | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 4 | 20CYO01 | Instrumental Methods of Analysis | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |

| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| 5 | 20MEO02 | Design of Experiments | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | | | |
| 5 | 20MTO02 | Factory Automation | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | ✓ | | ✓ | | |
| 5 | 20MTO03 | Data Acquisition and Virtual Instrumentation | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | | |



| | | | | | | | | | | | | | | | | |
|---|---------|---|---|---|---|---|---|---|---|---|---|---|--|---|--|--|
| 5 | 20AUO02 | Automotive Electronics | ✓ | ✓ | ✓ | ✓ | ✓ | | | | ✓ | ✓ | | ✓ | | |
| 5 | 20ECO04 | PCB Design and Fabrication | ✓ | ✓ | ✓ | | ✓ | | | ✓ | ✓ | ✓ | | ✓ | | |
| 5 | 20EEO04 | Energy Conservation and Management | ✓ | ✓ | ✓ | | ✓ | | | | | | | | | |
| 5 | 20EIO02 | Industrial Automation | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 5 | 20EIO03 | Measurements and Instrumentation | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 5 | 20CSO03 | Computational Science for Engineers | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 20CSO04 | Formal Languages and Automata | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 20ITO05 | Data Science | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 5 | 20ITO06 | Advanced Java Programming | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 20CHO03 | Renewable Bioenergy Resources | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | | | |
| 5 | 20CHO04 | Intelligent Controllers | ✓ | | ✓ | ✓ | | ✓ | | | | | | | | |
| 5 | 20FTO03 | Processing of Milk and Milk Products | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | | |
| 5 | 20FTO04 | Processing of Fruits and Vegetables | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | | |
| 5 | 20CDO02 | Fundamentals of User Interactive Design | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 20ADO02 | Computer Vision | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 5 | 20ALO02 | Data Exploration and Visualization Techniques | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 5 | 20PHO02 | High Energy Storage Devices | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 20CYO02 | Corrosion Science and Engineering | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 5 | 20CYO03 | Chemistry of Cosmetics in Daily Life | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 20CYO04 | Chemistry of Nutrition for Women Health | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 5 | 20MAO01 | Mathematical Foundations for Machine Learning | ✓ | ✓ | | ✓ | ✓ | | | | | | | | | |
| 5 | 20MAO02 | Graph Theory and its Applications | ✓ | ✓ | ✓ | | | | | | | | | | | |



| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| 6 | 20MEO03 | Fundamentals of Ergonomics | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | ✓ | | |
| 6 | 20MEO04 | Principles of Management and Industrial Psychology | | | | | | ✓ | | ✓ | ✓ | ✓ | ✓ | | | |
| 6 | 20MTO04 | 3D Printing and Design | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | | |
| 6 | 20MTO05 | Drone System Technology | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | | |
| 6 | 20MTO06 | Virtual and Augment Reality in Industry 4.0 | | | | | | | | | | | | | | |
| 6 | 20AUO03 | Vehicle Maintenance | ✓ | ✓ | ✓ | ✓ | | | | | | | | ✓ | | |
| 6 | 20ECO05 | Electronic Hardware and Troubleshooting | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | |

| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| 6 | 20ECO06 | Bioinspired Computing Technologies | ✓ | ✓ | ✓ | | ✓ | | | | ✓ | | | | | |
| 6 | 20EEO05 | Micro Grid and Smart Grid | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 6 | 20EEO06 | E-Waste Management | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 6 | 20EIO04 | Biomedical Instrumentation and Applications | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | |
| 6 | 20EIO05 | PLC Programming and Its Applications | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 6 | 20EIO06 | Instrumentation for Industry 4.0 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 6 | 20CSO05 | Java Programming | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 6 | 20CSO06 | Web Engineering | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 6 | 20CSO07 | Nature Inspired Optimization Techniques | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 6 | 20ITO07 | Bio Natural Language Processing | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 6 | 20ITO08 | Disaster Management for Information Technology | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 6 | 20CHO05 | Food as Medicine | ✓ | ✓ | ✓ | ✓ | | ✓ | | | | | | ✓ | | |
| 6 | 20CHO06 | Organic Farming | ✓ | | ✓ | | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | | |
| 6 | 20FTO05 | Principles of Food Safety | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | |
| 6 | 20FTO06 | Fundamentals of Food Packaging and Storage | ✓ | ✓ | ✓ | | ✓ | ✓ | | ✓ | | | | ✓ | | |



| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-------------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| 6 | 20CDO03 | Introduction to Mobile Game Design | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 6 | 20ADO03 | Neural Networks and Deep Learning | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 6 | 20ALO03 | Industrial Machine Learning | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 6 | 20PHO03 | Structural and Optical Characterization of Materials | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 6 | 20CYO05 | Chemistry Concepts for Competitive Examinations | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 6 | 20CYO06 | Waste and Hazardous Waste Management | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | | | |
| 6 | 20MAO03 | Data Analytics using R Programming | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 6 | 20MAO04 | Number Theory and Cryptography | ✓ | ✓ | ✓ | | ✓ | | | | | | | | | |
| 8 | 20MEO05 | Safety Measures for Engineers | ✓ | | | ✓ | | ✓ | ✓ | ✓ | | | | | | |
| 8 | 20MEO06 | Energy Conservation in Thermal Equipments | ✓ | ✓ | | | | | | | | | | | | |
| 8 | 20MTO06 | Robotics | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ | | |
| 8 | 20MTO07 | Virtual and Augment Reality in Industry 4.0 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | | |
| 8 | 20AUO04 | Public Transport Management | ✓ | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| 8 | 20AUO05 | Autonomous Vehicles | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 8 | 20ECO07 | Optical Engineering | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | ✓ | | | ✓ | | |
| 8 | 20EEO07 | Electric Vehicle | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 8 | 20EIO07 | Graphical Programming using Virtual Instrumentation | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 8 | 20EIO08 | Testing of Materials | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | | | |
| 8 | 20CSO08 | Fundamentals of Internet of Things | ✓ | ✓ | ✓ | | ✓ | | | | | | | | | |
| 8 | 20CSO09 | Machine Translation | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 8 | 20CSO10 | Fundamentals of Blockchain | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 8 | 20ITO09 | Modern Application Development | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 8 | 20ITO10 | Object Oriented System Development using UML | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |



| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|------|-------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| 8 | 20ITO11 | Reinforcement Learning | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| 8 | 20CHO07 | Cosmetics and Personal Health Care Products | ✓ | | ✓ | | | ✓ | | ✓ | | | | ✓ | | |
| 8 | 20CHO08 | Brewing and Alcohol Technology | ✓ | ✓ | | | | | | | | | | | | |
| 8 | 20FTO07 | Food Ingredients | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | | |
| 8 | 20FTO08 | Food and Nutrition | ✓ | ✓ | ✓ | | | ✓ | | | | | | ✓ | | |
| 8 | 20CDO04 | Introduction to Graphics Design | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 8 | 20ADO04 | Business Analytics | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 8 | 20ALO04 | Machine Learning for Smart Cities | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 8 | 20MAO05 | Advanced Linear Algebra | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 8 | 20MAO06 | Optimization Techniques | ✓ | ✓ | ✓ | | | | | | | | | | | |

| Sem. | Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-------------|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| | | GENERAL OPEN ELECTIVE | | | | | | | | | | | | | | |
| 4,5,6,8 | 20GEO01 | German Language Level 1 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 4,5,6,8 | 20GEO02 | Japanese Language Level 1 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 5 | 20GEO03 | Design Thinking for Engineers | ✓ | ✓ | ✓ | | | | | | | | | | | |
| 6 | 20GEO04 | Innovation and Business Model Development | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| 4,5,6,8 | 20GEO05 | German Language Level 2 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 4,5,6,8 | 20GEO06 | German Language Level 3 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 4,5,6,8 | 20GEO07 | German Language Level 4 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 4,5,6,8 | 20GEO08 | Japanese Language Level 2 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 4,5,6,8 | 20GEO09 | Japanese Language Level 3 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 4,5,6,8 | 20GEO10 | Japanese Language Level 4 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 4,5,6,8 | 20GEO11 | NCC Studies (Army Wing) - I | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |
| 4,5,6,8 | 20GEO12 | NCC Studies (Air Wing) - I | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | |



| | | | | | | | | | | | | | | | | |
|---------|---------|------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|--|--|
| 4,5,6,8 | 20GEO13 | French Language Level 1 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 4,5,6,8 | 20GEO14 | French Language Level 2 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 4,5,6,8 | 20GEO15 | French Language Level 3 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 4,5,6,8 | 20GEO16 | Spanish Language Level 1 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 4,5,6,8 | 20GEO17 | Spanish Language Level 2 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 4,5,6,8 | 20GEO18 | Spanish Language Level 3 | | | | | | | | ✓ | ✓ | ✓ | | ✓ | | |
| 8 | 20GEO19 | Entrepreneurship Development | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | |

**B.E. DEGREE IN CIVIL ENGINEERING
CURRICULUM UNDER REGULATIONS 2020****(For the candidates admitted in the academic year 2020-21)**

| SEMESTER – I | | | | | | | | | |
|---------------------|--|------------|----|----|-----------|---------------|-----|-------|----------|
| Course Code | Course Title | Hours/Week | | | Credit | Maximum Marks | | | Category |
| | | 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 | | | | |

*Alternate week

| SEMESTER – II | | | | | | | | | |
|----------------------|---|------------|----|----|-----------|---------------|-----|-------|----------|
| Course Code | Course Title | Hours/Week | | | Credit | Maximum Marks | | | Category |
| | | 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 | Engineering Mechanics | 3 | 0 | 0 | 3 | 50 | 50 | 100 | ES |
| | Practical/ Employability Enhancement | | | | | | | | |
| 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 | | | | |

*Alternate week



B.E. CIVIL ENGINEERING CURRICULUM – R2020
(For the candidates admitted in the academic year 2020-21)

| SEMESTER – III | | | | | | | | | |
|---------------------------------------|--|--------------|---|---|--------|---------------|-----|-------|-----------|
| Course Code | Course Title | Hours / Week | | | Credit | Maximum Marks | | | Cate gory |
| | | L | T | P | | CA | ESE | Total | |
| Theory/Theory with Practical | | | | | | | | | |
| 20MAT31 | Probability and Partial Differential Equations | 3 | 1 | 0 | 4 | 50 | 50 | 100 | BS |
| 20CSC31 | Programming in C | 3 | 0 | 2 | 4 | 50 | 50 | 100 | ES |
| 20CET31 | Mechanics of Materials | 3 | 1 | 0 | 4 | 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 | | | | |

| SEMESTER – IV | | | | | | | | | |
|---------------------------------------|--|--------------|-----|-----|--------|---------------|-------|-------|-----------|
| Course Code | Course Title | Hours / Week | | | Credit | Maximum Marks | | | Cate gory |
| | | L | T | P | | CA | ESE | Total | |
| Theory/Theory with Practical | | | | | | | | | |
| 20MAT41 | Statistics and Numerical Methods | 3 | 1 | 0 | 4 | 50 | 50 | 100 | BS |
| 20CSC41 | Python Programming | 3 | 0 | 2 | 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 | 40/50 | 60/50 | 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 | | | | |



| 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 | 40/50 | 60/50 | 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 | 0 | 0 | 80 | 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 | Estimation and Quantity Surveying | 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 | 0 | 0 | 80 | 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
(For the candidates admitted in the academic year 2020-21)

| 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 | Pre-Engineered Buildings | 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 | 12 | 6 | 50 | 50 | 100 | EC |
| Total Credits to be earned | | | | | 24 | | | | |

| SEMESTER – VIII | | | | | | | | | |
|---------------------------------------|--------------------------|--------------|---|---|--------|---------------|-----|-------|--------------|
| Course Code | Course Title | Hours / Week | | | Credit | Maximum Marks | | | Cate gory |
| | | 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 | 0 | 0 | 8 | 4 | 50 | 50 | 100 | EC |
| Total Credits to be earned | | | | | 10 | | | | |

Total Credits: 169



B.E. DEGREE IN CIVIL ENGINEERING
CURRICULUM UNDER REGULATIONS 2020
 (with the inclusion of Amendment No.2022.18.07)

(For the candidates admitted in the academic year 2021-22)

| SEMESTER – I | | | | | | | | | |
|---------------------|--|------------|----|----|-----------|---------------|-----|-------|----------|
| Course Code | Course Title | Hours/Week | | | Credit | Maximum Marks | | | Category |
| | | L | T | P | | CA | ESE | Total | |
| | Theory/Theory with Practical | | | | | | | | |
| 20EGT11 | English Language Skills | 3 | 0 | 0 | 3 | 40 | 60 | 100 | HS |
| 20MAC11 | Matrices and Differential Equations | 3 | 1* | 2* | 4 | 50 | 50 | 100 | BS |
| 20PHT11 | Applied Physics | 3 | 0 | 0 | 3 | 40 | 60 | 100 | BS |
| 20CYT11 | Applied Chemistry | 3 | 0 | 0 | 3 | 40 | 60 | 100 | BS |
| 20MEC11 | Engineering Drawing | 2 | 1 | 0 | 3 | 40 | 60 | 100 | ES |
| 20CET11 | Construction Materials and Practices | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| | Practical | | | | | | | | |
| 20PHL11 | Physical Sciences Laboratory-I | 0 | 0 | 2 | 1 | 60 | 40 | 100 | BS |
| 20MEL11 | Engineering Practices Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 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 | | | | |

* Alternate week

| SEMESTER – II | | | | | | | | | |
|----------------------|---|------------|----|----|-----------|---------------|-----|-------|----------|
| Course Code | Course Title | Hours/Week | | | Credit | Maximum Marks | | | Category |
| | | L | T | P | | CA | ESE | Total | |
| | Theory/ Theory with Practical | | | | | | | | |
| 20EGT21 | Advanced Communication Skills | 3 | 0 | 0 | 3 | 40 | 60 | 100 | HS |
| 20MAC21 | Multivariable Calculus and Complex Analysis | 3 | 1* | 2* | 4 | 50 | 50 | 100 | BS |
| 20PHT21 | Materials Science | 3 | 0 | 0 | 3 | 40 | 60 | 100 | BS |
| 20CYT21 | Chemistry of Building Materials | 3 | 0 | 0 | 3 | 40 | 60 | 100 | BS |
| 20CET21 | Surveying and Geomatics | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 20CSC31 | Programming in C | 3 | 0 | 2 | 4 | 50 | 50 | 100 | ES |
| | Practical/ Employability Enhancement | | | | | | | | |
| 20PHL20 | Physical Sciences Laboratory-II | 0 | 0 | 2 | 1 | 60 | 40 | 100 | BS |
| 20CEL21 | Surveying Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| | Total | | | | 22 | | | | |

*Alternate week



| 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 Differential Equations | 3 | 1 | 0 | 4 | 40 | 60 | 100 | BS |
| 20CSC33 | Fundamentals of Data Structures | 3 | 0 | 2 | 4 | 50 | 50 | 100 | ES |
| 20CET22 | Engineering Mechanics | 3 | 0 | 0 | 3 | 40 | 60 | 100 | ES |
| 20CET32 | Concrete Technology | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 20CET33 | Geotechnical Engineering-I | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| 20CET34 | Water Resources and Irrigation Engineering | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| Practical / Employability Enhancement | | | | | | | | | |
| 20CEL31 | Strength of Materials Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | ES |
| 20CEL32 | Concrete Technology Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 20MNT31 | Environmental Science | 2 | 0 | 0 | 0 | 100 | 0 | 100 | MC |
| Total Credits to be earned | | | | | 22 | | | | |

| SEMESTER – IV | | | | | | | | | |
|---------------------------------------|--|--------------|-----|-----|--------|---------------|-------|-------|----------|
| Course Code | Course Title | Hours / Week | | | Credit | Maximum Marks | | | Category |
| | | L | T | P | | CA | ESE | Total | |
| Theory/Theory with Practical | | | | | | | | | |
| 20MAT41 | Statistics and Numerical Methods | 3 | 1 | 0 | 4 | 40 | 60 | 100 | BS |
| 20CET31 | Mechanics of Materials | 3 | 1 | 0 | 4 | 40 | 60 | 100 | ES |
| 20CEC41 | Geotechnical Engineering - II | 2 | 0 | 2 | 3 | 50 | 50 | 100 | PC |
| 20CET41 | Fluid Mechanics and Hydraulics Engineering | 3 | 1 | 0 | 4 | 40 | 60 | 100 | PC |
| | Open Elective-I | 3 | 1/0 | 0/2 | 4 | 40/50 | 60/50 | 100 | PC |
| Practical / Employability Enhancement | | | | | | | | | |
| 20CEL41 | Fluid Mechanics and Machineries Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 20CEL42 | Computer Aided Building Drawing Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 20EGL31 | English for Workplace Communication Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | HS |
| 20GEL51/ 20GEI51 | Professional Skills Training-I / Industrial Training-I * | 0 | 0 | 80 | 2 | 100 | 0 | 100 | EC |
| Total Credits to be earned | | | | | 24 | | | | |

*80 hours of training



B.E. CIVIL ENGINEERING CURRICULUM – R2020
(For the candidates admitted in the academic year 2021-22)

| 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 | 40 | 60 | 100 | PC |
| 20CET52 | Design of RC Elements | 3 | 1 | 0 | 4 | 40 | 60 | 100 | PC |
| | Professional Elective-I | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Open Elective-II | 3 | 1/0 | 0/2 | 4 | 40/50 | 60/50 | 100 | OE |
| Practical / Employability Enhancement | | | | | | | | | |
| 20CEL51 | Computer Aided Structural Design Laboratory-I | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 20CEL52 | Computer Aided Building Information Modelling Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 20CEL53 | Computational Laboratory for Construction Management | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 20GEL61/ 20GEI61 | Professional Skills Training-II / Industrial Training-II * | 0 | 0 | 80 | 2 | 100 | 0 | 100 | EC |
| Total Credits to be earned | | | | | 23 | | | | |

*80 hours of training

| 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 | 40 | 60 | 100 | PC |
| 20CET62 | Estimation and Quantity Surveying | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| | Open Elective-III | 3 | 0 | 0 | 3 | 40 | 60 | 100 | OE |
| Practical / Employability Enhancement | | | | | | | | | |
| 20CEL61 | Computer Aided Structural Design Laboratory-II | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 20CEL62 | Structural Engineering Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 20CEL63 | Computer Aided Structural Detailing Laboratory | 0 | 0 | 2 | 1 | 60 | 40 | 100 | PC |
| 20GET31 | Universal Human Values | 2 | 0 | 0 | 2 | 100 | 0 | 100 | HS |
| 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****(For the candidates admitted in the academic year 2021-22)**

| SEMESTER – VII | | | | | | | | | |
|---------------------------------------|--------------------------------------|--------------|---|----|--------|---------------|-----|-------|-----------|
| Course Code | Course Title | Hours / Week | | | Credit | Maximum Marks | | | Cate gory |
| | | L | T | P | | CA | ESE | Total | |
| Theory/Theory with Practical | | | | | | | | | |
| 20GET71 | Engineering Economics and Management | 3 | 0 | 0 | 3 | 40 | 60 | 100 | HS |
| 20CET71 | Pre-Engineered Buildings | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PC |
| | Professional Elective-II | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Professional Elective-III | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Professional Elective-IV | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| | Professional Elective-V | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| Practical / Employability Enhancement | | | | | | | | | |
| 20CEP71 | Project Work-II Phase-I | 0 | 0 | 12 | 6 | 50 | 50 | 100 | EC |
| Total Credits to be earned | | | | | 24 | | | | |

| SEMESTER – VIII | | | | | | | | | |
|---------------------------------------|--------------------------|--------------|---|---|--------|---------------|-----|-------|-----------|
| Course Code | Course Title | Hours / Week | | | Credit | Maximum Marks | | | Cate gory |
| | | L | T | P | | CA | ESE | Total | |
| Theory/Theory with Practical | | | | | | | | | |
| | Open Elective-IV | 3 | 0 | 0 | 3 | 40 | 60 | 100 | OE |
| | Professional Elective-VI | 3 | 0 | 0 | 3 | 40 | 60 | 100 | PE |
| Practical / Employability Enhancement | | | | | | | | | |
| 20CEP81 | Project Work-II Phase-II | 0 | 0 | 8 | 4 | 50 | 50 | 100 | EC |
| Total Credits to be earned | | | | | 10 | | | | |

Total Credits: 169



| LIST OF PROFESSIONAL ELECTIVES | | | | | | |
|--------------------------------|---|------------|---|---|--------|----------------|
| Course Code | Course Title | Hours/Week | | | Credit | Domain/ Stream |
| | | L | T | P | | |
| Semester 5 | | | | | | |
| Elective I | | | | | | |
| 20CEE01 | Design of Prestressed Concrete Structures | 3 | 0 | 0 | 3 | SE |
| 20CEE02 | Construction Engineering and Management | 3 | 0 | 0 | 3 | CEM |
| 20CEE03 | Solid and Hazardous Waste Management | 3 | 0 | 0 | 3 | EE |
| 20CEE04 | Railway, Airport and Harbour Engineering | 3 | 0 | 0 | 3 | TE |
| 20CEE05 | Ground Improvement Techniques | 3 | 0 | 0 | 3 | GTE |
| 20CEE06 | Remote Sensing and Geographical Information Systems | 3 | 0 | 0 | 3 | BG |
| Semester 7 | | | | | | |
| Elective II | | | | | | |
| 20CEE07 | Advanced Structural Analysis | 3 | 0 | 0 | 3 | SE |
| 20CEE08 | Contract Management | 3 | 0 | 0 | 3 | CEM |
| 20CEE09 | Environmental Impact Assessment | 3 | 0 | 0 | 3 | EE |
| 20CEE10 | Public Transportation Systems | 3 | 0 | 0 | 3 | TE |
| 20CEE11 | Environmental Geo-technology | 3 | 0 | 0 | 3 | GTE |
| 20CEE12 | Engineering Geology | 3 | 0 | 0 | 3 | BG |
| Elective III | | | | | | |
| 20CEE13 | Advanced Steel Design | 3 | 0 | 0 | 3 | SE |
| 20CEE14 | Architecture and Town Planning | 3 | 0 | 0 | 3 | CEM |
| 20CEE15 | Air and Noise Pollution Control Engineering | 3 | 0 | 0 | 3 | EE |
| 20CEE16 | Urban Transportation Planning | 3 | 0 | 0 | 3 | TE |
| 20CEE17 | Rock Mechanics | 3 | 0 | 0 | 3 | GTE |
| 20CEE18 | Finite Element Method | 3 | 0 | 0 | 3 | BG |
| 20GEE01 | Fundamentals of Research | 3 | 0 | 0 | 3 | GE |
| Elective IV | | | | | | |
| 20CEE19 | Earthquake Engineering and Design | 3 | 0 | 0 | 3 | SE |
| 20CEE20 | Sustainable Engineering | 3 | 0 | 0 | 3 | CEM |
| 20CEE21 | Industrial Waste Management | 3 | 0 | 0 | 3 | EE |
| 20CEE22 | Traffic Engineering and Management | 3 | 0 | 0 | 3 | TE |
| 20CEE23 | Site Investigation and Soil Exploration | 3 | 0 | 0 | 3 | GTE |
| 20CEE24 | Green Building | 3 | 0 | 0 | 3 | BG |
| 20CEE25 | Total Quality Management | 3 | 0 | 0 | 3 | BG |



| Elective V | | | | | | |
|--------------------|--|---|---|---|---|-----|
| 20CEE26 | Design of Prefabricated Structures | 3 | 0 | 0 | 3 | SE |
| 20CEE27 | Construction Equipment and Management | 3 | 0 | 0 | 3 | CEM |
| 20CEE28 | Surface Hydrology | 3 | 0 | 0 | 3 | WRE |
| 20CEE29 | Intelligent Transportation System | 3 | 0 | 0 | 3 | TE |
| 20CEE30 | Reinforced Soil Structures | 3 | 0 | 0 | 3 | GTE |
| 20CEE31 | Safety in Construction Practices | 3 | 0 | 0 | 3 | BG |
| Semester 8 | | | | | | |
| Elective VI | | | | | | |
| 20CEE32 | Design of Bridges | 3 | 0 | 0 | 3 | SE |
| 20CEE33 | Distress Monitoring and Rehabilitation of Structures | 3 | 0 | 0 | 3 | CEM |
| 20CEE34 | Water Power Engineering | 3 | 0 | 0 | 3 | WRE |
| 20CEE35 | Transportation Economics | 3 | 0 | 0 | 3 | TE |
| 20CEE36 | Geotechnical Earthquake Engineering | 3 | 0 | 0 | 3 | GTE |
| 20CEE37 | Disaster Preparedness and Planning | 3 | 0 | 0 | 3 | BG |
| 20CEE38 | Advanced Reinforced Concrete Design | 3 | 0 | 0 | 3 | SE |

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



LIST OF OPEN ELECTIVES OFFERED TO OTHER DEPARTMENTS
(Offered to other departments except the offering department)

| Course Code | Course Title | Hours/Week | | | Credit | Sem |
|-------------|--|------------|---|---|--------|-----|
| | | L | T | P | | |
| 20CEO01 | Remote Sensing and its Applications | 3 | 0 | 2 | 4 | 4 |
| 20CEO02 | Disaster Management | 3 | 1 | 0 | 4 | 5 |
| 20CEO03 | Introduction to Smart Cities | 3 | 0 | 0 | 3 | 6 |
| 20CEO04 | Environmental Health and Safety | 3 | 0 | 0 | 3 | 6 |
| 20CEO05 | Infrastructure Planning and Management | 3 | 0 | 0 | 3 | 8 |
| 20CEO06 | Environmental Laws and Policy | 3 | 0 | 0 | 3 | 8 |



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”, 4 th Edition, Cambridge University Press, New York, 2017. |
|----|--|

REFERENCES:

| | |
|----|---|
| 1. | Sanjay Kumar and Pushp Lata, “Communication Skills”, 2 nd 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: $e^{ax} - \cos ax / \sin ax$ – $x^n - e^{ax}x^n$, $e^{ax}\sin bx$ and $e^{ax}\cos bx - x^n\sin ax$ and $x^n\cos ax$ – Differential Equations with variable coefficients: Euler-Cauchy's equation – Legendre's equation. | | |
| Unit - IV | Applications of Ordinary Differential Equations: | 9 |
| Method of variation of parameters – Simultaneous first order linear equations with constant coefficients – Applications of differential equations: Simple harmonic motion – Electric circuits (Differential equations and associated conditions need to be given). | | |
| Unit - V | Laplace Transform & 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", 1 st Edition, McGraw Hill Education, New Delhi, 2016. |
|----|--|

REFERENCES:

| | |
|----|--|
| 1. | Kreyszig E., "Advanced Engineering Mathematics", 10 th 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", 2 nd 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)



| 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 - CO₂ 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", 11 th Edition, S. Chand & Company Pvt. Ltd., New Delhi, 2019. |
|----|--|

REFERENCES:

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|----|---|
| 1. | Purnima Khare and Swarup A., "Engineering Physics: Fundamentals and Modern Applications", 1 st Edition, Jones and Bartlett Publishers, Sudbury, Massachusetts, 2009. |
| 2. | Gaur R.K. and Gupta S.L., "Engineering Physics", 8 th Edition, Dhanpat Rai and Sons, New Delhi, 2009. |
| 3. | Tamilarasan K. and Prabu K., "Engineering Physics – I", 3 rd 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", 2 nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019. |
|----|---|

REFERENCES:

| | |
|----|--|
| 1. | Palanisamy P.N., Manikandan P., Geetha A.& Manjula Rani K., "Applied Chemistry", 6 th 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)



| 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", 15 th Edition, New Age International Pvt. Ltd., New Delhi, 2018. |
|----|--|

REFERENCES:

| | |
|----|---|
| 1. | Basant Agrawal, Agrawal C.M., "Engineering Drawing", 2 nd 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", 1 st 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)



| | | | | | | | |
|-------------------------------|-------------------------------|-------------|-----------------|----------|----------|----------|---------------|
| 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”, 4 th Edition, McGraw-Hill Education, New Delhi, 2017. |
|----|---|

REFERENCES:

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|----|--|
| 1. | Navaneethakrishnan P., “Basic of Civil and Mechanical Engineering”, 1 st Edition, McGraw-Hill Education, New Delhi, 2016. |
| 2. | Duggal S.K., “Building Materials”, 5 th 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", 1 st Edition, SCM Publishers, Erode, 2020. |
| 2. | Palanisamy P.N., Manikandan P., Geetha A. and Manjula Rani K., "Chemistry Laboratory Manual", 1 st 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:**

- 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)



(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”, 4 th 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", 1 st Edition, McGraw Hill Education, New Delhi, 2016. |
|----|--|

REFERENCES:

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



| 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 - Homo junction 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)



| | | | | | | | |
|-------------------------------|------------------------------|-------------|-----------------|----------|----------|----------|---------------|
| 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 Ettringite formation – corrosion assessment method - half cell potential measurement - preventive measures for corrosion of steel in concrete - corrosion control by inhibitors.

Total: 45

TEXT BOOK:

| | |
|----|---|
| 1. | Wiley Editorial Board, "Wiley Engineering Chemistry". 2 nd 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, 1 st Edition, CRC Press, Boca Raton, Florida, 1997 for UNIT V. |
| 2. | Shikha Agarwal. "Engineering Chemistry: Fundamentals and Applications",2 nd 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 |

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



| | | | | | | | |
|-------------------------------|--------------------------------|-------------|-----------------|----------|----------|----------|---------------|
| 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, 4 th Edition, Tata McGraw-Hill Publications, New Delhi, 2013. |
|---|---|

REFERENCES:

| | |
|---|---|
| 1 | Subramanian R., "Surveying and Levelling", 2 nd Edition, Oxford University Press, Noida, 2013. |
| 2 | Roy S.K., "Fundamentals of Surveying", 2 nd 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)



| 20CSC33– FUNDAMENTALS OF DATA STRUCTURES | | | | | | | | | | | | | |
|---|---|------|--|--------------|--|---|--|---|--|---|--|--------|--|
| (Common to Automobile, Civil, Mechanical, Chemical, Food Technology Branches) | | | | | | | | | | | | | |
| Programme & Branch | Automobile, Civil, Mechanical, Chemical, Food Technology | Sem. | | Categ ory | | L | | T | | P | | Credit | |
| Prerequisites | Programming in C | 3 | | PC | | 3 | | 0 | | 2 | | 4 | |
| Preamble | This course is indented to introduce the concept of elementary data structures and notion of algorithms to novice learner from cross disciplines in Engineering and Technology. | | | | | | | | | | | | |
| Unit – I | List: | | | | | | | | | | | 9 | |
| Data Structures - Abstract Data Types (ADT) - List ADT and Array Implementation - Linked List- Singly Linked List- Insertion - Deletion - Copying Singly Linked List - Doubly Linked List- Insertion -Deletion. | | | | | | | | | | | | | |
| Unit – II | Stack and Queues: | | | | | | | | | | | 9 | |
| Stack ADT – Array and Linked List implementation of Stacks - Application: Balancing Parenthesis – Infix to Postfix - Postfix Expression Evaluation - Queue ADT – Array and Linked List implementation of Queues - Applications | | | | | | | | | | | | | |
| Unit – III | Trees: | | | | | | | | | | | 9 | |
| Trees- Preliminaries – Binary Trees –Binary Tree Traversals - The Search Tree ADT – Binary Search Trees– Operations : Find – FindMin – FindMax – Insertion – Deletion- Expression Tree | | | | | | | | | | | | | |
| Unit – IV | Graphs: | | | | | | | | | | | 9 | |
| Graphs – Definitions – Graph Traversals: Breadth First Search – Depth First Search - Shortest-Path Algorithms: Unweighted Shortest Paths – Dijkstra’s Algorithm – Minimum Spanning Tree – Prim’s Algorithm- Kruskal’s Algorithm | | | | | | | | | | | | | |
| Unit – V | Sorting and Hashing: | | | | | | | | | | | 9 | |
| Sorting - Preliminaries – Insertion Sort – Quicksort – Merge sort – Hashing – General Idea – Hash Function – Separate Chaining – Open Addressing | | | | | | | | | | | | | |
| LIST OF EXPERIMENTS / EXERCISES: | | | | | | | | | | | | | |
| 1. | Implementation of C programs using pointers | | | | | | | | | | | | |
| 2. | Implementation of singly linked list and its operations | | | | | | | | | | | | |
| 3. | Implementation of doubly linked list and its operations | | | | | | | | | | | | |
| 4. | Implementation of Stack and its operations | | | | | | | | | | | | |
| 5. | Implementation of Queue and its operations | | | | | | | | | | | | |
| 6. | Implementation of Stack and Queue using Singly Linked List | | | | | | | | | | | | |
| 7. | Evaluate the Post-fix Expression using Stack ADT | | | | | | | | | | | | |
| 8. | Implementation of Binary Search Tree traversals | | | | | | | | | | | | |
| 9. | Implementation of Insertion sort and Quick sort | | | | | | | | | | | | |
| 10. | Implementation of hash function | | | | | | | | | | | | |
| Lecture:45, Practical:30, Total:75 | | | | | | | | | | | | | |
| TEXT BOOK: | | | | | | | | | | | | | |
| 1. | Weiss M. A., "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education Asia, New Delhi, 2016. | | | | | | | | | | | | |
| REFERENCES/ MANUAL / SOFTWARE: | | | | | | | | | | | | | |
| 1. | Horowitz Sahni, Andreson Freed, "Fundamentals of Data Structures in C", 2nd Edition, Universities Press, Hyderabad, 2011. | | | | | | | | | | | | |
| 2. | Langsam Y.M., Augenstein J. and Tenenbaum A. M., “Data Structures using C and C++”, 2nd Edition, Pearson Education, 2015. | | | | | | | | | | | | |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|---|--------------------------------------|
| CO1 | apply List ADT for solving the given problems | Applying (K3) Precision (S3) |
| CO2 | make use of arrays and linked lists to create Stack and Queue ADTs. | Applying (K3) Precision (S3) |
| CO3 | utilize Tree ADT to develop simple application | Applying (K3) Precision (S3) |
| CO4 | make use of Graph ADT for standard problems | Applying (K3) Precision (S3) |
| CO5 | illustrate the use of standard sorting and Hashing Techniques | Applying (K3) Precision (S3) |

| Mapping of COs with POs and PSOs | | | | | | | | | | | | | | |
|---|------------|------------|------------|------------|------------|------------|-----------------|-----------------|------------|-------------|-------------|-------------|-------------|-------------|
| COs/ POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy | | | | | | | | | | | | | | |

| ASSESSMENT PATTERN - THEORY | | | | | | | |
|--|-------------------------------|---------------------------------|----------------------------|-----------------------------|------------------------------|----------------------------|--------------------|
| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
| CAT1 | 10 | 60 | 30 | | | | 100 |
| CAT2 | 5 | 35 | 60 | | | | 100 |
| ESE | 5 | 35 | 60 | | | | 100 |
| * ±3% may be varied (CAT 1 & 2 – 60 marks & ESE – 100 marks) | | | | | | | |



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

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

| | | |
|-----------------|------------------------------|----------|
| Unit - I | Statics of Particles: | 9 |
|-----------------|------------------------------|----------|

Introduction –Laws of Mechanics – Parallelogram and Triangular Law of forces – Principle of Transmissibility – 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", 1 st 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", 12 th Edition, McGraw Hill Education, Chennai, 2019. |
| 2 | Hibbeler R.C., "Engineering Mechanics", 14 th 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", 1 st Edition, SCM Publishers, Erode, 2020. |
| 2. | Palanisamy P.N., Manikandan P., Geetha A. and Manjula Rani K., "Chemistry Laboratory Manual", 1 st 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", 10 th Edition, John Wiley & Sons, Limited, 2019. |
| 2. | Veerarajan T., "Transforms and Partial Differential Equations", 3 rd Reprint, Tata Mc Graw Hill Education Pvt. Ltd., New Delhi, 2013. |
| 3. | Jay L. Devore., "Probability and Statistics for Engineering and the Sciences", 9 th 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)



| | | | | | | | |
|-------------------------------|--|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | All BE/BTech Engineering & Technology branches except CSE, IT | Sem. | Category | L | T | P | Credit |
| Prerequisites | NIL | 2/3 | 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 ", 2 nd Edition, Oxford University Press, New Delhi, 2018. |
|----|--|

REFERENCES:

| | |
|----|---|
| 1. | Yashavant Kanetkar, "Let us C", 16 th Edition, BPB Publications, 2018. |
| 2. | Sumitabha Das, "Computer Fundamentals and C Programming", 1 st Edition, McGraw Hill, 2018. |
| 3. | Balagurusamy E., "Programming in ANSI C", 7 th 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 and Thin 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", 7 th Edition, S. Chand & Company Ltd, New Delhi, 2018. |
|----|---|

REFERENCES:

| | |
|----|--|
| 1. | Subramanian R., "Strength of Materials", 2 nd Edition, Oxford University Press, 2014. |
| 2. | Ferdinand Pierre Beer, Elwood Russell Johnston, John T. De Wolf and David Francis Mazurek, "Mechanics of Materials", 7 th Edition, McGraw-Hill Education, 2015. |



| COURSE OUTCOMES: | | BT Mapped (Highest Level) |
|---|--|--------------------------------------|
| On completion of the course, the students will be able to | | |
| 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)



| Programme & Branch | B.E. & CIVIL ENGINEERING | Sem. | Category | L | T | P | Credit |
|--------------------|--------------------------------------|------|----------|---|---|---|--------|
| Prerequisite | Construction Materials and Practices | 3 | 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", 8 th Edition, S.Chand & Company Ltd., New Delhi, 2018. |
|----|---|

REFERENCES:

| | |
|----|---|
| 1. | Neville A.M., "Concrete Technology", 27 th Edition, Pearson India Education Services, 2019. |
| 2. | Santhakumar A.R., "Concrete Technology", 2 nd 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 | 3 | 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", 3 rd Edition, New Age International Pvt. Ltd, 2020. |
|----|---|

REFERENCES:

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



| | | | | | | | |
|-------------------------------|-------------------------------------|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | B.E. & CIVIL ENGINEERING | Sem. | Category | L | T | P | Credit |
| Prerequisite | Nil | 3 | 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)



| | | | | | | | |
|-------------------------------|--|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | B.E. & CIVIL ENGINEERING | Sem. | Category | L | T | P | Credit |
| Prerequisite | Mechanics of Materials | 3 | ES | 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



| | | | | | | | |
|-------------------------|---|--------------|-----------------|----------|----------|----------|---------------|
| 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)



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



| 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 |

Total:75**Lecture:45, Practical:30,**

**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", 7 th 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 permeability characteristics | 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 | 4 | 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 | 2 | 1 | | | 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 LABORATORY**

| | | | | | | | |
|-------------------------------|---|-------------|-----------------|----------|----------|----------|---------------|
| 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 | 3 | | 3 | | | 1 | | | 2 | 3 | 3 |
| CO2 | 3 | 2 | 1 | 3 | | 3 | | | 1 | | | 2 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | | 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", 4 th 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 | 4 | 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", 1 st 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", 1 st 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 Engineering & 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 | | | | | | |

* $\pm 3\%$ 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 | 2 | 1 | | | 2 | | | | | | | 3 | 3 |
| CO2 | 3 | 2 | 1 | | | 2 | | | | | | | 3 | 3 |
| CO3 | 3 | 2 | 1 | | | 2 | | | | | | | 3 | 3 |
| CO4 | 3 | 2 | 1 | | | 2 | | | | | | | 3 | 3 |
| CO5 | 3 | 2 | 1 | | | 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 compatibility conditions – Primary structure – Element and global flexibility matrix – Applications – Analysis of indeterminate beams, frames and trusses (Redundancy restricted to two).

| | | |
|------------------|---------------------------------|------------|
| Unit – IV | Stiffness Matrix Method: | 9+3 |
|------------------|---------------------------------|------------|

Introduction – 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", 13 th 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 deflection 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 | 5 | 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, 3 rd Edition, Tata McGraw-Hill, New Delhi, 2009 |
|----|--|

REFERENCES:

| | |
|----|---|
| 1. | Subramanian N., Design of Reinforced Concrete Structures, 1 st Edition, Oxford University Press, 2014 |
| 2. | Varghese P.C., Limit State Design of Reinforced Concrete, 2 nd 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 | 2 | 1 | | | 3 | | | | 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 | | | | | | | | | | | | | | |

| ASSESSMENT PATTERN - THEORY | | | | | | | |
|------------------------------------|--------------------|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
| CAT1 | 10 | 55 | 35 | | | | 100 |
| CAT2 | 10 | 25 | 65 | | | | 100 |
| CAT3 | 10 | 25 | 65 | | | | 100 |
| ESE | 10 | 20 | 70 | | | | 100 |

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

**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





| | | | | | | | |
|-------------------------------|--|-------------|-----------------|----------|----------|----------|---------------|
| 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 | 3 | 2 | 3 | | | 1 | 2 | | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 2 | 3 | | | 1 | 2 | | 2 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 2 | 3 | | | 1 | 2 | | 2 | 3 | 3 |

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

**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 Chatfield 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 | 3 | 1 | 3 | | | 1 | 2 | | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 2 | 3 | | | 1 | 2 | | 2 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 2 | 3 | | | 1 | 2 | | 2 | 3 | 3 |

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



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", 6 th 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", 3 rd 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 | | | | | | |

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



| 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 | 2 | 1 | | | | | | | | | | 3 | 3 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 3 | 3 |
| CO4 | 3 | 2 | 1 | | | | | | | | | | 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, 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+3 |
| 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+3 |
| 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+3 |
| 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+3 |
| 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+3 |
| 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, Tutorial:15, Total:60

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 | apply the basic concepts of steel design | Applying (K3) |
| CO2 | discriminate the various connection methods | Analysing (K4) |
| CO3 | analyse and design the various profiles of tension members | Analysing (K4) |
| CO4 | analyse and design the forms of compression members | Analysing (K4) |
| CO5 | discriminate and design the flexural members | 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 | 60 | 10 | | | 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 – 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 | 6 | 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", 28 th 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)", 13 th 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)

**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 | 6 | 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: | | BT Mapped (Highest Level) |
|---|--|-----------------------------------|
| On completion of the course, the students will be able to | | |
| 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 |



Mapping of COs with POs and PSOs

| | | | | | | | | | | | | | | |
|-----|---|---|---|---|--|---|--|---|---|--|--|---|---|---|
| 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



| | | | | | | | |
|-------------------------------|--|-------------|-----------------|----------|----------|----------|---------------|
| 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: | | BT Mapped (Highest Level) |
|---|---|-----------------------------------|
| On completion of the course, the students will be able to | | |
| 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 | 6 | 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 Steel, 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 | carry out the detailing for flexural members | Analyzing (K4), Manipulation (S2) |
| CO2 | carry out detailing for column and footings | Analyzing (K4), Manipulation (S2) |
| CO3 | Carry out detailing for various steel 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 – II | 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", 6 th 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," 5 th edition, Pearson Education, India, 2013. |
| 3 | Rizvi, Ashraf M, "Effective Technical Communication," 2 nd 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)



20GEP61 COMPREHENSIVE TEST AND VIVA
(Common to all BE/BTech branches)

| | | | | | | | |
|-------------------------------|------------------------------|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | All BE/BTech branches | Sem. | Category | L | T | P | Credit |
| Prerequisites | Nil | 6 | EC | 0 | 0 | 0 | 2 |

| COURSE OUTCOMES: | | BT Mapped (Highest Level) |
|---|---|----------------------------------|
| On completion of the course, the students will be able to | | |
| CO1 | demonstrate knowledge in their respective programme domain | Applying (K3) |
| CO2 | defend any type of interviews, viva-voce, and aptitude tests conducted for career progression | Applying (K3) |
| CO3 | exhibit professional etiquette and solve related engineering problems | Applying (K3) |

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

**20CEP61 - PROJECT WORK I**

| | | | | | | | |
|-------------------------------|-------------------------------------|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | B.E. & Civil Engineering | Sem. | Category | L | T | P | Credit |
| Prerequisites | Nil | 6 | EC | 0 | 0 | 4 | 2 |

Total: 60

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

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



| Programme & Branch | All BE/BTech branches except Chemical Engineering | Sem. | Category | L | T | P | Credit |
|--------------------|---|------|----------|---|---|---|--------|
| Prerequisites | Nil | 7 | HS | 3 | 0 | 0 | 3 |

| | | |
|--|--|---|
| Preamble | The aim of the course is to create fundamental knowledge on management by introducing concepts like economics, national income, marketing, operations management, accounting principles etc. | |
| Unit - I | Micro Economics: | 9 |
| Economics – Basics Concepts and Principles – Demand and Supply – Law of demand and Supply – Determinants – Market Equilibrium – Circular Flow of Economic activities and Income. | | |
| Unit - II | Macro Economics, Business Ownership and Management concepts: | 9 |
| National Income and its measurement techniques. Inflation - Causes of Inflation – Controlling Inflation – Business Cycle. Forms of business – Ownership types. Management concepts: Taylor and Fayol's Principles – Functions of Management - Managerial Skills - Levels of Management - Roles of manager. | | |
| Unit - III | Marketing Management | 9 |
| Marketing - Core Concepts of Marketing - Four P's of Marketing - New product development – Intellectual Property rights (IPR), Product Life Cycle - Pricing Strategies and Decisions. | | |
| Unit - IV | Operations Management: | 9 |
| Operations Management - Resources - Types of Production system - Site selection, Plant Layout, Steps in Production Planning and Control - Inventory - EOQ Determination. | | |
| Unit - V | Financial Management: | 9 |
| Accounting Principles – Financial Statements and its uses – Depreciation: Straight Line and Diminishing Balance Method – Break Even Analysis – Capital Budgeting: Significance –Traditional and discounted cash flow methods. | | |

Total:45**TEXT BOOK:**

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

REFERENCES:

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

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

| | | BT Mapped (Highest Level) |
|-----|---|--------------------------------------|
| CO1 | identify market equilibrium and interpret national income calculations and inflation issues | Applying (K3) |
| CO2 | choose a suitable business ownership for their enterprise and illustrate managerial functions | Applying (K3) |
| CO3 | infer marketing management decisions | Understanding (K2) |
| CO4 | apply appropriate operation management concept in business situations | Applying (K3) |
| CO5 | interpret financial and accounting statements and evaluate new proposals | Applying (K3) |

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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



| 20CET71 - PRE-ENGINEERED BUILDINGS | | | | | | | |
|--|--|------|----------|---|---|---|----------|
| Programme & Branch | BE – Civil Engineering | Sem. | Category | L | T | P | Credit |
| Prerequisites | Design of steel structures | 7 | PC | 3 | 0 | 0 | 3 |
| | | | | | | | |
| Preamble | This course imparts the basic knowledge of pre-engineered buildings and its components such as framing members, columns and rafters, roof purlins, eave struts, wall girts and roofing sheets. | | | | | | |
| Unit – I | Basics of Metal Building Systems | | | | | | 9 |
| Metal building systems – Origin - Advantages and comparison with conventional RCC and Steel structures – Applicable Indian & International standards - Industry groups – MBMA – AISI – MBCEA – NAIMA – MCA – NRCA – LGSI – CCFSS – Components of the typical PEB system - Structural loads – Loads and load combinations – Structural behavior - Lateral and longitudinal directions – Structural system selection criteria. | | | | | | | |
| Unit – II | Primary Framing | | | | | | 9 |
| Available systems – Tapered beams – Single span rigid frame – Multi span rigid frame –Single span and continuous trusses – framing systems - Lean – to – framing – role of frame bracing – End wall framing | | | | | | | |
| Unit – III | Secondary framing | | | | | | 9 |
| Girts and Purlins – Types of purlins for metal building systems - Design of cold-formed framing – Cold-formed steel purlins- Purlin bracings – cold-formed steel girts – Hot –rolled steel girts - Eave struts | | | | | | | |
| Unit – IV | Metal roofing and Wall Materials | | | | | | 9 |
| Types of metal roofs – Seam configurations – Through-fastened Roofing – Structural standing-seam roof – Insulated structural panels – Architectural metal roofing – Panel finishes – Site-formed metal panels-Wind uplift ratings of metal roofs – Roofing selection and construction. Wall Materials - Metal panels – Hard walls – Single-Wythe Masonry – Brick veneer walls – Combination walls – Concrete Materials – selection of wall system | | | | | | | |
| Unit – V | Foundation design for Metal building systems | | | | | | 9 |
| Soil investigation program – Difference between conventional foundation and foundation for metal building system – Estimation of column reaction –Methods of resisting lateral reactions – Anchor bolt and base plates – Design of slabs on grade. | | | | | | | |
| | | | | | | | Total:45 |
| TEXT BOOK: | | | | | | | |
| 1. | Alexander Newman, “Metal Building Systems”, 3 st Edition, McGraw Hill, 2014. | | | | | | |
| REFERENCES: | | | | | | | |
| 1. | Subramanian N., “Design of Steel Structures Limit States Method”, 2ndEdition, Oxford University Press, New Delhi, 2016. | | | | | | |
| 2. | Bhavikatti S.S., “Design of Steel Structures”, 5th Edition, I.K. International Publishing House Pvt. Ltd., New Delhi, 2017. | | | | | | |
| 3. | Duggal S., “Design of Steel Structures”, 3rd Edition, McGraw Hill Education, 2017. | | | | | | |



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

Mapping of COs with POs and PSOs

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 1 | | | 3 | | | | 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 | 20 | 80 | | | | | 100 |
| CAT2 | 20 | 70 | 10 | | | | 100 |
| ESE | 20 | 70 | 10 | | | | 100 |

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



| | | | | | | | |
|-------------------------------|-------------------------------------|-------------|-----------------|----------|----------|-----------|---------------|
| Programme & Branch | B.E. & Civil Engineering | Sem. | Category | L | T | P | Credit |
| Prerequisites | Nil | 7 | EC | 0 | 0 | 12 | 6 |

Total: 180

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

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

**20CEP81 - PROJECT WORK II PHASE II**

| | | | | | | | |
|-------------------------------|-------------------------------------|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | B.E. & Civil Engineering | Sem. | Category | L | T | P | Credit |
| Prerequisites | Nil | 8 | EC | 0 | 0 | 8 | 4 |

Total: 120

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

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



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 | 5 | PE | 3 | 0 | 0 | 3 |

| | | |
|---|--|---|
| Preamble | This course gives knowledge on the prestressing principles and the methods of prestressing for real time applications. | |
| Unit - I | Introduction: | 9 |
| Concepts of Prestressing – Historical development – Requirements for high strength steel and concrete – Partial prestressing – Moderate prestressing – Bonded & unbonded 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 | 5 | 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", 5 th 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 | 1 | | | 3 | | | | 1 | 1 | | 3 | 2 |
| CO2 | 3 | 2 | 1 | | | 3 | | | | | 2 | 1 | 3 | 3 |
| CO3 | 3 | 2 | 1 | | | 3 | | | | | 2 | 1 | 3 | 3 |
| CO4 | 3 | 2 | 1 | | | 3 | | | | | 2 | 1 | 3 | 3 |
| CO5 | 3 | 2 | 1 | | | 3 | | | | | 2 | 1 | 3 | 3 |

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

ASSESSMENT PATTERN - THEORY

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|--------------------------|--------------------|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| CAT1 | 20 | 35 | 45 | | | | 100 |
| CAT2 | 25 | 40 | 35 | | | | 100 |
| CAT3 | 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 | 5 | PE | 3 | 0 | 0 | 3 |

| | |
|----------|---|
| Preamble | This course helps to interpret the nature and characteristics of solid and hazardous wastes for providing appropriate treatment 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", 2 nd 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 |

* $\pm 3\%$ 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 | 5 | PE | 3 | 0 | 0 | 3 |

| | | |
|--|---|---|
| Preamble | To impart knowledge about the planning & geometric design of Railway, Airport and Harbour engineering | |
| Unit - I | Railway Planning: | 9 |
| Role of Indian Railways in National development – Conventional and Modern methods – Obligatory points – Track Stress, Coning of wheels, Creep in rails, Defects in rails – Geometric design of railway tracks – Points and Crossings – Turnouts – Working principle – Signalling, Interlocking and Track circuiting. | | |
| Unit - II | Railway Infrastructure, Construction and Maintenance: | 9 |
| Earthwork – Stabilization of track on poor soil – Track drainage – Calculation of Materials required for track laying – 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 | 5 | PE | 3 | 0 | 0 | 3 |

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

| | | |
|----------|---|----------|
| Unit - I | Problematic Soil and Improvement Techniques: | 9 |
|----------|---|----------|

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

| | | |
|-----------|--------------------|----------|
| Unit - II | Dewatering: | 9 |
|-----------|--------------------|----------|

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

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

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

| | | |
|-----------|-----------------------------|----------|
| Unit - IV | Earth Reinforcement: | 9 |
|-----------|-----------------------------|----------|

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

| | | |
|----------|-----------------------------|----------|
| Unit - V | Grouting Techniques: | 9 |
|----------|-----------------------------|----------|

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

Total:45**TEXT BOOK:**

| | |
|----|--|
| 1. | Purushothama Raj. P, "Ground Improvement Techniques", 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 | 5 | 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", 2 nd Edition, Oxford University Press, 2011. |
|----|---|

REFERENCES:

| | |
|----|--|
| 1. | M. Anji Reddy, "Remote sensing and Geographical Information Systems", 4 th Edition, B S Publications, 2019. |
| 2. | Kang-Tsung Chang, "Introduction to Geographic Information Systems", 2 nd 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 | 3 | 2 | 1 | | 1 | 2 | | | | | | | 3 | 2 |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy | | | | | | | | | | | | | | |

| ASSESSMENT PATTERN - THEORY | | | | | | | |
|------------------------------------|--------------------|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
| CAT1 | 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 | 7 | 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, 2 nd Edition, Narosa Publishing House, New Delhi, 2018. |
|----|---|

REFERENCES:

| | |
|----|--|
| 1. | Hibbeler, R.C, Structural Analysis, 10 th Edition, Pearson India, Bengaluru, 2018. |
| 2. | Stephen Timoshenko, Theory of Plates & Shells, 2 nd 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)



| Programme & Branch | B.E. & CIVIL ENGINEERING | Sem. | Category | L | T | P | Credit |
|--------------------|--------------------------|------|----------|---|---|---|--------|
| Prerequisite | Nil | 7 | 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", 7 th Edition, McGraw-Hill, New York, 2010. |
| 2. | Jimmie Hinze, "Construction Contracts", 3 rd 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 | 7 | 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", 1 st Edition, CRC Press., United States, 2017. |
|----|---|

REFERENCES:

| | |
|----|---|
| 1. | Y.Anjaneyulu and Valli Manikam, "Environmental Impact Assessment Methodologies", 2 nd Edition, B.S Publications., Hyderabad, 2011. |
| 2. | Barthwal R.R., "Environmental Impact Assessment", 2 nd 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 | 3 | 1 | | | | 2 | 1 | | | | | 1 | 3 | 2 |
| CO2 | 3 | 1 | | | | 2 | 1 | | | | | 1 | 3 | 2 |
| CO3 | 3 | 2 | 1 | | | 3 | 1 | | | | | 1 | 3 | 3 |
| CO4 | 3 | 2 | 1 | | | 3 | 1 | | | | | 1 | 3 | 3 |
| CO5 | 3 | 1 | | | | 2 | 1 | | | | | 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 | 7 | PE | 3 | 0 | 0 | 3 |

| | | |
|--|---|---|
| Preamble | To impart knowledge on public transportation systems and planning | |
| Unit - I | Introduction: | 9 |
| Modes of public transport and comparison - Public transport travel characteristics - Prioritization of public transport -Technology of bus, rail, rapid transit systems – Transit classification – Right of way – Transit system performance – Transit capacity – Quality of service | | |
| Unit - II | Rail Transit System | 9 |
| Rail transport – Types of rail transit - 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 |
| Transittsystem 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 | | |

Total:45**TEXT BOOK:**

| | |
|----|--|
| 1. | L. R. Kadiyali, "Traffic Engineering and Transport Planning", Khanna Publishers, 9th Edition, 2018 |
|----|--|

REFERENCES:

| | |
|----|---|
| 1. | G.V.Rao "Principles of Transportation and Highway Engineering" Tata McGraw-Hill Publishing Co. Ltd, 5th Edition, 2012 |
| 2. | P.Chakroborty & A. Das, Principles of Transportation Engineering , 6th Edition Prentice Hall India Learning Private Limited, 2nd Edition 2003 |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|---|--------------------------------------|
| CO1 | summarize different modes of public transport and its characteristics | Understanding (K2) |
| CO2 | explain the types of rail transit system and its development in India | Understanding (K2) |
| CO3 | illustrate rail transit planning system, routing and scheduling | Applying (K3) |
| CO4 | infer the transit management techniques and finance | Understanding (K2) |
| CO5 | interpret the coordination of public transport system and financing | Applying (K3) |

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

| ASSESSMENT PATTERN - THEORY | | | | | | | |
|------------------------------------|--------------------|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
| CAT1 | 20 | 80 | | | | | 100 |
| CAT2 | 20 | 60 | 20 | | | | 100 |
| CAT3 | 20 | 60 | 20 | | | | 100 |
| ESE | 20 | 60 | 20 | | | | 100 |

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

**20CEE11 ENVIRONMENTAL GEO-TECHNOLOGY**

| Programme & Branch | B.E. & CIVIL ENGINEERING | Sem. | Category | L | T | P | Credit |
|--------------------|------------------------------|------|----------|---|---|---|--------|
| Prerequisite | Geotechnical Engineering - I | 7 | 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, volatilization, 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 assess the waste characterization | Understanding (K2) |
| CO3 | select suitable treatment techniques based on waste containment system | Applying (K3) |
| CO4 | design engineered land fill systems | Applying (K3) |
| CO5 | choose suitable remediation techniques based on type of pollutant | Understanding (K2) |

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|--------------------------|--------------------|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| CAT1 | 20 | 80 | | | | | 100 |
| CAT2 | 10 | 30 | 60 | | | | 100 |
| CAT3 | 10 | 30 | 60 | | | | 100 |
| ESE | 10 | 50 | 40 | | | | 100 |

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





| | | | | | | | |
|-------------------------------|-------------------------------------|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | B.E. & CIVIL ENGINEERING | Sem. | Category | L | T | P | Credit |
| Prerequisite | Nil | 7 | 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 tectonics 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 | 7 | PE | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| Preamble | This course offers the design of steel structures as per limit state method. It aims at determination of safe as well as economical steel section for various industrial and framed structures. | |
| 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”, 2 nd 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 |

* $\pm 3\%$ 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 | 7 | PE | 3 | 0 | 0 | 3 |

| | |
|-----------------|---|
| Preamble | This course imparts knowledge on building standards, zone regulation, design of architectural elements in buildings and surveys related to site analysis. |
|-----------------|---|

| | | |
|-----------------|---------------------------------------|----------|
| Unit - I | Architectural Space Standards: | 9 |
|-----------------|---------------------------------------|----------|

Introduction to architectural design-aesthetics, concepts of space, form and function-Factors and concepts related to building design - climate, site characteristics, land form, visual elements, behavioural factors, space utilization.

| | | |
|------------------|-------------------------------------|----------|
| Unit - II | Town Planning & Surveys: | 9 |
|------------------|-------------------------------------|----------|

Evolution of planning- Objects of planning- 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", 17 th Edition, Dhanpat Rai Publications, 2017. |
| 2. | Francis D. K. Ching., "Architecture: Form, Space & Order", 4 th 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 | 7 | PE | 3 | 0 | 0 | 3 |

| | | |
|--|--|---|
| Preamble | To realize the importance of air and noise pollution measurement and its control strategies for maintaining environmental quality standards. | |
| Unit - I | Sources and Effects of Air Pollutants: | 9 |
| Classification of air pollutants -Sources of air pollution -Effects of air pollution on human beings, materials, vegetation, 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", 1 st Edition, Tata-McGraw-Hill., New Delhi, 2017. |
|----|---|

REFERENCES:

| | |
|----|---|
| 1. | Keshav Kant and Er.RajniKant., "Air Pollution and Control Engineering", 1 st 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)", 2 nd 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 | 7 | 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 | 1 | | | 2 | | | | | | 1 | 3 | 2 |
| CO2 | 3 | 2 | 1 | | | 3 | | | | | | 1 | 3 | 3 |
| CO3 | 2 | 1 | 1 | | | 2 | | | | | | 1 | 3 | 2 |
| CO4 | 3 | 2 | 1 | | | 3 | | | | | | 1 | 3 | 3 |
| CO5 | 2 | 1 | 1 | | | 2 | | | | | | 1 | 3 | 2 |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy | | | | | | | | | | | | | | |

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

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

**20CEE17 ROCK MECHANICS**

| | | | | | | | |
|-------------------------------|-------------------------------------|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | B.E. & CIVIL ENGINEERING | Sem. | Category | L | T | P | Credit |
| Prerequisite | Nil | 7 | PE | 3 | 0 | 0 | 3 |

| | | |
|--|--|---|
| Preamble | To impart knowledge on fundamentals of rock mechanics and its applications in solving problems associated with rock slopes and underground openings. | |
| Unit - I | Classification and index properties of rocks: | 9 |
| Introduction – Scope of rock mechanics- Geological classification –Index properties of rock systems – Classification of rock masses for engineering purpose- Rock mass rating and Q System | | |
| 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 |

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





| | | | | | | | |
|-------------------------------|-------------------------------------|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | B.E. & CIVIL ENGINEERING | Sem. | Category | L | T | P | Credit |
| Prerequisite | Structural Analysis | 7 | 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 | 7 | PE | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| Preamble | This course imparts knowledge on earthquake-resistant design of structures in the field of engineering wherein many exciting developments are possible. | |
| Unit - I | 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 | 7 | PE | 3 | 0 | 0 | 3 |

| | | | | | | | |
|---|---|----------------|------------------|--------------------|--------------|--|---|
| Preamble | This course imparts knowledge on sustainable construction methods incorporating site and climatic zone-specific sustainability features | | | | | | |
| Unit - I | Introduction to Sustainable Engineering: | | | | | | 9 |
| Definitions of Sustainability - Need for Sustainability-Concept of sustainable development-three pillar basic model - Egg of sustainability model- Attkisson's Pyramid Model-Prism Model-Principles of sustainable development-Threats for sustainability | | | | | | | |
| Unit - II | Environmental issues: | | | | | | 9 |
| 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 ISO 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 Transportation | Prevention-Industrial Ecology | Green Business | Green Technology | Green Construction | Green Energy | | |

Total:45**TEXT BOOK:**

| | |
|----|---|
| 1. | R.L.Rag, "Introduction to sustainable engineering", 1 st Edition, PHI Learning Pvt. Ltd, New Delhi, 2015 |
|----|---|

REFERENCES:

| | |
|----|--|
| 1. | Mohamed Salama, "Principles of Sustainable Project Management", 1 st Edition, Goodfellow Publishers Ltd, Oxford, 2018 |
| 2. | Rogers Peter P, "An Introduction to Sustainable Development", 1 st Edition, Glen Educational Foundation Inc, USA, 2012. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|---|--------------------------------------|
| CO1 | explain the concept of sustainability for future | Understanding (K2) |
| CO2 | predict the local and global environmental issues to overcome the challenges in implementing sustainability | Applying (K3) |
| CO3 | identify sustainable tools for construction | Understanding (K2) |
| CO4 | apply green building practices in a building | Applying (K3) |
| CO5 | illustrate sustainable industrialization and urbanization process | Applying (K3) |

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

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

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



**20CEE21 INDUSTRIAL WASTE MANAGEMENT**

| | | | | | | | |
|-------------------------------|-------------------------------------|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | B.E. & CIVIL ENGINEERING | Sem. | Category | L | T | P | Credit |
| Prerequisite | Environmental Engineering | 7 | 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 by-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 | 7 | 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 | 7 | PE | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| Preamble | This course enhances the knowledge on the preparation of soil exploration report based on laboratory, field exploration and testing techniques. | |
| Unit - I | 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 | 1 | | | 2 | | | | | | 1 | 3 | 2 |
| CO2 | 3 | 2 | 1 | | | 3 | | | | | | 1 | 3 | 3 |
| CO3 | 3 | 2 | 1 | | | 3 | | | | | | 1 | 3 | 3 |
| CO4 | 2 | 1 | 1 | | | 2 | | | | | | 1 | 3 | 2 |
| CO5 | 2 | 1 | 1 | | | 2 | | | | | | 1 | 3 | 2 |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy | | | | | | | | | | | | | | |

| ASSESSMENT PATTERN - THEORY | | | | | | | |
|------------------------------------|--------------------|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
| CAT1 | 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 | 7 | 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 | 1 | | | 2 | | | | | | 1 | 3 | 2 |
| CO2 | 3 | 2 | 1 | | | 3 | | | | | | 1 | 3 | 3 |
| CO3 | 2 | 1 | 1 | | | 2 | | | | | | 1 | 3 | 2 |
| CO4 | 3 | 2 | 1 | | | 3 | | | | | | 1 | 3 | 3 |
| CO5 | 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)

**20CEE25 - TOTAL QUALITY MANAGEMENT**

| | | | | | | | |
|-------------------------------|-------------------------------------|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | B.E. & Civil Engineering | Sem. | Category | L | T | P | Credit |
| Prerequisites | NIL | 7 | PE | 3 | 0 | 0 | 3 |

| | | |
|--|--|---|
| Preamble | This course deals with quality concepts and Total Quality Management (TQM) principles focusing on process quality to assure product quality to the customers. It also deals with the basic and modern quality management tools including ISO standards | |
| Unit - I | Quality Concepts and Principles | 9 |
| Definition of Quality, Dimensions of Quality, Quality Planning, Quality Assurance and Control, Quality Costs With Case Studies, Elements/Principles of TQM - Historical Review, Leadership-Qualities/Habits, Quality Council, Quality Statements, Strategic Planning – Importance - Case Studies, Deming Philosophy, Barriers to TQM Implementation. | | |
| Unit - II | TQM-Principles and Strategies | 9 |
| Customer Satisfaction –Customer Perception of Quality - Customer Complaints - Customer Retention, Employee Involvement – Motivation - Empowerment - Teams - Recognition and Reward- Performance Appraisal, Continuous Process Improvement –Juran's Trilogy - PDSA Cycle - 5S – Kaizen, Supplier Partnership – Partnering - Sourcing - Supplier Selection - Supplier Rating - RelationshipDevelopment, Performance Measures-Purpose- Methods-Cases. | | |
| Unit - III | Control Charts for Process Control | 9 |
| Basic Seven Tools of Quality and its Role in Quality Control, Statistical Fundamentals –Measures of Central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for Variables and Attributes - Process Capability- Case Study- Introduction to Six Sigma. | | |
| Unit - IV | TQM-Modern Tools: | 9 |
| New Seven Tools of Quality, Benchmarking-Need - Types and Process, Quality Function Deployment-House Of Quality (HOQ) Construction - Case Studies, Introduction to Taguchi's Robust Design-Quality Loss Function — Design of Experiments (DOE), Total Productive Maintenance (TPM)-Uptime Enhancement, Failure Mode and Effect Analysis(FMEA)-Risk Priority Number (RPN) - Process - Case Studies. | | |
| Unit - V | Quality Systems | 9 |
| Need For ISO 9000 and Other Quality Systems - ISO 9000 : 2015 Quality System –Elements - Implementation of Quality System - Documentation - Quality Auditing, Introduction to ISO 14000- IATF 16949 - TL 9000-IEC 17025 - ISO 18000 - ISO 20000 - ISO 22000. Process of Implementing ISO - Barriers in TQM Implementation. | | |

Total: 45**TEXT BOOK:**

| | |
|----|--|
| 1. | Besterfield Dale H., Besterfield Carol, Besterfield Glen H., Besterfield Mary, Urdhwareshe Hemant, UrdhwaresheRashmi. "Total Quality Management", 5 th Edition, Pearson Education, Noida, 2018. |
|----|--|

REFERENCES:

| | |
|----|---|
| 1. | Subburaj Ramasamy, "Total Quality Management", McGraw Hill Education, New Delhi, 2017. |
| 2. | James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8 th Edition, Cengage Learning, 2012. |
| 3. | David Goetsch & Stanley Davis, "Quality Management for Organizational Excellence: Introduction to Total Quality", 8 th Edition, Pearson, 2015. |

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

| | | BT Mapped (Highest Level) |
|-----|---|--------------------------------------|
| CO1 | demonstrate the evolution of TQM principles. | Applying (K3) |
| CO2 | illustrate the principles and strategies of TQM | Applying (K3) |
| CO3 | make use of various tools and techniques of quality management | Applying (K3) |
| CO4 | apply various quality tools and techniques in both manufacturing and service industry | Applying (K3) |
| CO5 | explain the concepts of quality management system and ISO. | Applying (K3) |

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

20CEE26 DESIGN OF PREFABRICATED STRUCTURES

| | | | | | | | |
|-------------------------------|-------------------------------------|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | B.E. & CIVIL ENGINEERING | Sem. | Category | L | T | P | Credit |
| Prerequisite | Design of RC Elements | 7 | PE | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| Preamble | This course enhances the knowledge among the students to understand the principles, components and design of various prefabricated structural elements. | |
| Unit - I | Design Principles: | 9 |
| 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", 1 st Edition, Dipti Press OPC Private Limited, Chennai; 2017. |
|----|---|

REFERENCES:

| | |
|----|--|
| 1. | Kim S. Elliott, "Precast Concrete Structures", 2 nd Edition, CRC Press, United States, 2016. |
| 2. | "PCI Design Hand Book", 6 th 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 |

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



| | | | | | | | |
|-------------------------------|--|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | B.E. & CIVIL ENGINEERING | Sem. | Category | L | T | P | Credit |
| Prerequisite | Construction Engineering and Management | 7 | 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", 1 st Edition, Khanna Publishers, India, 2016. |
|----|---|

REFERENCES:

| | |
|----|---|
| 1. | Douglas D. Gransberg, "Construction Equipment Management for Engineers, Estimators, and Owners", 22 nd Edition, CRC Press, 2020. |
| 2. | Peurifoy R.L., "Construction Planning, Equipment and Methods", 7 th 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 | 7 | 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", 4 th 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-Hill Publishing Company, New Delhi, 2010. |

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

| | | BT Mapped (Highest Level) |
|-----|--|--------------------------------------|
| CO1 | illustrate 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 | 7 | 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", 1 st Edition ,PHI Learning Pvt Ltd, New Delhi,2017. |
|----|--|

REFERENCES:

| | |
|----|---|
| 1. | Ignacio Julio, Enrique Onieva , "Intelligent Transport Systems", 1 st 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 |

* $\pm 3\%$ 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 | 7 | PE | 3 | 0 | 0 | 3 |

| | |
|-----------------|--|
| Preamble | This course imparts knowledge on geosynthetics, design principles and mechanism of reinforced soil, soil nailing and its applications in dams, embankments, pavements and foundation structures. |
|-----------------|--|

| | | |
|-----------------|-----------------------------------|----------|
| Unit - I | Principles and Mechanisms: | 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 | 7 | 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", 1 st 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 | 8 | PE | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| Preamble | The course deals with the analysis and design of long and short span bridges. It also deals with the bearings and balanced cantilever bridges | |
| Unit - I | Introduction: | 9 |
| Introduction to bridges – Classification – Computation of discharge – Linear waterway – economic span – Afflux, scour depth – Design loads for bridges – Introduction to I.R.C. loading standards – Load Distribution Theory – Bridge slabs – Effective width – Introduction to methods as per I.R.C. | | |
| Unit - II | Short span bridges and culvert: | 9 |
| Load distribution theory – General design principles for 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 | 1 | | | 2 | | | | | | | 3 | 2 |
| CO2 | 2 | 1 | 1 | | | 2 | | | | | | | 3 | 2 |
| CO3 | 2 | 1 | 1 | | | 2 | | | | | | | 3 | 2 |
| CO4 | 3 | 2 | 1 | | | 3 | | | | | | 1 | 3 | 3 |
| CO5 | 2 | 1 | 1 | | | 2 | | | | | | | 3 | 2 |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy | | | | | | | | | | | | | | |

| ASSESSMENT PATTERN - THEORY | | | | | | | |
|------------------------------------|--------------------|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
| CAT1 | 50 | 50 | | | | | 100 |
| CAT2 | 25 | 50 | 25 | | | | 100 |
| CAT3 | 20 | 50 | 30 | | | | 100 |
| ESE | 35 | 40 | 25 | | | | 100 |

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

**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 | 8 | PE | 3 | 0 | 0 | 3 |

| | | |
|--|---|---|
| Preamble | This course aims to impart knowledge in maintenance and rehabilitation of concrete structures by the application of various repair materials and suitable strengthening techniques. | |
| Unit - I | Introduction | 9 |
| Maintenance, rehabilitation, repair, retrofit and strengthening - need for rehabilitation of structures - Cracks in R.C. buildings - causes and effects - importance of maintenance, routine and preventive maintenance. | | |
| Unit - II | Repair Materials | 9 |
| Criteria for material selection -Special mortars and concrete - Polymer Concrete and Mortar - Quick setting compounds - Grouting materials - Gas forming grouts - Bonding agents -Latex emulsions - Epoxy bonding agents - Protective coatings - FRP sheets. | | |
| Unit - III | 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 | 1 | | | 2 | | | | | | 1 | 3 | 2 |
| CO2 | 2 | 1 | 1 | | | 2 | | | | | | 1 | 3 | 2 |
| CO3 | 3 | 2 | 1 | | | 3 | | | | | | 1 | 3 | 3 |
| CO4 | 3 | 2 | 1 | | | 3 | | | | | | 1 | 3 | 3 |
| CO5 | 3 | 2 | 1 | | | 3 | | | | | | 1 | 3 | 3 |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy | | | | | | | | | | | | | | |

| ASSESSMENT PATTERN - THEORY | | | | | | | |
|------------------------------------|--------------------|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
| CAT1 | 50 | 50 | | | | | 100 |
| CAT2 | 25 | 25 | 50 | | | | 100 |
| CAT3 | 25 | 25 | 50 | | | | 100 |
| ESE | 25 | 25 | 50 | | | | 100 |

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

**20CEE34 WATER POWER ENGINEERING**

| Programme & Branch | B.E. & CIVIL ENGINEERING | Sem. | Category | L | T | P | Credit |
|--------------------|--|------|----------|---|---|---|--------|
| Prerequisite | Environmental Engineering, Fluid Mechanics and Hydraulics. | 8 | PE | 3 | 0 | 0 | 3 |

| | | | | | | | |
|----------|--|--|--|--|--|--|--|
| Preamble | This course helps to understand the importance and function of Hydro power plants and the components, layouts needed to generate power in a 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", 2 nd 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", 2 nd Edition, S.Chand & Co. Ltd., New Delhi, 2012. |
| 2. | Duggal K.N. and Soni J.P., - "Elements of Water Resources Engineering", 1 st 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 | 8 | PE | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| Preamble | This course helps the students to understand the concept and evaluation of economics in various transportation projects | |
| Unit - I | ECONOMIC EVALUATION | 9 |
| Need for economic evaluation of urban transport projects – Principles of economic analysis – Methods of economic evaluation – Comparison of various methods – Application of simulation 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 | 8 | PE | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| Preamble | This course imparts knowledge on earthquake mechanism, earthquake Hazards and mitigation, ground motion, liquefaction and earthquake resistant design in the field of geotechnical engineering. | |
| Unit - I | Seismology and Earthquakes: | 9 |
| Seismic waves and their properties- 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., 1 st edition, 2004. |
|----|---|

REFERENCES:

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|----|---|
| 1. | Bharat Bhushan Prasad, Fundamentals of Soil Dynamics and Earthquake Engineering, 1 st edition, PHI Learning Pvt.Ltd., New Delhi, 2009. |
| 2. | Bharat Bhushan Prasad, Advanced Soil Dynamics and Earthquake Engineering, 1 st 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 | 8 | PE | 3 | 0 | 0 | 3 |

| | | | | | | | |
|----------|---|--|--|--|--|--|--|
| Preamble | This course imparts knowledge about various natural hazards like Earthquakes, slope stability, floods, droughts and Tsunami and the mitigation measures | | | | | | |
|----------|---|--|--|--|--|--|--|

| | | |
|----------|----------------------------|---|
| Unit - I | Introduction to Disasters: | 9 |
|----------|----------------------------|---|

Definition - Disaster, Hazard, Vulnerability, Resilience, Risks - Disasters: Types of disasters - Earthquake, Landslide, Flood, Drought, Fire, Forest Fire, Industrial and Technological Disasters, Climate Change- Classification, Causes, Impacts - Do's and Don'ts during disaster - Global trends in disasters: urban disasters, 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, 1 st 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, 2 nd 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)

**20CEE38 - 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 | 8 | PE | 3 | 0 | 0 | 3 |

| | | |
|--|--|---|
| Preamble | This course enhances the knowledge of students in the design of water tank, shear wall, retaining walls, flat slab and corbels | |
| UNIT – I | Design of Water Tank | 9 |
| Design of circular and rectangular water tanks resting on ground - Design principles for elevated water tank. | | |
| Unit - II | Design of RC 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. | | |

Total:45

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

REFERENCES:

| | |
|----|--|
| 1. | Varghese P.C., Advanced Reinforced Concrete Design, 2 nd Edition, Prentice Hall of India, New Delhi, 2013 |
| 2. | Unnikrishna Pillai S. and Devdas Menon, Reinforced Concrete Design, 3 rd 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)



20CEO01 - REMOTE SENSING AND ITS APPLICATIONS
(Offered by Department of Civil Engineering)

| Programme & Branch | All BE/BTech branches except Civil Engineering | Sem. | Category | L | T | P | Credit |
|--------------------|--|------|----------|---|---|---|--------|
| Prerequisites | NIL | 4 | 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", 7 th Edition, Willey Publications, United States, 2015. |
|----|--|

REFERENCES:

| | |
|----|--|
| 1. | George Joseph, Jeganathan C, "Fundamentals of Remote Sensing", 3 rd Edition, Universities Press (India) Private limited, Hyderabad, 2018. |
| 2. | Basudeb Bhatta, "Remote Sensing and GIS", 2 nd 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 |

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



20CEO02 - DISASTER MANAGEMENT
(Offered by Department of Civil Engineering)

| Programme & Branch | All BE/BTech branches except Civil Engineering | Sem. | Category | L | T | P | Credit |
|--------------------|--|------|----------|---|---|---|--------|
| Prerequisites | NIL | 5 | 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", 1 st Edition, Laxmi Publications, India, 2007. |
|----|--|

REFERENCES:

| | |
|----|--|
| 1. | Gupta.M.C., "Manual on natural disaster management in India", NIDM, New Delhi, 2000. |
| 2. | "National Disaster Management Policy", Government of India, 2009. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|---|--------------------------------------|
| CO1 | diagnose the different forms of disaster and their causes. | Understanding (K2) |
| CO2 | construct a disaster management cycle with disaster risk reduction measures | Applying (K3) |
| CO3 | interpret the various effects of development projects | Applying (K3) |
| CO4 | identify the agencies involved to manage the disaster in india | Understanding (K2) |
| CO5 | summarize the role of technology in disaster | Understanding (K2) |

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

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

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



20CEO03 - INTRODUCTION TO SMART CITIES
(Offered by Department of Civil Engineering)

| | | | | | | | |
|-------------------------------|---|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | All BE/BTech branches except Civil Engineering | Sem. | Category | L | T | P | Credit |
| Prerequisites | NIL | 6 | 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 policies. | | |
| 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", 1 st Edition, Pearson India Education Service Pvt Ltd, Noida,Uttar Pradesh, India, 2019. |
|----|--|

REFERENCES:

| | |
|----|---|
| 1. | Germaine R. Halegoua, "Smart Cities", 1 st Edition, The MIT Press Essential Knowledge Series, London, England, 2020. |
| 2. | Andy Pike, Andres Rodriguez-Pose & John Tomaney, "Handbook of Local and Regional Development", 3 rd Edition, Taylor & Francis, United Kingdom, 2010. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|--|--------------------------------------|
| CO1 | discuss the importance, features and case histories of smart cities in India | Understanding (K2) |
| CO2 | describe mobility and energy in smart city | Understanding (K2) |
| CO3 | explain water and waste management techniques in smart city | Understanding (K2) |
| CO4 | model smart environment and smart buildings | Applying (K3) |
| CO5 | plan e-governance and ICT in smart city | Applying (K3) |

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

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

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





20CEO04 - ENVIRONMENTAL HEALTH AND SAFETY
(Offered by Department of Civil Engineering)

| | | | | | | | |
|-------------------------------|---|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | All BE/BTech branches except Civil Engineering | Sem. | Category | L | T | P | Credit |
| Prerequisites | NIL | 6 | 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", 1 st Edition, McGraw Hill, New Delhi, 2017. |
|----|---|

REFERENCES:

| | |
|----|--|
| 1. | Nicholas P.Cheremisinoff & Madelyn L.Graffia, "Environmental and Health & Safety Management- A Guide to Compliance", 1 st Edition, William Andrew Publisher, Norwich, 1995. |
| 2. | David Yates W., "Safety Professional's Reference & Study Guide", 2 nd Edition, CRC Press Publishers, New Delhi, 2015. |

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

**BT Mapped
(Highest Level)**

| | | |
|-----|--|---------------|
| CO1 | apply the concept of EHS and their framework. | Applying (K3) |
| CO2 | identify the monitoring principles in workplace systems. | Applying (K3) |
| CO3 | choose the need of training and methods of EHS. | Applying (K3) |
| CO4 | organize the safety auditing management systems and their prevention techniques. | Applying (K3) |
| CO5 | identify the key steps involved in HSE legislations. | Applying (K3) |

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|--------------------------|--------------------|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| CAT1 | 20 | 50 | 30 | | | | 100 |
| CAT2 | 15 | 40 | 45 | | | | 100 |
| CAT3 | 25 | 40 | 35 | | | | 100 |
| ESE | 20 | 45 | 35 | | | | 100 |

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



20CEO05 - INFRASTRUCTURE PLANNING AND MANAGEMENT
(Offered by Department of Civil Engineering)

| | | | | | | | |
|-------------------------------|---|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | All BE/BTech branches except Civil Engineering | Sem. | Category | L | T | P | Credit |
| Prerequisites | NA | 8 | 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", 1 st Edition, John Wiley & Sons, 1988. |
|----|--|

REFERENCES:

| | |
|----|---|
| 1. | Ronald Hudson W., Ralph Haas & Waheed Uddin, "Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation", 1 st Edition, McGraw-Hill, New Delhi, 1997. |
| 2. | World Development Report: Infrastructure for Development, 1994. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|--|--------------------------------------|
| CO1 | explain the basic concepts related to Infrastructure | Understanding (K2) |
| CO2 | demonstrate the various analysis techniques in infrastructure planning | Applying (K3) |
| CO3 | explain the role of private sector in infrastructure growth | Understanding (K2) |
| CO4 | explain the challenges in infrastructure planning and management | Understanding (K2) |
| CO5 | carry out strategic planning for successful Infrastructure Project implementation. | Applying (K3) |

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

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

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



20CEO06 - ENVIRONMENTAL LAWS AND POLICY
(Offered by Department of Civil Engineering)

| | | | | | | | |
|-------------------------------|---|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | All BE/BTech branches except Civil Engineering | Sem. | Category | L | T | P | Credit |
| Prerequisites | NIL | 8 | 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", 1 st 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", 1 st Edition, Central Pollution Control Board, New Delhi, 1997. |
| 2. | Shyam Divan & Armin Roseneranz, "Environmental law and policy in India", 1 st Edition, Oxford University Press, New Delhi, 2001. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|---|--------------------------------------|
| CO1 | interpret the origin and behaviour of environmental protection acts. | Understanding (K2) |
| CO2 | illustrate the environmental protection mechanisms based on environmental indicators. | Understanding (K2) |
| CO3 | describe the national environmental policies for enhanced ecology. | Understanding (K2) |
| CO4 | classify the significance of federal and state environmental protection acts. | Understanding (K2) |
| CO5 | recommend the code of ethics given by pollution regulatory boards to safeguard the environment. | Applying (K3) |

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
|--------------------------|--------------------|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| CAT1 | 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)

**20GEO01 – GERMAN LANGUAGE LEVEL 1**

(Offered by Department of Electronics and Communication Engineering)

| Programme & Branch | All BE/BTech Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|--|---------|----------|---|---|---|--------|
| Prerequisites | Basics of Language | 4,5,6,8 | HS | 4 | 0 | 0 | 4 |

| | | |
|--|--|----|
| Preamble | To acquire the vocabulary as per the Common European framework of German language A1 level competence. This course will help to assimilate the basic grammar structures and gain vocabulary to understand and reciprocate in daily life situations on a broader sense. A thorough learner will be able to gain a comprehensive understanding of the German grammar and confidently articulate in day today situations. | |
| Unit - I | Contacts (Kontakte): | 12 |
| Understanding Letters, simple instructions, speaking about language learning, finding specific information in text, Acknowledging the theme and understanding conversations, Making appointments. Grammar – Preposition with Dative, Articles in Dative and Accusative possessive articles. | | |
| Unit - II | Accommodation (Die Wohnung): | 12 |
| Understanding Accommodation advertisements, describing accommodation and directions, responding to an invitation, Expressing feelings, Colours. Grammar – Adjective with to be verb, Adjective with <i>sehr/zu</i> , Adjective with Accusative, prepositions with Dative | | |
| Unit - III | Working Environment Communication (ArbeitenSie): | 12 |
| Daily Schedule, speaking about past, understanding Job openings advertisements, Opinions, Telephonic conversations, Speaking about Jobs. Grammar – Perfect tense, Participle II – regular and irregular verbs, Conjunctions – <i>und, oder, aber</i> . | | |
| Unit - IV | Clothes and Style (Kleidung und mode) : | 12 |
| Clothes, Chats on shopping clothes, reporting on past, Orienting oneself in Supermarkets, Information and research about Berlin. Grammar – Interrogative articles and Demonstrative articles, Partizip II – separable and non-separable verbs, Personal pronouns in Dative, Verbs with Dative. | | |
| Unit - V | Health and Vacation (Gesundheit und Urlaub): | 12 |
| Personal information, Human Body parts, Sports, Understanding instructions and prompts, health tips. Grammar – Imperative with <i>du/Ihr</i> , Modal verbs – <i>sollen, müssen, nichtdürfen, dürfen</i> . Suggestions for travel, Path, Postcards, weather, Travel reports, Problems in hotel, Tourist destinations. Grammar – Pronoun: <i>man</i> , Question words – <i>Wer, Wen, Was, Wem</i> , Adverbs – <i>Zuerst, dann, Später, ZumSchl</i> | | |

Total:60**TEXT BOOK:**

| | |
|----|--|
| 1. | "Stefanie Dengler, Paul Rusch, Helen Schmitz, TanjaSieber, "Netzwerk Deutsch alsFremdsprache A1–ursbuch, Arbeitsbuch und Glossar with 2 CDs", Goyal Publishers, Delhi, 2015. |
|----|--|

REFERENCES:

| | |
|----|---|
| 1. | https://ocw.mit.edu – Massachusetts Institute of Technology Open Courseware Refer: German 1 for undergraduate students |
| 2. | https://www.dw.com/en/learn-german - Deutsche Welle , Geramany's International Broadcaster |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|---|--------------------------------------|
| CO1 | understanding letters and simple texts | Remembering (K1) |
| CO2 | assimilating vocabulary on accommodation and invitation | Understanding (K2) |
| CO3 | comprehend concept of time, telephonic conversation and job-related information | Understanding (K2) |
| CO4 | understanding how to do shopping in a German store | Understanding (K2) |
| CO5 | understanding body parts and how to plan personal travel | Understanding (K2) |

| Mapping of COs with POs and PSOs | | | | | | | | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO5 | | | | | | | | 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 | 25 | 75 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

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

**20GEO02 – JAPANESE LANGUAGE LEVEL 1**

(Offered by Department of Electronics and Communication Engineering)

| Programme & Branch | All BE/BTech Engineering & Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|--|---------|----------|---|---|---|--------|
| Prerequisites | Basics of Language | 4/5/6/8 | HS | 4 | 0 | 0 | 4 |

| | | |
|--|---|----|
| Preamble | To understand the basics of Japanese language which provides understanding of Hiragana, Katakana and 110 Kanjis and provides the ability to understand basic conversations and also enables one to request other person and also understand Casual form | |
| Unit - I | Introduction to groups of verbs: | 12 |
| tai form-Verb groups-te form-Give and ask permission to do an action-Present continuous form-Restrict other person from doing an action-nouns-Basic Questions | | |
| Unit - II | Introduction to Casual Form: | 12 |
| nai form-Dictionary form-ta form-Polite style and Casual style differences-Conversation in plain style-Place of usage of Polite style and Casual style | | |
| Unit - III | Express opinions and thoughts: | 12 |
| Introduction to new particle-Express someone one's thought-Convey the message of one person to another-Ask someone if something is right -Noun modifications | | |
| Unit - IV | Introduction to If clause and Kanjis: | 12 |
| If clause tara form-Express gratitude for an action done by other person-Hypothetical situation-Particles to use in case of Motion verbs-110 Kanjis | | |
| Unit - V | Introduction to Counters: | 12 |
| How to use numbers-How to use quantifiers-Past form of adjectives and Nouns-Way to say preference-Way of expression degrees of an action-Other necessary particles-How to use numbers-How to use quantifiers-Past form of adjectives | | |

Total:60**TEXT BOOK:**

| | |
|----|--|
| 1. | "MINNA NO NIHONGO—Japanese for Everyone", 2 nd Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017. |
|----|--|

REFERENCES:

| | |
|----|--|
| 1. | MargheritaPezzopane, "Try N5", 2 nd Edition, Tankobon Softcover, Japan, 2017. |
| 2. | Sayaka Kurashina, "Japanese Word Speedmaster", 2 nd Edition, Tankobon Softcover, Japan, 2018. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|--|--------------------------------------|
| CO1 | read and understand typical expression in Hiragana and Katakana | Remembering (K1) |
| CO2 | understand Polite form and Casual form of Japanese | Understanding (K2) |
| CO3 | comprehend personal communication and express greetings | Understanding (K2) |
| CO4 | understand the Kanjis in Japanese Script | Understanding (K2) |
| CO5 | comprehend concept of time, counters and job-related information | Understanding (K2) |

| Mapping of COs with POs and PSOs | | | | | | | | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO5 | | | | | | | | 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 | 25 | 75 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

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



| Programme & Branch | All BE/BTech Branches | Sem. | Category | L | T | P | Credit |
|--------------------|---------------------------------|------|----------|---|---|---|--------|
| Prerequisites | Problem Solving and Programming | 6 | OE | 3 | 0 | 0 | 3 |

| | | |
|---|--|---|
| Preamble | In this course, systematic process of thinking which empowers even the most traditional thinker to develop new, innovative solutions to the problem at hand are studied with an emphasis on bringing ideas to life based on how real users think, feel and behave. | |
| Unit - I | Introduction:: | 9 |
| Introduction – Need for design thinking – Design and Business – The Design Process – Design Brief –Visualization – Four Questions, Ten Tools – Explore – STEEP Analysis – Strategic Priorities – Activity System – Stakeholder Mapping – Opportunity Framing. | | |
| Unit - II | Visualization: | 9 |
| Introduction – Visualization – Journey Mapping – Value Chain Analysis – Mind Mapping – Empathize –Observations – Need Finding – User Personas. | | |
| Unit - III | Brainstorming: | 9 |
| Introduction – Brainstorming – Concept Development – Experiment – Ideation – Prototyping – Idea Refinement. | | |
| Unit - IV | Assumption Testing: | 9 |
| Introduction – Assumption Testing – Rapid Prototyping – Engage – Storyboarding. | | |
| Unit - V | Customer Co-Creation Learning Launch: | 9 |
| Introduction – Customer Co-Creation Learning Launch – Leading Growth and Innovation – Evolve– Concept Synthesis – Strategic Requirements – Evolved Activity Systems – Quick Wins. | | |

Total:45**TEXT BOOK:**

| | |
|----|---|
| 1. | Jeanne Liedtka and Tim Ogilvie, "Designing for Growth: A Design Thinking Tool Kit for Managers", Columbia University Press, 2011. |
|----|---|

REFERENCES:

| | |
|----|---|
| 1. | Lee Chong Hwa, "Design Thinking The Guidebook", Design Thinking Master Trainers of Bhutan, 2017. |
| 2. | Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, "The Designing for Growth FieldBook: A Step-by-Step Project Guide", Columbia University Press, 2014. |

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

**BT Mapped
(Highest Level)**

| | | |
|-----|--|--------------------|
| CO1 | outline the basic concepts of design thinking | Understanding (K2) |
| CO2 | make use of the mind mapping process for designing any system | Applying (K3) |
| CO3 | develop many creative ideas through structured brainstorming sessions. | Applying (K3) |
| CO4 | develop rapid prototypes to bring the ideas into reality | Applying (K3) |
| CO5 | plan the implementation of the any system considering the real time feedback | Applying (K3) |

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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

**20GEO04 - INNOVATION AND BUSINESS MODEL DEVELOPMENT**

(Offered by Department of Mechatronics Engineering)

| Programme & Branch | All BE/BTech Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|--|------|----------|---|---|---|--------|
| Prerequisites | NIL | 8 | OE | 3 | 0 | 0 | 3 |

| | | |
|---|---|----------|
| Preamble | This course will inspire the students to think innovation concepts and ideas for business model developments. | |
| Unit - I | Innovation and Design Thinking: | 9 |
| Innovation and Creativity– Types of innovation – challenges in innovation- steps in innovation management- 7 concerns of design. Design Thinking and Entrepreneurship – Design Thinking Stages: Empathize – Define – Ideate – Prototype – Test. Design thinking tools: Analogies – Brainstorming – Mind mapping | | |
| Unit - II | User Study and Contextual Enquiry: | 9 |
| Explanatory research – primary and secondary data – classification of secondary data – sources of secondary data – qualitative research – focus groups – depth interviews – analysis of qualitative data – survey methods – observations- Process of identifying customer needs –organize needs into a hierarchy –establish relative importance of the needs- Establish target specifications | | |
| Unit - III | Product Design: | 9 |
| Techniques and tools for concept generation, concept evaluation – Product architecture –Minimum Viable Product (MVP)- Product prototyping – tools and techniques– overview of processes and materials – evaluation tools and techniques for user-product interaction | | |
| Unit - IV | Business Model Canvas (BMC): | 9 |
| Lean Canvas and BMC - difference and building blocks- BMC: Patterns – Design – Strategy – Process–Business model failures: Reasons and remedies | | |
| Unit - V | IPR and Commercialization: | 9 |
| Need for Intellectual Property- Basic concepts - Different Types of IPs: Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design– Patent Licensing - Technology Commercialization – Innovation Marketing | | |

Total:45**TEXT BOOK:**

1. Rishikesh T.Krishnan, “8 Steps To Innovation: Going From Jugaad To Excellence”, Collins India, 2013.

REFERENCES:

1. Peter Drucker, “Innovation and Entrepreneurship”, Routledge CRC Press, London, 2014.
2. Eppinger, S.D. and Ulrich, K.T. “Product design and development”, 7th Edition, McGraw-Hill Higher Education, 2020.
3. Alexander Osterwalder, “Business model generation: A handbook for visionaries, game changers, and challengers”, 1st Edition, John Wiley and Sons; 2010.
4. Indian Innovators Association, “Patent IPR Licensing – Technology Commercialization – Innovation Marketing: Guide Book for Researchers, Innovators”, Notion Press, Chennai, 2017.



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|--|--------------------------------------|
| CO1 | understand innovation need and design thinking phases | Understanding (K2) |
| CO2 | identify, screen and analyse ideas for new products based on customer needs | Analysing (K4) |
| CO3 | develop and analyse the product concepts based on the customer needs and presents the overall architecture of the product. | Analysing (K4) |
| CO4 | predict a structured business model for MVP | Applying (K3) |
| CO5 | practice the procedures for protection of their ideas' IPR | 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 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| CO4 | | | | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| CO5 | | | | 3 | 2 | 2 | | 3 | 2 | 3 | 3 | 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 | 20 | 30 | 40 | 10 | | | 100 |
| CAT2 | 20 | 30 | 40 | 20 | | | 100 |
| CAT3 | 30 | 30 | 40 | | | | 100 |
| ESE | 20 | 30 | 30 | 20 | | | 100 |

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



| Programme & Branch | All BE/BTech Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|--|---------|----------|---|---|---|--------|
| Prerequisites | German Language Level 1 | 4/5/6/8 | HS | 4 | 0 | 0 | 4 |

| | | | | | | | |
|----------|---|--|--|--|--|--|--|
| Preamble | This course aims to help the learner to acquire the vocabulary as per the Common European framework of German language A1 level competence. This course will help to assimilate the basic grammar structures and gain vocabulary to understand and reciprocate in daily life situations on a broader sense. A thorough learner will be able to gain a comprehensive understanding of the German grammar and confidently articulate in day today situations. | | | | | | |
|----------|---|--|--|--|--|--|--|

| | | |
|----------|----------------------------|-----------|
| Unit - I | Contacts(Kontakte): | 12 |
|----------|----------------------------|-----------|

Understanding Letters, simple instructions, speaking about language learning, finding specific information in text, Acknowledging the theme and understanding conversations, Making appointments. Grammar – Preposition with Dative, Articles in Dative and Accusative possessive articles.

| | | |
|-----------|------------------------------------|-----------|
| Unit - II | Accommodation(Die Wohnung): | 12 |
|-----------|------------------------------------|-----------|

Understanding Accommodation advertisements, describing accommodation and directions, responding to an invitation, Expressing feelings, Colours. Grammar – Adjective with to be verb, Adjective with *sehr/zu*, Adjective with Accusative, prepositions with Dative

| | | |
|------------|--|-----------|
| Unit - III | Are you Working?(Arbeiten Sie): | 12 |
|------------|--|-----------|

Daily Schedule, speaking about past, understanding Job openings advertisements, Opinions, Telephonic conversations, Speaking about Jobs. Grammar – Perfect tense, Participle II – regular and irregular verbs, Conjunctions – *und, oder, aber*.

| | | |
|-----------|--|-----------|
| Unit - IV | Clothes and Style(Kleidung und mode): | 12 |
|-----------|--|-----------|

Clothes, Chats on shopping clothes, reporting on past, Orienting oneself in Supermarkets, Information and research about Berlin. Grammar – Interrogative articles and Demonstrative articles, Partizip II – separable and non-separable verbs, Personal pronouns in Dative, Verbs with Dative

| | | |
|----------|--|-----------|
| Unit - V | Health and Vacation(Gesundheit und Urlaub): | 12 |
|----------|--|-----------|

Personal information, Human Body parts, Sports, Understanding instructions and prompts, health tips. Grammar – Imperative with *du/Ihr*, Modal verbs – *sollen, müssen, nicht dürfen, dürfen*. Suggestions for travel, Path, Postcards, weather, Travel reports, Problems in hotel, Tourist destinations. Grammar – Pronoun: *man*, Question words – *Wer, Wen, Was, Wem*, Adverbs – *Zuerst, dann, Später, Zum Schl*

Total: 60**TEXT BOOK:**

| | |
|---|---|
| 1 | Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, "Netzwerk Deutsch als Fremdsprache A1–ursbuch, Arbeitsbuch und Glossar with 2 CDs", Goyal Publishers, Delhi, 2015. |
|---|---|

REFERENCES:

| | |
|---|--|
| 1 | https://ocw.mit.edu – Massachusetts Institute of Technology Open Courseware |
| 2 | https://www.dw.com/en/learn-german - Deutsche Welle , Germany's International Broadcaster |

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

| | | BT Mapped (Highest Level) |
|-----|---|--------------------------------------|
| CO1 | understand letters and simple texts | Remembering (K1) |
| CO2 | assimilate vocabulary on Accommodation and invitation | Understanding (K2) |
| CO3 | comprehend concept of time, telephonic conversation and job-related information | Understanding (K2) |
| CO4 | understand how to do shopping in a German store | Understanding (K2) |
| CO5 | understand body parts and how to plan personal travel | Understanding (K2) |

Mapping of COs with POs and PSOs

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO5 | | | | | | | | 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 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

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



| Programme & Branch | All BE/BTech Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|--|---------|----------|---|---|---|--------|
| Prerequisites | German Language Level 2 | 4/5/6/8 | HS | 3 | 0 | 0 | 3 |

| | |
|----------|--|
| Preamble | This course provides enriching information about various everyday situations in personal and professional life and enhances the vocabulary and speaking ability to respond to and also seek information in those situations. It also equips one to express opinions and negotiate appointments. With diligent learning one can capture all basic grammatical structure to answer confidently in everyday situations. |
|----------|--|

| | | |
|-----------------|---|----------|
| Unit - I | All about food (Rund Ums Essen): | 9 |
|-----------------|---|----------|

Understand information about person, Speak about food, Introduce self and others, Understand and explain a picture base story, To justify something, To speak about feelings, To express opinions, To answer questions on a text, To describe a restaurant. Grammar: Possessive Articles in Dative, Yes/No questions, Reflexive verbs, Sentence with 'weil'

| | | |
|------------------|---|----------|
| Unit - II | School days (Nach der Schulzeit): | 9 |
|------------------|---|----------|

Understand School reports, Speak and write comments about schooldays, To speak about habits, Understand and provide City-Tipps, To Understand School types in Germany and speak about it. Grammar: Modal verbs in Past tense, Positional Verbs, Two-way prepositions in Dativ and Akkusativ.

| | | |
|-------------------|---|----------|
| Unit - III | Media in everyday life (Medien in Alltag): | 9 |
|-------------------|---|----------|

To speak about advantages and disadvantages of Media, formulate comparisons, Express your own opinion, Talk about Movies, Understand and Write Movie reviews. Grammar: Comparative degree, Comparative Sentences with 'Als' and 'Wie', Subordinate clause with 'dass', Superlative degree.

| | | |
|------------------|--|----------|
| Unit - IV | Feelings and expressions (Gefühle): | 9 |
|------------------|--|----------|

Express thanks and congratulations, Talk about feelings, To understand information about festivals and speak about it, To describe a city, Express joy and regrets, Understand and write Blog entries, Write appropriate heading. Grammar: Subordinate Clause with 'Wenn', Adjectives to be used along with definite articles.

| | | |
|-----------------|---|----------|
| Unit - V | Profession and Travel (Beruf und Reisen): | 9 |
|-----------------|---|----------|

To have a conversation at ticket counter, To talk about leisure activities, To gather information from Texts, Introduce people, Express career preferences, Ideate the dream job, To prepare and make telephone calls, To understand text about Workplace. Ask for information, Express uncertainty, Understand and give directions, Understand a newspaper article, Say your own opinion, Talk about the way to work, Describe a statistic, Understand information about a trip, Talk about travel. Grammar: Adjective to be used along with indefinite articles, Prepositions, verb – 'werden', Subordinate clause – indirect questions, All units will include elements for reading, writing, speaking and listening.

Total: 45**TEXT BOOK:**

| | |
|----|---|
| 1. | Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, "Netzwerk Deutsch als Fremdsprache A1–ursbuch, Arbeitsbuch und Glossar with 2 CDs", Goyal Publishers, Delhi, 2015. |
|----|---|

REFERENCES:

| | |
|----|---|
| 1. | Rosa-Maria Dallapiazza, Eduard von Jan, Till Schoneherr, "Tangram 2 (German)", Goyal Publishers, Delhi, 2011. |
| 2. | https://www.dw.com/en/learn-german - Deutsche Welle, Germany's International Broadcaster |

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

**BT Mapped
(Highest Level)**

| | | |
|-----|--|--------------------|
| CO1 | understand German food style, restaurant and be able express oneself. | Remembering (K1) |
| CO2 | understand German school system and discuss about habits and provide City-Tipps. | Understanding (K2) |
| CO3 | analyze and compare media in everyday life. | Understanding (K2) |
| CO4 | express feelings, describe a city and write blog entries. | Understanding (K2) |
| CO5 | seek and provide information in a professional setup, give directions to others and talk about travel. | Understanding (K2) |

Mapping of COs with POs and PSOs

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO5 | | | | | | | | 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 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

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



| Programme & Branch | All BE/BTech Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|--|---------|----------|---|---|---|--------|
| Prerequisites | German Language Level 3 | 4/5/6/8 | HS | 3 | 0 | 0 | 3 |

| | |
|----------|--|
| Preamble | This course imparts knowledge about interacting with external world, understanding various cultural aspects, behaviour and addressing relationships in personal and professional front. It helps one to understand reports from various media and at work. Enhance learner's grammatical exposure and cover the core basic grammatical concepts which would lay the foundation to have a better hold of the language. With focused learning one should be able to read and respond to reports, write simple formal and informal letters and text messages and be able to engage in simple conversations in known situations. |
|----------|--|

| | | |
|----------|---------------------------|----------|
| Unit - I | Learning (Lernen): | 9 |
|----------|---------------------------|----------|

Understanding and describing learning problems, Understanding and giving advice, Giving reasons, Understanding reports about everyday work life, Talking about everyday working life, Understanding a radio report, Understanding and making a mini-presentation. Grammar: Conjunctions- denn, weil, Konjunktiv II: Sollte (suggestions), Genitive, Temporal prepositions – bis, über + Akkusativ, ab+dativ

| | | |
|-----------|------------------------------|----------|
| Unit - II | Athletic (Sportlich): | 9 |
|-----------|------------------------------|----------|

Expressing enthusiasm, hope, disappointment, Understanding and writing fan comments, Formulating follow-ups, Making suggestions and reacting, Making an appointment, Understanding a report about an excursion, Understanding difficult texts, Introducing a tourist attraction. Grammar: Conjunctions – deshalb, trotzdem, Verbs with Dativ and Akkusativ

| | | |
|------------|--|----------|
| Unit - III | Living Together (Zusammen Leben): | 9 |
|------------|--|----------|

To complain, apologize & give in, As for something, Understand experience reports, Report on the past, Talk about pets, Respond to information, Write and correct a story. Grammatik: Konjunktiv II- könnte, Subordinate clauses – als and Wenn.

| | | |
|-----------|--|----------|
| Unit – IV | Good Entertainment (Gute Unterhaltung): | 9 |
|-----------|--|----------|

Talk about music style, Buy concert tickets, Introduce a musician / band, Understand newspaper reports, Give more detailed information about a person, Understand information about painting, Understand description of a picture, Describe a picture. Grammatik: Interrogative Articles: Was fuer eine? , Pronouns – man/jemand/niemand and alles/etwas/nichts , Relative sentences in Nominativ.

| | | |
|----------|---|----------|
| Unit - V | Passage of time and Culture (Zeitablauf & Kultur): | 9 |
|----------|---|----------|

Talk about wishes, Express wishes, Give Suggestions, Understand a conversation, Plan something together, To ask others something, Understand a text, Exchange information, Talk about proverbs, write a story. Understand information about other cultures, Discuss about behavior, Express intentions, Use the appropriate salutation, Understand tips in a text, Talk about forms of addressing others, Give more information, Discuss about clichés and write about them. All units will include elements for reading, writing, speaking and listening. Grammatik: Konjunktiv II (Wishes, Suggestions), Verbs with prepositions, W- questions with prepositions, Relative sentences in Akkusativ, Subordinate clauses with damit and Um...Zu.

Total: 45**TEXT BOOK:**

| | |
|----|--|
| 1. | Stefanie Dengler, Paul Rusch, Helen Schmitz, Tanja Sieber, "Netzwerk Deutsch als Fremdsprache A1–ursbuch, Arbeitsbuch", Goyal Publishers, Delhi, 2015. |
|----|--|

REFERENCES:

| | |
|----|---|
| 1. | Rosa-Maria Dallapiazza, Eduard von Jan, Till Schonherr, "Tangram 2 (German)", Goyal Publishers, Delhi, 2011. |
| 2. | https://www.dw.com/en/learn-german - Deutsche Welle, Germany's International Broadcaster |

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

| | | BT Mapped (Highest Level) |
|-----|--|--------------------------------------|
| CO1 | leverage learning in Workplace, understanding reports and make presentation. | Remembering (K1) |
| CO2 | reciprocate to different situations, make appointment and understand texts. | Understanding (K2) |
| CO3 | handle relationships and respond appropriately to exchange information | Understanding (K2) |
| CO4 | familiarize to various channels of entertainment | Understanding (K2) |
| CO5 | know about various cultural aspects, usage of proverbs and cliches. | Understanding (K2) |

Mapping of COs with POs and PSOs

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 1 | 3 | | 3 | | |
| CO5 | | | | | | | | 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 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

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



| Programme & Branch | All BE/BTech Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|--|---------|----------|---|---|---|--------|
| Prerequisites | Japanese Language Level 1 | 4/5/6/8 | HS | 4 | 0 | 0 | 4 |

| | | |
|---|---|----|
| Preamble | The basic level of Japanese which provides understanding of Hiragana, Katakana and 110 Kanjis and provides the ability to understand basic conversations and also enables one to request other person and also understand Casual form | |
| Unit - I | Introduction to groups of verbs: | 12 |
| tai form-Verb groups-te form-Give and ask permission to do an action-Present continuous form-Restrict other person from doing an action-nouns-Basic Questions | | |
| Unit - II | Introduction to Casual Form: | 12 |
| nai form-Dictionary form-ta form-Polite style and Casual style differences-Conversation in plain style-Place of usage of Polite style and Casual style | | |
| Unit - III | Express opinions and thoughts: | 12 |
| Introduction to new particle-Express someone one's thought-Convey the message of one person to another-Ask someone if something is right -Noun modifications | | |
| Unit - IV | Introduction to If clause and remaining Kanjis: | 12 |
| If clause tara form-Express gratitude for an action done by other person-Hypothetical situation-Particles to use in case of Motion verbs-50 Kanjis | | |
| Unit - V | Introduction to giving and receiving with te form and “when, even if” usages: | 12 |
| Providing to and getting from differences - Understanding of situations and framing sentences using when and even if..etc. | | |

Total: 60**TEXT BOOK:**

| | |
|----|--|
| 1. | “MINNA NO NIHONGO—Japanese for Everyone”, 2 nd Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017. |
|----|--|

REFERENCES:

| | |
|----|--|
| 1. | Margherita Pezzopane, “Try N5”, 2 nd Edition, Tankobon Softcover, Japan, 2017. |
| 2. | Sayaka Kurashina, “Japanese Word Speedmaster”, 2 nd Edition, Tankobon Softcover, Japan, 2018. |

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

| | | BT Mapped (Highest Level) |
|-----|---|--------------------------------------|
| CO1 | differentiate groups of verbs and its forms | Remembering (K1) |
| CO2 | understand Polite form and Casual form of Japanese | Understanding (K2) |
| CO3 | comprehend personal communication and express greetings | Understanding (K2) |
| CO4 | understand the Kanjis in Japanese Script and If clause | Understanding (K2) |
| CO5 | comprehend concept of “even if”, “when” and job-related information | Understanding (K2) |

Mapping of COs with POs and PSOs

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO5 | | | | | | | | 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 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

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



| Programme & Branch | All BE/BTech Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|--|---------|----------|---|---|---|--------|
| Prerequisites | Japanese Language Level 2 | 4/5/6/8 | HS | 3 | 0 | 0 | 3 |

| | | |
|--|--|---|
| Preamble | The intermediate level of Japanese which provides understanding of all forms of verbs, adverbs, conjunctions, etc. which includes 150 Kanji's and provides the ability to comprehend conversations encountered in daily life | |
| Unit - I | Introduction to Potential verbs: | 9 |
| Causes and Reasons-Favouring Expressions-Expressing a State-Potential Verb Sentences-Simultaneous actions-Verb Groups-te Form-Customary Actions-Nouns-Basic Questions and Kanji's. | | |
| Unit - II | Introduction to Transitive and Intransitive verbs: | 9 |
| Consequence of verbs- Embarrassment about Facts- Consequence of Verbs with an Intentions-Affirmative Sentences- Conjunctions-Basic Questions and kanji's. | | |
| Unit - III | Introduction to Volitional forms: | 9 |
| Expressions of Speakers Intention-Expressing Suggestion or Advice-Usage of Adverbs and Quantifiers-Basic Questions and kanji's. | | |
| Unit - IV | Introduction to Imperative and Prohibitive verbs: | 9 |
| Commanding person- Interrogatives-Expressions of Third Person-Actions and its Occurrence - Possibilities of an Action-Changing of States Basic Questions and Kanji's. | | |
| Unit - V | Introduction to Conditional form and Passive verbs: | 9 |
| Description of Requirement and Speaker's Judgement, Habitual Actions, Directions and suggestions-Passive forms of Verbs-Basic Questions and Kanji's. | | |

Total: 45**TEXT BOOK:**

| | |
|----|--|
| 1. | "MINNA NO NIHONGO—Japanese for Everyone", 2 nd Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017. |
|----|--|

REFERENCES:

| | |
|----|--|
| 1. | Margherita Pezzopane, "Try N5", 2 nd Edition, Tankobon Softcover, Japan, 2017. |
| 2. | Sayaka Kurashina, "Japanese Word Speedmaster", 2 nd Edition, Tankobon Softcover, Japan, 2018. |

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

| | | BT Mapped (Highest Level) |
|-----|---|--------------------------------------|
| CO1 | read and understand BasicVocabularies. | Remembering (K1) |
| CO2 | understand Conversations used in daily life. | Understanding (K2) |
| CO3 | comprehend personal communication and express greetings. | Understanding (K2) |
| CO4 | understand the Kanji's in Japanese Script. | Understanding (K2) |
| CO5 | comprehend Coherent conversations in everyday situations. | Understanding (K2) |

Mapping of COs with POs and PSOs

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO5 | | | | | | | | 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 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

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



| Programme & Branch | All BE/BTech Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|--|---------|----------|---|---|---|--------|
| Prerequisites | Japanese Language Level 3 | 4/5/6/8 | HS | 3 | 0 | 0 | 3 |

| | | |
|--|--|---|
| Preamble | The intermediate level of Japanese provides understanding of expressions of verbs, its pattern, Relationships which also includes 150 Kanji's and also provides the ability to understand relationship among the people. | |
| Unit - I | Introduction to Reasoning: | 9 |
| Causes and Sequences-Causes and Effects-Interrogative Patterns-Adjective as a Noun -Basic Questions and Kanji's. | | |
| Unit - II | Introduction to Exchanging of things: | 9 |
| Expressions for Giving and Receiving of Things-Polite Expression of Request-Indicating a Purpose of Actions-Basic Quantifiers-Basic Questions and kanji's. | | |
| Unit - III | Introduction to States of an Action: | 9 |
| Sentence Pattern to Indicate Appearance-Degree of Action and State-Adjectives as Adverbs- Convey information -Basic Questions and kanji's. | | |
| Unit - IV | Introduction to Causative Verbs: | 9 |
| Causative Forms of Verbs-Asking Opportunity to do something-Hypothetical Questions-Judgement and Course of an actions-Basic Questions and Kanji's. | | |
| Unit - V | Introduction to Relationship in Social Status: | 9 |
| Honorific expressions- Respectful expressions- Humble expressions-Polite expressions-Basic Questions and Kanji's. | | |

Total: 45**TEXT BOOK:**

| | |
|----|--|
| 1. | "MINNA NO NIHONGO—Japanese for Everyone", 2 nd Edition, Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2017. |
|----|--|

REFERENCES:

| | |
|----|--|
| 1. | Margherita Pezzopane, "Try N5", 2 nd Edition, Tankobon Softcover, Japan, 2017. |
| 2. | Sayaka Kurashina, "Japanese Word Speedmaster", 2 nd Edition, Tankobon Softcover, Japan, 2018. |

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

**BT Mapped
(Highest Level)**

| | | |
|-----|---|--------------------|
| CO1 | read and Understand Relationship of a Person. | Remembering (K1) |
| CO2 | understand Conversations Used in Everyday Activities. | Understanding (K2) |
| CO3 | comprehend Contents at Near Natural Speed. | Understanding (K2) |
| CO4 | understand the Kanji's in Japanese Script. | Understanding (K2) |
| CO5 | comprehend Orally Presented Materials. | Understanding (K2) |

Mapping of COs with POs and PSOs

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | |
| CO5 | | | | | | | | 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 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

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



| Programme & Branch | All BE/BTech Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|--|-------|----------|---|---|---|--------|
| Prerequisites | NIL | 5 / 6 | OE | 3 | 0 | 2 | 4 |

| | |
|----------|--|
| Preamble | This course is designed especially for NCC Cadets. This course will help develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams, learning military subjects including weapon training. |
|----------|--|

| | | |
|-----------------|---|----------|
| Unit - I | NCC Organisation and National Integration: | 9 |
|-----------------|---|----------|

NCC Organisation – History of NCC- NCC Organisation- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honours and Awards – Incentives for NCC cadets by central and state govt. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration.

| | | |
|------------------|---|----------|
| Unit - II | Basic physical Training and Drill: | 9 |
|------------------|---|----------|

Basic physical Training – various exercises for fitness(with Demonstration)-Food – Hygiene and Cleanliness. Drill- Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with arms- ceremonial drill- guard mounting.(WITH DEMONSTRATION)

| | | |
|-------------------|-------------------------|----------|
| Unit - III | Weapon Training: | 9 |
|-------------------|-------------------------|----------|

Main Parts of a Rifle- Characteristics of 5.56mm INSAS rifle- Characteristics of .22 rifle- loading and unloading – position and holding- safety precautions – range procedure- MPI and Elevation- Group and Snap shooting- Long/Short range firing(WITH PRACTICE SESSION) - Characteristics of 7.62mm SLR- LMG- carbine machine gun.

| | | |
|------------------|--|----------|
| Unit - IV | Social Awareness and Community Development: | 9 |
|------------------|--|----------|

Aims of Social service-Variety Means and ways of social services- family planning – HIV and AIDS- Cancer its causes and preventive measures- NGO and their activities- Drug trafficking- Rural development programmes - MGNREGA-SGSY-JGSY-NSAP-PMGSY- Terrorism and counter terrorism- Corruption – female foeticide -dowry –child abuse-RTI Act- RTE Act- Protection of children from sexual offences act- civic sense and responsibility

| | | |
|-----------------|------------------------------------|----------|
| Unit - V | Specialized Subject (ARMY): | 9 |
|-----------------|------------------------------------|----------|

Basic structure of Armed Forces- Military History – War heroes- battles of Indo-Pak war- Param Vir Chakra- Career in the Defence forces- Service tests and interviews-Fieldcraft and Battlecraft-Basics of Map reading including practical.

Lecture :45, Practical:30, Total:75

TEXT BOOK:

| |
|--|
| 1. "National Cadet Corps- A Concise handbook of NCC Cadets", Ramesh Publishing House, New Delhi, 2014. |
|--|

REFERENCES:

| |
|---|
| 1. "Cadets Handbook – Common Subjects SD/SW", published by DG NCC, New Delhi. |
| 2. "Cadets Handbook- Specialized Subjects SD/SW", published by DG NCC, New Delhi. |
| 3. "NCC OTA Precise", published by DG NCC, New Delhi. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|---|--------------------------------------|
| CO1 | display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion. | Applying (K3) |
| CO2 | demonstrate Health Exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders.. | Applying (K3) |
| CO3 | basic knowledge of weapons and their use and handling. | Applying (K3) |
| CO4 | understanding about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils | Applying (K3) |
| CO5 | acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles. | 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 | 3 | 3 | 3 | | | | |
| CO2 | | | | | 3 | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | | | |

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

| ASSESSMENT PATTERN - THEORY | | | | | | | |
|------------------------------------|---|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
| CAT1 | - | - | - | - | - | - | - |
| CAT2 | - | - | - | - | - | - | - |
| CAT3 | - | - | - | - | - | - | - |
| ESE | The examination and award of marks will be done by the Ministry of Defence, Government of India which includes all K1 to K6 knowledge levels. The maximum marks for the End Semester Examination is 500 marks. It will be converted to 100 marks. | | | | | | |



Kongu Engineering College, Perundurai, Erode – 638060, India
20GEO12 - NCC STUDIES (AIR WING) – I
 (Offered by Department of Information Technology)

| Programme & Branch | All BE/BTech Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|--|-------|----------|---|---|---|--------|
| Prerequisites | Nil | 5 / 6 | OE | 3 | 0 | 2 | 4 |

| | | | | | | | |
|----------|---|--|--|--|--|--|--|
| Preamble | This course is designed especially for NCC Cadets. This course will help develop character , camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams, honing qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets. | | | | | | |
|----------|---|--|--|--|--|--|--|

| | | |
|-----------------|---|----------|
| Unit – I | NCC Organization and National Integration: | 9 |
|-----------------|---|----------|

NCC Organization – History of NCC- NCC Organization- NCC Training- NCC Uniform – Promotion of NCC cadets – Aim and advantages of NCC Training- NCC badges of Rank- Honors' and Awards – Incentives for NCC cadets by central and state govt. History and Organization of IAF-Indo-Pak War-1971-Operation Safed Sagar. National Integration- Unity in diversity- contribution of youth in nation building- national integration council- Images and Slogans on National Integration.

| | | |
|------------------|-----------------------------------|----------|
| Unit – II | Drill and Weapon Training: | 9 |
|------------------|-----------------------------------|----------|

Drill- Words of commands- position and commands- sizing and forming- saluting- marching- turning on the march and wheeling- saluting on the march- side pace, pace forward and to the rear- marking time- Drill with arms- ceremonial drill- guard mounting.(WITH DEMONSTRATION). Main Parts of a Rifle- Characteristics of .22 rifle- loading and unloading – position and holding- safety precautions – range procedure- MPI and Elevation- Group and Snap shooting- Long/Short range firing (WITH PRACTICE SESSION).

| | | |
|-------------------|------------------------------|----------|
| Unit – III | Principles of Flight: | 9 |
|-------------------|------------------------------|----------|

Laws of motion-Forces acting on aircraft–Bernoulli's theorem-Stalling-Primary control surfaces – secondary control surfaces-Aircraft recognition.

| | | |
|------------------|----------------------|----------|
| Unit - IV | Aero Engines: | 9 |
|------------------|----------------------|----------|

Introduction of Aero engine-Types of engine-piston engine-jet engines-Turboprop engines-Basic Flight Instruments-Modern trends.

| | | |
|-----------------|-----------------------|----------|
| Unit – V | Aero Modeling: | 9 |
|-----------------|-----------------------|----------|

History of aero modeling-Materials used in Aero-modeling-Types of Aero-models – Static Models-Gliders-Control line models-Radio Control Models-Building and Flying of Aero-models.

Lecture :45, Practical30, Total:75

TEXT BOOK:

| | |
|---|--|
| 1 | "National Cadet Corps- A Concise handbook of NCC Cadets" by Ramesh Publishing House, New Delhi,2014. |
|---|--|

REFERENCES:

| | |
|---|--|
| 1 | "Cadets Handbook – Common Subjects SD/SW" by DG NCC, New Delhi. |
| 2 | "Cadets Handbook – Specialised Subjects SD/SW" by DG NCC, New Delhi. |
| 3 | "NCC OTA Precise" by DGNCC, New Delhi. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|--|--------------------------------------|
| CO1 | display sense of patriotism, secular values and shall be transformed into motivated youth who will carry out nation building through national unity and social cohesion. | Applying (K3) |
| CO2 | demonstrate the sense of discipline with smartness and have basic knowledge of weapons and their use and handling | Applying (K3) |
| CO3 | illustrate various forces and moments acting on aircraft | Applying (K3) |
| CO4 | outline the concepts of aircraft engine and rocket propulsion | Applying (K3) |
| CO5 | design, build and fly chuck gliders/model airplanes and display static models. | 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 | 3 | 3 | 3 | | | | |
| CO2 | | | | | 3 | | | | | | | | | |
| CO3 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | 1 | | | | | | | | | | |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy | | | | | | | | | | | | | | |

| ASSESSMENT PATTERN - THEORY | | | | | | | |
|------------------------------------|---|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
| CAT1 | - | - | - | - | - | - | - |
| CAT2 | - | - | - | - | - | - | - |
| CAT3 | - | - | - | - | - | - | - |
| ESE | The examination and award of marks will be done by the Ministry of Defence, Government of India which includes all K1 to K6 knowledge levels. The maximum marks for the End Semester Examination is 500 marks. It will be converted to 100 marks. | | | | | | |



| Programme & Branch | All Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|---|---------|----------|---|---|---|--------|
| Prerequisites | Fundamentals of French Language | 5/6/7/8 | HS | 3 | 1 | 0 | 4 |

| | | |
|--|---|----|
| Preamble | This course provides a foundation of the French language as well as an understanding of the French culture and lifestyle of France and other French-speaking nations. The student will be learning how to introduce him/herself and acquire basic everyday vocabulary. By following the structured curriculum and practicing the same as per the learning process, one can comprehend the structure of sentences and respond to basic communications. | |
| Unit - I | Introduction: | 12 |
| French and French culture, alphabets, pronunciation, accents, rules, and terms for pronunciation (mas-fem),Salutations, numbers. | | |
| Unit - II | Daily Life: | 12 |
| Subject Pronoun, Francophonie's, adjectives – colors, week, months, seasons. | | |
| Unit - III | Articles and Verbs: | 12 |
| Articles - Indefinite, definite, partitive, and contracted, (examples), introductions to verbs, 1 st group of verb | | |
| Unit - IV | In the City: | 12 |
| 2 nd group of verbs, irregular verbs (avoir, etre, faire) present yourself & negative sentences. (faire and Jouer verb with the expressions) | | |
| Unit - V | Food and Culture: | 12 |
| Prepositions – preposition of places (country, cities and etc), Imperative mode, invitations, culture – food (wine, cheese) Future (recent future) | | |

Total:60

TEXT BOOK:

| | |
|----|-------------|
| 1. | A1 – saison |
|----|-------------|

REFERENCES:

| | |
|----|---|
| 1. | Apprenons les francais – 0 and 1 |
| 2. | Grammaire – langue et de civilization francaises – Mauger G |
| 3. | .Les idees – 0 and 1 |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|--|--------------------------------------|
| CO1 | understand the grammatical structure of the language and introduce self to others. | Remembering (K1) |
| CO2 | understand basic verbs and appropriate vocabulary. | Understanding (K2) |
| CO3 | ask for directions and arrange for transportation, etc,as needed. | Understanding (K2) |
| CO4 | understand the food habits of France and ask for appointments | Understanding (K2) |
| CO5 | learn to socialize in French-speaking countries | Understanding (K2) |

| Mapping of COs with POs and PSOs | | | | | | | | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO5 | | | | | | | | 1 | 2 | 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 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

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

20GEO14 - FRENCH LANGUAGE LEVEL 2

| Programme & Branch | All Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|---|---------|----------|---|---|---|--------|
| Prerequisites | Fundamentals of French Language | 5/6/7/8 | HS | 3 | 1 | 0 | 4 |

| | | | |
|----------|---|--|----|
| Preamble | This course is designed to assist students in developing vocabulary in accordance with the Common European Framework of Reference for Languages at the A2 level. This course will aid in the integration of basic grammar structures as well as the acquisition of vocabulary necessary to comprehend and respond in everyday circumstances. The learner will be able to develop a thorough comprehension of French grammar and confidently express themselves in everyday circumstances. | | |
| Unit - I | French and You: | | 12 |



Habits, Strengths & Weakness, Recommendations, Sentiments, Motivations, about favorite films and Types of screens in the movie world, Verbs (Regulars and irregulars), Reflexive Verbs, Prepositions

| | | |
|------------------|------------------------|-----------|
| Unit - II | Eat and Repeat: | 12 |
|------------------|------------------------|-----------|

Favorite foods, Recopies, Types of meals, Describing House and Kitchen, Presentation of the recipe, Comparatives, Possessive pronouns, Present continuous tense, Simple conditional form

| | | |
|-------------------|------------------|-----------|
| Unit - III | Vacation: | 12 |
|-------------------|------------------|-----------|

Invitations, presentation, Greetings, Goodbyes, Activities on vacation, past experiences, Describing favorite place, Recommendations on various tours, Past perfect, Past imperfect tense

| | | |
|------------------|-------------------------|-----------|
| Unit - IV | Likes and Views: | 12 |
|------------------|-------------------------|-----------|

Favorite persons & things, Giving advice, Experience, Moods, Illness, Discomforts, Symptoms, Roleplay (Doctor & Patient, Guide & Tourist, Pharmacist & Patient), Past perfect, Past indefinite, Imperative

| | | |
|-----------------|----------------------|-----------|
| Unit - V | Then and Now: | 12 |
|-----------------|----------------------|-----------|

Habits, customs, circumstances of the past and present, Debates on past and present situations and feelings. Past imperfect tense, Past perfect and Present comparatives.

Total:60

TEXTBOOK:

| | |
|----|-------------|
| 1. | A2 – Saison |
|----|-------------|

REFERENCES:

- | | |
|----|---|
| 1. | Apprenons les francais – 0 and 1 |
| 2. | Grammaire – langue et de civilization francaises – Mauger G |
| 3. | .Les idees – 0 and 1 |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|--|--------------------------------------|
| CO1 | understand the French language in deep and its usage | Remembering (K1) |
| CO2 | preparation of their Favorite recipes, Know the Objects used in Kitchen and house. | Understanding (K2) |
| CO3 | converse about their vacation, their Favorite Destination | Understanding (K2) |
| CO4 | understand complex verbs and be able to communicate about their past experiences | Understanding (K2) |
| CO5 | know the difference between Past and Present and Compare them. | Understanding (K2) |

| Mapping of COs with POs and PSOs | | | | | | | | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO5 | | | | | | | | 1 | 2 | 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 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

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

**20GEO15 - FRENCH LANGUAGE LEVEL 3**

| Programme& Branch | All Engineering courses | Sem. | Category | L | T | P | Credit |
|-------------------|---------------------------------|---------|----------|---|---|---|--------|
| Prerequisites | Fundamentals of French Language | 5/6/7/8 | HS | 3 | 0 | 0 | 3 |

| | | |
|--|--|---|
| Preamble | This course gives knowledge regarding a variety of personal and professional circumstances, as well as improving vocabulary and speaking abilities to reply to and seek information in those settings. It also gives you the ability to articulate yourself and arrange appointments. With perseverance, one can master all of the essential grammatical structures needed to respond confidently in everyday circumstances. It almost gives you an idea of how Natives communicate. | |
| Unit - I | Start Over: | 9 |
| Use of periphrases, Discuss a day in life, work, problems in the world, Predictions about the future (actions and situations), Hypothetical situations, Imperfect and future tense. | | |
| Unit - II | Prohibitions and More: | 9 |
| Prohibitions, Obligations, Habits to change, social customs, Use of the subjunctive, Describe synopsis of Movie and its relation to real life, Debate on books vs movies, usage of connectors, Object Direct and Indirect. | | |
| Unit - III | Let's be Creative: | 9 |
| Write a letter by describing the problem, talk about desires and Necessities, propose solutions, Recommendations and Suggestions, Create an Advertisement, Give Instructions, Imperative negative, Use of Object Direct, and Indirect. | | |
| Unit - IV | Travel and Communication: | 9 |
| Talk about Tours, Types of tourism and communication, Send messages, petitions, Talk to people on the telephone, Roleplay (Tourists and Guide, Tourists and Travel agents), Past Pluscumperfect, All Past tenses. | | |
| Unit - V | Let's Talk: | 9 |
| Expression of Interests, Sentiments, Feelings, Sensations, Manias etc. Certain suggestions to make a better future, the use of superlatives, Exclamatory phrases, subjunctives. | | |

Total:45**TEXT BOOK:**

| | |
|----|-------------|
| 1. | B1 – Saison |
|----|-------------|

REFERENCES:

| | |
|----|---|
| 1. | Apprenons les francais – 0 and 1 |
| 2. | Grammaire – langue et de civilization francaises – Mauger G |
| 3. | .Les idees – 0 and 1 |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|--|--------------------------------------|
| CO1 | learn on Future tense. | Remembering (K1) |
| CO2 | understand Permissions and Prohibitions. | Understanding (K2) |
| CO3 | know about Letter writing, Creating Ads, Expressing Desires, and Instructing Others. | Understanding (K2) |
| CO4 | understand rules for travel and Enhancing communications. | Understanding (K2) |
| CO5 | express the feelings and emotions using advanced grammar | Understanding (K2) |

| Mapping of COs with POs and PSOs | | | | | | | | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO5 | | | | | | | | 1 | 2 | 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 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

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



| Programme & Branch | All Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|---|---------|----------|---|---|---|--------|
| Prerequisites | Fundamentals of Spanish Language | 5/6/7/8 | HS | 3 | 1 | 0 | 4 |

| | | |
|--|---|----|
| Preamble | This course provides a foundation of the Spanish language as well as an understanding of the Spanish culture and lifestyle of Spain and other Spanish-speaking nations. The student will be learning how to introduce him/herself and acquire basic everyday vocabulary. By following the structured curriculum and practicing the same as per the learning process, one can comprehend the structure of sentences and respond to basic communications. | |
| Unit - I | Greetings and Good byes (Los Saludos y Despedirse): | 12 |
| Greetings,Self-Introduction , Formal and Informal ways of introducing oneself and others, Alphabets& Numbers, Countries and Languages Spoken, Parts of Grammar – Noun, Personal Pronoun, Describe surroundings and its vocabulary | | |
| Unit - II | Vida Cotidiana (Daily Life): | 12 |
| Time of the day, Days of the week, Months of the year, Seasons, Verb (To be, To Have), Adverbs, Likes and Dislikes, Personality and physical description, simple sentences | | |
| Unit - III | Friends and Family (Amigos y La Familia): | 12 |
| Vocabulary of family, Animals, Professions, Parts of the body, Opinions on family cultures, Articles – Definite and Indefinite, Hobbies, Regular and Irregular verbs. | | |
| Unit - IV | In the City (En la Ciudad): | 12 |
| Buildings in the city, Name of the places, asking for directions, Helping each other, Description of house and its components, Modes of Transport, Grammar - Possessive articles, prepositions | | |
| Unit - V | Food and Culture(La comida y cultura): | 12 |
| Food (types and varieties) , shopping, ordering at a restaurant, inviting to parties, Roleplay (as diner and customer, salesman and customer...etc.) Past tense (all three tenses-Past Participle, Indefinite past and past imperfect- (to be and to have) | | |

Total:60

TEXT BOOK:

| | |
|----|---|
| 1. | Chicos Chicas Libro de Alumno nivel 1, Ma Angeles Palomino, edelsa, GRUPO DIDASCALIA, S.A., plaza ciudad de salta, 3-28043 MADRID (ESPANA). |
|----|---|

REFERENCES:

| | |
|----|---|
| 1. | https://nuevadelhi.cervantes.es/en/spanish_courses/students/spanish_general_courses/spanish_courses_level_a1.htm |
|----|---|

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

**BT Mapped
(Highest Level)**

| | | |
|-----|--|--------------------|
| CO1 | understand the grammatical structure of the language and introduce self to others. | Remembering (K1) |
| CO2 | understand basic verbs and appropriate vocabulary. | Understanding (K2) |
| CO3 | ask for directions and arrange for transportation, etc, as needed. | Understanding (K2) |
| CO4 | understand the food habits of Spain and Latin countries and ask for appointments | Understanding (K2) |
| CO5 | learn to socialize in Spanish speaking countries | Understanding (K2) |

Mapping of COs with POs and PSOs

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO5 | | | | | | | | 1 | 2 | 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 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

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

**20GEO17 - SPANISH LANGUAGE LEVEL 2**

| Programme & Branch | All Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|---|---------|----------|---|---|---|--------|
| Prerequisites | Fundamentals of Spanish Language | 5/6/7/8 | HS | 3 | 1 | 0 | 4 |

| | | |
|---|---|-----------|
| Preamble | This course aims to help the Learner to acquire the vocabulary as per the framework of Spanish language A2 level competence. This course will help to assimilate the basic grammar structures and gain vocabulary to understand and reciprocate in daily life situations on a broader sense. A thorough learner will be able to gain a comprehensive understanding of the Spanish grammar and confidently articulate in day today situations. | |
| Unit - I | Spanish and You (El Español y tú): | 12 |
| Habits, Strengths & Weakness, Recommendations, Sentiments, Motivations, About favorite films and Types of screens in the movie world, Verbs(Regulars and irregulars), Reflexive Verbs, Prepositions | | |
| Unit - II | Eat and Repeat (Comer y repetir): | 12 |
| Favorite foods, Recipies, Types of meals, Describing House and Kitchen, Presentation of recipe, Comparatives, Possessive pronouns, Present continuous tense, Simple conditional form | | |
| Unit - III | Its Vacation Time (Tiempo de vacaciones): | 12 |
| Invitations, presentation, Greetings, Goodbyes, Activities on vacation, past experiences, Describing favorite place, Recommendations on various tours, Past perfect, Past imperfect tense, Usage of Todavía or No | | |
| Unit - IV | Likes and Views (Gustasyvistas): | 12 |
| Favorite persons & things, Giving advices, Experience, Moods, Illness, Discomforts, Symptoms, Roleplay (Doctor & Patient, Guide & Tourist, Pharmacist & Patient), Past perfect, Past indefinite, Imperative | | |
| Unit - V | Then and Now(Antes y Ahora): | 12 |
| Habits, customs, circumstances of the past and present, Debates on past and present situations and feelings. Past imperfect tense, Past perfect and Present comparatives. | | |

Total:60**TEXT BOOK:**

| | |
|----|---|
| 1. | AULA INTERNACIONAL 2 (A2), Jaime Corpas, Agustin Garmendia, Nuria Sanchez, Carmen Soriano Goyal Publishers and Distributors Pvt LTD, 86, UB Jawahar Nagar, Kamla Nagar, Delhi-110007. |
|----|---|

REFERENCES:

| | |
|----|---|
| 1. | https://nuevadelhi.cervantes.es/en/spanish_courses/students/spanish_general_courses/spanish_courses_level_a1.htm |
|----|---|

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

| | | BT Mapped (Highest Level) |
|-----|--|--------------------------------------|
| CO1 | understand the Spanish language in deep and its usage | Remembering (K1) |
| CO2 | preparation of their Favorite recipes, Know the Objects used in Kitchen and house. | Understanding (K2) |
| CO3 | converse about their vacation, their Favorite Destination | Understanding (K2) |
| CO4 | understand complex verbs and be able to communicate about their past experiences | Understanding (K2) |
| CO5 | know the difference between Past and Present and Comparing them. | Understanding (K2) |

Mapping of COs with POs and PSOs

| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO5 | | | | | | | | 1 | 2 | 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 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

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

**20GEO18 - SPANISH LANGUAGE LEVEL 3**

| Programme & Branch | All Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|---|---------|----------|---|---|---|--------|
| Prerequisites | Fundamentals of Spanish Language | 5/6/7/8 | HS | 3 | 0 | 0 | 3 |

| | | |
|--|---|---|
| Preamble | This course provides enriching information about various everyday situations in personal and professional life and enhances the vocabulary and speaking ability to respond to and also seek information in those situations. It also equips one to express opinions and negotiate appointments. With diligent learning one can capture all basic grammatical structure to answer confidently in everyday situations. It almost gives a basic idea on how Natives speak. | |
| Unit - I | Start Over(Volver a Empezar): | 9 |
| Use of periphrases, Discuss a day in life, work, problems in the world, Predictions about future (actions and situations),Hypothetical situations, Imperfect and future tense. | | |
| Unit - II | Prohibitions and More(Prohibiciones y mas): | 9 |
| Prohibitions, Obligations, Habits to change, social customs, Use of subjunctive, Describe synopsis of Movie and its relation to real life, Debate on books vs movies, usage of connectors, Object Direct and Indirect. | | |
| Unit - III | Let's be Creative (Seamos creatives): | 9 |
| Write a letter by describing the problem,talk about desires and Necessities, propose solutions, Recommendations and Suggestions, Create an Advertisement, Give Instructions, Imperative negative, Use of Object Direct and Indirect. | | |
| Unit - IV | Travel and Communication (Viajar y comunicar): | 9 |
| Talk about Tours, Types of tourism and communication, Send messages, petitions, Talk to people on telephone, Role play(Tourists and Guide, Tourists and Travel agents), Past Pluscumperfect, All Past tenses. | | |
| Unit - V | Let's Talk(Hablemos): | 9 |
| Expression of Interests, Sentiments, Feelings, Sensations, Manias etc. Certain suggestions to make a better future, use of superlatives, Exclamatory phrases, subjunctive. | | |

Total:45**TEXT BOOK:**

| | |
|----|---|
| 1. | AULA INTERNACIONAL 3 (B1) [Paperback] Jaime Corpas, Agusin Garmendia, Nuria Sanchez, Carmen Soriano Goyal Publishers and Distributors Pvt LTD, 86, UB Jawahar Nagar, Kamla Nagar, Delhi-110007. |
|----|---|

REFERENCES:

| | |
|----|---|
| 1. | https://nuevadelhi.cervantes.es/en/spanish_courses/students/spanish_general_courses/spanish_courses_level_a1.htm |
|----|---|



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|---|--------------------------------------|
| CO1 | learn on Future tense. | Remembering (K1) |
| CO2 | understand about Permissions and Prohibitions. | Understanding (K2) |
| CO3 | know about Letter writing, Creating Ads, Expressing Desires and Instructing Others. | Understanding (K2) |
| CO4 | understand rules for travel and Enhance communications. | Understanding (K2) |
| CO5 | express the feelings and emotions using advanced grammar | Understanding (K2) |

| Mapping of COs with POs and PSOs | | | | | | | | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO2 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO3 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO4 | | | | | | | | 1 | 2 | 3 | | 3 | | 2 |
| CO5 | | | | | | | | 1 | 2 | 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 | 75 | 25 | | | | | 100 |
| CAT2 | 25 | 75 | | | | | 100 |
| CAT3 | 25 | 75 | | | | | 100 |
| ESE | 25 | 75 | | | | | 100 |

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



| Programme & Branch | All BE/BTech Engineering and Technology Branches | Sem. | Category | L | T | P | Credit |
|--------------------|--|------|----------|---|---|---|--------|
| Prerequisites | Economics and Management for Engineers | 6 | EC | 3 | 0 | 0 | 3 |

| | | |
|---|--|---|
| Preamble | The purpose of this course to create entrepreneurial awareness among engineering students. | |
| Unit - I | Entrepreneurship Concepts: | 9 |
| Entrepreneurship & Entrepreneur- Role in Economic Development - Factors affecting Entrepreneurship- Creativity and Innovation - Entrepreneurship vs Intrapreneurship- Entrepreneurial Motivation factors – Types of Entrepreneurship & Entrepreneurs - Characteristics of Entrepreneurs - Entrepreneurship Development in India | | |
| Unit - II | Entrepreneurial Ventures and opportunity assessment: | 9 |
| New venture creation – Bootstrapping, Minipreneurship, Start-ups, Acquiring, Franchising & Social venturing - Venture development stages - Models of market opportunity- Opportunity assessment: Critical Factors In Opportunity Assessment, Idea vs Opportunity, Evaluation process, Global opportunities for entrepreneurs. | | |
| Unit - III | Business Plan: | 9 |
| Designing Business Model- Business Model Canvas- Objectives of a Business Plan - Business Planning Process – Structure of a Business Plan – Technical, Marketing, Financial Feasibility assessment - Competitive analysis - Common errors in Business Plan formulation - Presentation of the Business Plan: The 'Pitch'- case studies | | |
| Unit - IV | Financing and accounting: | 9 |
| Forms of entrepreneurial capital – Sources of Financial capital: debt financing- Commercial banks and other sources, equity financing: Initial Public offering (IPO), Private placement - Venture capitalists - Angel investors-New forms of financing: Impact investors, Micro-financing, Peer-to-Peer Lending, Crowd funding - Natural capital. Preparing Financial Budget, Break even analysis, Taxation-Direct and indirect taxes, Insolvency and Bankruptcy. | | |
| Unit - V | Small Business Management: | 9 |
| Definition of Small Scale Industries: Strengths and Weaknesses, Sickness in Small Enterprises: Symptoms -Causes and remedies- Indian Startup Ecosystem – Institutions supporting small business enterprises, Business Incubators – Government Policy for Small Scale Enterprises - Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger, FDI and Sub-Contracting | | |

Total:45**TEXT BOOK:**

| | |
|----|---|
| 1. | Donald F. Kuratko, "Entrepreneurship: Theory, Process, Practice", 11 th Edition, Cengage Learning, Boston, 2020. |
|----|---|

REFERENCES:

| | |
|----|---|
| 1. | Robert D. Hisrich, Michael P. Peters & Dean A. Shepherd, Sabyasachi Sinha "Entrepreneurship", 11 th Edition, McGraw Hill, Noida, 2020. |
| 2. | Charantimath Poornima .M, "Entrepreneurship Development and Small Business Enterprises", 3 rd Edition, Pearson Education, Noida, 2018. |
| 3. | Gordon E & Natarajan K, "Entrepreneurship Development", 6 th Edition, Himalaya Publishing House, Mumbai, 2017. |

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

**BT Mapped
(Highest Level)**

| | | |
|-----|---|--------------------|
| CO1 | understand the importance of entrepreneurship and demonstrate the traits of an entrepreneur | Applying (K3) |
| CO2 | identify suitable entrepreneurial ventures and business opportunity | Applying (K3) |
| CO3 | assess the components of business plan | Analyzing (K4) |
| CO4 | appraise the sources of finance and interpret accounting statements | Applying (K3) |
| CO5 | interpret the causes of sickness of small scale enterprises and its remedies | 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 | 1 | 1 | | 3 | 2 | | 1 |
| CO2 | 1 | 2 | 2 | 2 | | 2 | 2 | 1 | 1 | | 3 | 2 | | 2 |
| CO3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | | 1 |
| CO4 | 1 | 1 | 2 | 1 | | 2 | 1 | 1 | 1 | 2 | 3 | 2 | | 1 |
| CO5 | 1 | 1 | 2 | 1 | | 2 | 1 | 1 | 1 | 2 | 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 | 30 | 30 | 20 | | | 100 |
| CAT3 | 30 | 30 | 40 | | | | 100 |
| ESE | 20 | 30 | 40 | 10 | | | 100 |

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



20MA001 - MATHEMATICAL FOUNDATIONS FOR MACHINE LEARNING
(Common to all Engineering and Technology Branches)

| Programme & Branch | All Engineering and Technology branches | Sem. | Category | L | T | P | Credit |
|--------------------|---|------|----------|---|---|---|--------|
| Prerequisites | Nil | 4 | OE | 3 | 1 | 0 | 4 |

| | | |
|---|--|-----|
| Preamble | To impart the basic knowledge in linear algebra, decomposition of matrices, continuous optimization, linear regression and support vector machines which provide the foundations for machine learning and deep learning. | |
| Unit - I | Vector Spaces: | 9+3 |
| Definition – Subspaces – Linear dependence and independence – Basis and dimension – Row space, Column space and Null Space – Rank and nullity. | | |
| Unit - II | Linear Transformations: | 9+3 |
| Introduction – Kernel and range – Matrices of linear transformations – Change of basis – Rank and nullity. | | |
| Unit - III | Inner Product Spaces: | 9+3 |
| Norms – Inner products – Length and Distance – Angle and Orthogonality – Orthonormal Basis – Gram-Schmidt Process – QR-Decomposition – Orthogonal Projection – Rotations. | | |
| Unit - IV | Matrix Decomposition and Continuous Optimization: | 9+3 |
| Matrix Decomposition: Cholesky decomposition – Singular Value Decomposition. Continuous Optimization: Introduction Unconstrained Optimization – Gradient Descent method – Constrained Optimization – Lagrange Multipliers method – Convex Optimization. | | |
| Unit - V | Linear regression and Support Vector Machines: | 9+3 |
| Linear Regression: Parameter Estimation – Maximum Likelihood estimation – Bayesian linear regression. Support Vector Machines: Introduction – Linear and Non-linear Support vector machine – Margin and support vectors – Hard and Soft margins in Support vector machines – Kernels – Primal support vector machine – Dual support vector machine. | | |

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

| | |
|----|---|
| 1. | Howard Anton and Chris Rorres, "Elementary Linear Algebra", 11th Edition, John Wiley & Sons, New Delhi, 2014 for Units I, II & III. |
| 2. | M. P. Deisenroth, A. A. Faisal, and C. S. Ong, "Mathematics for Machine Learning", 1 st Edition Cambridge University Press, 2019 for Units IV & V. |

REFERENCES:

| | |
|----|--|
| 1. | David C. Lay, Steven R. Lay, Judith McDonald, "Linear Algebra and its Applications", 5 th Edition, Pearson Education, New Delhi, 2016. |
| 2. | EthemAlpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning series)", 4 th Edition, MIT Press, USA, 2020. |
| 3. | R. O. Duda, E. Hart, and D.G. Stork, "Pattern classification", 2 nd Edition, John Wiley & Sons, 2012. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | | | | | | | | | | | BT Mapped (Highest Level) | | | |
|---|--|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------------------------------|--------------------|------|--|
| CO1 | understand the concepts of vector spaces. | | | | | | | | | | | | Understanding (K2) | | |
| CO2 | apply the concepts of linear mappings in machine learning. | | | | | | | | | | | | Applying (K3) | | |
| CO3 | understand the concept of inner product space and decompose the given matrix by means of orthonormal vectors. | | | | | | | | | | | | Understanding (K2) | | |
| CO4 | apply the knowledge of factorisation of matrices and optimization techniques in clustering and classification of data. | | | | | | | | | | | | Applying (K3) | | |
| CO5 | describe the concepts of parameter estimation and support vector machine. | | | | | | | | | | | | Understanding (K2) | | |
| Mapping of COs with POs and PSOs | | | | | | | | | | | | | | | |
| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | |
| CO1 | 3 | 1 | | | | | | | | | | | | | |
| CO2 | 3 | 1 | | | | | | | | | | | | | |
| CO3 | 3 | 2 | | | | | | | | | | | | | |
| CO4 | 3 | 3 | | 1 | 1 | | | | | | | | | | |
| CO5 | 3 | 2 | | 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 | 10 | 50 | 40 | | | | 100 |
| CAT2 | 10 | 20 | 70 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 5 | 25 | 70 | | | | 100 |

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

**20MAO02 - GRAPH THEORY AND ITS APPLICATIONS**

(Common to all Engineering and Technology branches)

| Programme & Branch | All Engineering and Technology branches | Sem. | Category | L | T | P | Credit |
|--------------------|---|------|----------|---|---|---|--------|
| Prerequisites | Nil | 4 | OE | 3 | 1 | 0 | 4 |

| | | |
|--|---|-----|
| Preamble | To develop rigorous logical thinking and analytical skills by graph theoretic concepts which helps for solving real time engineering problems in networks, computer architecture, compiling techniques, model checking, artificial intelligence, software engineering, expert systems, software/hardware correctness problem. | |
| Unit - I | Graphs: | 9+3 |
| Introduction – Definition – Types of graphs – Degree of vertex – Walk, path and cycle – Isomorphism – Connected graph – Hamiltonian graph – Euler graph – Digraph – Representations of graphs: Adjacency matrix – Incidence matrix. | | |
| Unit - II | Trees: | 9+3 |
| Introduction – Properties of trees – Pendant vertices in a tree – Distances and centers in a tree – Rooted and binary trees – Spanning tree – Construction of spanning tree: BFS algorithm – DFS algorithm – Finding all spanning trees of a graph – Fundamental circuits. | | |
| Unit - III | Graph Coloring: | 9+3 |
| Introduction – Properties of trees – Pendant vertices in a tree – Distances and centers in a tree – Rooted and binary trees – Spanning tree – Construction of spanning tree: BFS algorithm – DFS algorithm – Finding all spanning trees of a graph – Fundamental circuits. | | |
| Unit - IV | Network Flows and Applications: | 9+3 |
| Flows and cuts in networks - Max-flow Min-cut Theorem – Transport networks –Residual capacity and Residual network – Ford-Fulkerson Algorithm – Edmonds-Karp Algorithm – Maximal Flow Applications: Multiple sources and sinks – Maximum Bipartite matching. | | |
| Unit - V | Graph Theoretic Algorithms: | 9+3 |
| Shortest paths – Shortest path algorithms: Dijkstra's algorithm – Warshall's algorithm – The Chinese Postman Problem – Fleury's Algorithm – Travelling salesman problem – Minimum Spanning tree – Minimal spanning tree algorithms: Prim's algorithm – Krushkal's algorithm – Optimal assignment – Kuhn and Munkres algorithm. | | |

Lecture: 45, Tutorial: 15, Total: 60**TEXT BOOK:**

| | |
|----|--|
| 1. | NarsinghDeo, "Graph Theory with Applications to Engineering and Computer Science", 1 st Edition, Dover Publications, New York, 2016, for Units I, II & III. |
| 2. | S. Saha Ray, "Graph Theory with Algorithms and Its Applications in Applied Science and Technology", 1 st Edition, Springer, London, 2013, for Units IV & V. |

REFERENCES:

| | |
|----|--|
| 1. | Douglas B West, "Introduction to Graph Theory", 2 nd Edition, Pearson Education, New Delhi, 2002. |
| 2. | Jonathan L. Gross and Jay Yellen, "Graph Theory and its Applications", 2 nd Edition, CRC Press, New York, 2006. |
| 3. | J.A.Bondy and U.S.R. Murty, "Graph Theory and Applications", 5 th Edition, Elsevier Science Publishing Co., Inc., New York, 1982. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|--|--------------------------------------|
| CO1 | understand basic graph theoretic concepts. | Understanding (K2) |
| CO2 | interpret the concepts the concepts of trees and its types. | Applying (K3) |
| CO3 | compute the Chromatic partition, Chromatic polynomial and Matching of a given graph. | Applying (K3) |
| CO4 | identify the maximal flow in network by means of algorithms. | Applying (K3) |
| CO5 | apply various graph theoretic algorithms to communication and network problems | 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 | 1 | | | | | | | | | | | | |
| CO3 | 3 | 1 | | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | | | | | | | | | | | |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy | | | | | | | | | | | | | | |

| ASSESSMENT PATTERN - THEORY | | | | | | | |
|------------------------------------|--------------------|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
| CAT1 | 10 | 50 | 40 | | | | 100 |
| CAT2 | 10 | 30 | 60 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 10 | 35 | 55 | | | | 100 |

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

**20MAO03 - DATA ANALYTICS USING R PROGRAMMING**

(Common to all Engineering and Technology Branches)

| Programme & Branch | All Engineering and Technology branches | Sem. | Category | L | T | P | Credit |
|--------------------|---|------|----------|---|---|---|--------|
| Prerequisites | Nil | 6 | OE | 3 | 0 | 0 | 3 |

| | | |
|--|---|---|
| Preamble | To impart the basic knowledge in R and develop skills to apply the knowledge of R programming to statistical measures, data handling, probability, testing of hypothesis and design of experiments. | |
| Unit - I | Introduction to R: | 9 |
| Overview of R programming – Need for R – Installing R – Environment setup with R Studio – Packages: Installing packages – Running and manipulating packages – Basic objects: Vectors – Matrix – Array – Lists – Factors – Data frames. | | |
| Unit - II | R Programming Structures and Functions: | 9 |
| Basic expressions: Arithmetic expressions – Control Statements: if and if-else statements — switch statement – Loops: for loop – while loop – Function: Creating a function – calling a function – Default value for function arguments – Logical functions – Math functions – Statistical functions – Apply-family functions – Getting started with strings – Formatting data and time. | | |
| Unit - III | Descriptive Statistics: | 9 |
| Summary command – Summarizing samples – cumulative statistics – summary statistics for data frames – summary tables – Linear Modeling: Simple linear regression – Multiple regression – Curvilinear regression – Plotting linear models and curve fitting. | | |
| Unit - IV | Working with data: | 9 |
| Reading and writing data: Text-format in a file – Excel worksheets – Native data files – built-in datasets. Visualizing data: Scatter plots – line plots – bar charts – pie charts – Cleveland dot charts –Histogram and density plots – Box-whisker plots. | | |
| Unit - V | Probability Distributions, Testing of hypothesis and ANOVA: | 9 |
| Probability Distributions: Binomial Distribution – Poisson Distribution – Normal Distribution. Testing of Hypothesis and ANOVA: Student's t-test – Non-Parametric tests: Wilcoxon U-test – Paired t and U-tests – Correlation and covariance – Tests for association – Analysis of variance: One-way ANOVA – Two-way ANOVA. | | |

Total: 45**TEXT BOOK:**

| | |
|----|--|
| 1. | Kun Ren, "Learning R Programming", 1 st Edition, Packt Publishing Ltd, UK, 2016, for Units I, II. |
| 2. | Mark Gardener, "Beginning R-The Statistical Programming Language", 1 st Edition, John Wiley & Sons Inc., USA, 2012 for Units III, IV & V. |

REFERENCES:

| | |
|----|--|
| 1. | Seema Acharya, "Data Analytics using R", 1 st Edition, McGraw Hill Education, Chennai, 2018. |
| 2. | Norman Matloff, "The Art of R Programming", 1 st Edition, No Starch Press, San Francisco, 2011. |
| 3. | Paul Teetor, "R Cookbook", 1 st Edition, O'Reilly Media, USA, 2011. |



| COURSE OUTCOMES: | | BT Mapped (Highest Level) |
|---|---|--------------------------------------|
| On completion of the course, the students will be able to | | |
| CO1 | understand the basics of fundamentals of R. | Understanding (K2) |
| CO2 | understand the concepts of decision, looping structures and functions. | Understanding (K2) |
| CO3 | apply R programming to descriptive statistics. | Applying (K3) |
| CO4 | apply the libraries for data manipulation and data visualization in R. | Applying (K3) |
| CO5 | use R studio to identify the probability and test statistical hypothesis. | Applying (K3) |

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

| ASSESSMENT PATTERN - THEORY | | | | | | | |
|------------------------------------|--------------------|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
| CAT1 | 10 | 40 | 50 | | | | 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)



20MAO04 - NUMBER THEORY AND CRYPTOGRAPHY
(Common to all Engineering and Technology branches)

| Programme & Branch | All Engineering and Technology branches | Sem. | Category | L | T | P | Credit |
|--------------------|---|------|----------|---|---|---|--------|
| Prerequisites | Nil | 6 | OE | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| Preamble | To provide the skills for applying various number theoretic algorithms, congruences, primality tests in cryptography and network security and impart knowledge of basic cryptographic techniques. | |
| Unit - I | Divisibility Theory and Canonical Decompositions: | 9 |
| Division algorithm- Base-b representations – number patterns – Prime and composite numbers – Fibonacci and Lucas numbers – Fermat numbers – GCD – Euclidean Algorithm – Fundamental theorem of Arithmetic – LCM. | | |
| Unit - II | Theory of Congruences: | 9 |
| Basic concepts – Properties of congruences – Linear congruences – Solution of congruences – Fermat's Little theorem – Euler's theorem – Chinese remainder theorem. | | |
| Unit - III | Number Theoretic Functions: | 9 |
| Introduction – Functions τ and σ – Mobius function – Greatest integer function – Euler's Phi function – Euler's theorem – Properties of Euler's function – Applications to Cryptography. | | |
| Unit - IV | Primality testing and Factorization: | 9 |
| Primality testing: Fermat's pseudo primality test – Solvay-Strassen test – Miller-Rabin test – Fibonacci test – Lucas test – Integer factorization: Trial division – Pollard's Rho method – Quadratic sieve method. | | |
| Unit - V | Classical Cryptographic Techniques: | 9 |
| Introduction – Substitution techniques – Transposition techniques – Encryption and decryption – Symmetric and asymmetric key cryptography – Steganography. | | |

Total: 45

TEXT BOOK:

| | |
|----|---|
| 1. | Thomas Koshy, "Elementary Number Theory with Applications", 2 nd Edition, Academic Press, Elsevier, USA, 2007, for Units I,II,III. |
| 2. | William Stallings, "Cryptography and Network Security: Principles and Practice", 7 th Edition, Pearson Education, New Delhi, 2019, for Units IV,V. |

REFERENCES:

| | |
|----|--|
| 1. | Ivan Niven, Herbert S. Zuckerman, Hugh L. Montgomery, "An Introduction to the Theory of Numbers", Reprint Edition, John Wiley & Sons, New Delhi, 2008. |
| 2. | Bernard Menezes, "Cryptography and Network Security", Cengage Learning India, 1 st Edition, New Delhi, 2010. |



| COURSE OUTCOMES: | | BT Mapped (Highest Level) |
|---|---|--------------------------------------|
| On completion of the course, the students will be able to | | |
| CO1 | understand the concepts of divisibility and canonical decompositions | Understanding (K2) |
| CO2 | obtain the knowledge in theory of congruences and solution of linear congruences. | Understanding (K2) |
| CO3 | use different number theoretic function suitably in cryptography. | Applying (K3) |
| CO4 | apply Primality test and factorisation algorithms to network security problems. | Applying (K3) |
| CO5 | apply the suitable cryptographic techniques to handle real time security issues. | 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 | | | | | | | | | | | | |
| CO2 | 3 | 1 | | | | | | | | | | | | |
| CO3 | 3 | 1 | | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | 2 | | | | | | | | | |
| CO5 | 3 | 2 | 1 | | 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 | 30 | 60 | | | | 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)



20MAO05 -ADVANCED LINEAR ALGEBRA
(Common to all Engineering and Technology branches)

| Programme & Branch | All Engineering and Technology branches | Sem. | Category | L | T | P | Credit |
|--------------------|---|------|----------|---|---|---|--------|
| Prerequisites | Nil | 8 | OE | 3 | 0 | 0 | 3 |

| | | |
|---|---|---|
| Preamble | To provide the skills for solving linear equations, decomposition of matrices and linear transformations in real time engineering problems and impart knowledge of vector spaces. | |
| Unit - I | Linear Equations: | 9 |
| System of linear equations – Row reduction and echelon forms – Vector equations – Matrix equations – Solution sets of linear systems – Applications of Linear systems: Matrix operations – inverse of a matrix, Matrix factorization – Applications to computer graphics. | | |
| Unit - II | Vector Spaces: | 9 |
| Definition – Subspaces – Linear independence – Basis and dimension – Row space, Column space and Null Space – Rank and nullity. | | |
| Unit - III | Inner Product Spaces: | 9 |
| Inner products – Angle and Orthogonality in inner product spaces – Orthonormal Bases – Gram-Schmidt Process – QR-Decomposition – Orthogonal Projection – Least square technique. | | |
| Unit - IV | Linear Transformations: | 9 |
| General linear transformation – Kernel and range – Matrices of linear transformations – Change of basis – Rank and nullity. | | |
| Unit - V | Quadratic form and Matrix Decomposition: | 9 |
| Quadratic forms – Quadratic surfaces – Hermitian, Unitary and Normal matrices – LU decomposition – Singular value decomposition. | | |

Total: 45

TEXT BOOK:

| | |
|----|---|
| 1. | Howard Anton and Chris Rorres, "Elementary Linear Algebra", 11th Edition, John Wiley & Sons, New Delhi, 2014. |
|----|---|

REFERENCES:

| | |
|----|---|
| 1. | David C. Lay, Steven R. Lay, Judith McDonald, "Linear Algebra and its Applications", 5 th Edition, Pearson Education, New Delhi, 2016. |
| 2. | Gareth Williams, "Linear Algebra with Applications", 9 th Edition, Jones & Bartlett Publishers, Canada, 2017. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|--|--------------------------------------|
| CO1 | apply the concepts of matrices and vectors in solving the system of linear equations. | Applying (K3) |
| CO2 | understand the concept of vector spaces. | Understanding (K2) |
| CO3 | apply the concept of inner product spaces in orthogonalization. | Applying (K3) |
| CO4 | apply the concepts of linear transformation to engineering problems | Applying (K3) |
| CO5 | apply the knowledge of quadratic forms and matrix decompositions in practical problems | 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 | 1 | | | | | | | | | | | | |
| CO3 | 3 | 1 | 1 | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 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 | 10 | 20 | 70 | | | | 100 |
| CAT2 | 10 | 40 | 50 | | | | 100 |
| CAT3 | 10 | 20 | 70 | | | | 100 |
| ESE | 10 | 30 | 60 | | | | 100 |

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



20MAO06 - OPTIMIZATION TECHNIQUES
(Common to all Engineering and Technology branches)

| Programme & Branch | All Engineering and Technology branches | Sem. | Category | L | T | P | Credit |
|--------------------|---|------|----------|---|---|---|--------|
| Prerequisites | Nil | 8 | OE | 3 | 0 | 0 | 3 |

| | | |
|---|--|---|
| Preamble | To provide the skills for solving the real time engineering problems involving linear and non-linear problems and also impart knowledge in project management and game theoretic concepts. | |
| Unit - I | Linear Programming: | 9 |
| Introduction – Formulation of Linear Programming Problem – Basic assumptions – Limitations of Linear Programming models – Standard form of LPP – Graphical Method – Simplex Method – Artificial variable techniques – Big M Method. | | |
| Unit - II | Transportation and Assignment problems: | 9 |
| Transportation problem: Mathematical Formulation of Transportation Problem – Initial basic feasible solution – North West Corner Method – Least Cost Method – Vogel's approximation method – Optimal solution – MODI Method – Degeneracy – Unbalanced transportation problem – Maximization transportation problem. Assignment Problem: Mathematical model of Assignment problem – Hungarian Method – Unbalanced assignment problem. | | |
| Unit - III | Theory of Games: | 9 |
| Two-person zero-sum game – Pure strategies - Game with mixed strategies – Rules of Dominance – Solution methods: Algebraic method – Matrix method – Graphical method. | | |
| Unit - IV | Network Scheduling: | 9 |
| Basic Concept of network Scheduling – Construction of network diagram – Critical path method – Programme evaluation and review technique – Project crashing – Time-cost trade-off procedure. | | |
| Unit - V | Non-Linear Programming: | 9 |
| Formulation of non-linear programming problem – Constrained optimization with equality constraints – Kuhn-Tucker conditions – Constrained optimization with inequality constraints. | | |

Total: 45

TEXT BOOK:

| | |
|----|---|
| 1. | Hamdy A. Taha, "Operations Research: An Introduction", 10 th Edition, Dorling Kindersley, Pvt. Ltd, Uttar Pradesh, 2016. |
|----|---|

REFERENCES:

| | |
|----|--|
| 1. | Sharma J.K, "Operations Research – Theory and Applications", 4 th Edition, Macmillan Publishers India Ltd, New Delhi, 2009. |
| 2. | Gupta P.K. and Hira D.S., "Operations Research: An Introduction", 6 th Edition, S.Chand and Co. Ltd., New Delhi, 2008. |
| 3. | KantiSwarup, Gupta P.K. and Man Mohan, "Operation Research", 14 th Edition, Sultan Chand & Sons, New Delhi, 2014. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|---|--------------------------------------|
| CO1 | solve linear programming problems. | Applying (K3) |
| CO2 | apply transportation algorithms in engineering problems | Applying (K3) |
| CO3 | use assignment and game theory concepts in practical situations | Applying (K3) |
| CO4 | handle the problems of Project Management using CPM and PERT | Applying (K3) |
| CO5 | solve various types of Non-linear Programming problems | 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 | 1 | 1 | | | | | | | | | | | |
| CO3 | 3 | 1 | | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | | | | | | | | | | | |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy | | | | | | | | | | | | | | |

| ASSESSMENT PATTERN - THEORY | | | | | | | |
|------------------------------------|--------------------|----------------------|-----------------|------------------|-------------------|-----------------|---------|
| Test / Bloom's Category* | Remembering (K1) % | Understanding (K2) % | Applying (K3) % | Analyzing (K4) % | Evaluating (K5) % | Creating (K6) % | Total % |
| CAT1 | 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)



20PHO01 - THIN FILM TECHNOLOGY
(Common to all Engineering and Technology branches)

| Programme & Branch | All BE / BTech Branches | Sem. | Category | L | T | P | Credit |
|--------------------|-------------------------|------|----------|---|---|---|--------|
| Prerequisites | Nil | 4 | OE | 3 | 1 | 0 | 4 |

| | | |
|--|---|------------|
| Preamble | This course aims to impart the essential knowledge on deposition, characterization and application of thin films in various engineering fields, and also provides motivation towards innovations. | |
| Unit - I | Theories and models of thin film growth: | 9+3 |
| Introduction - Theories of thin film nucleation: Impingement, Adsorption and Thermal accommodation - The capillarity model - The atomistic models - Structural consequences of thin film nucleation - The four stages of film Growth - The incorporation of defects during growth. | | |
| Unit - II | Vacuum technology: | 9+3 |
| Principle and working of vacuum pumps: Roots vacuum pump, Rotary pump, Diffusion pump, Turbo molecular pump, Cryogenic pump, Ion pump, Ti-sublimation pump - Measurement of Pressure: Bayet-Albert gauge, Pirani and Penning gauge - Cold cathode and hot cathode ionization gauges - Pressure controlling system (qualitative). | | |
| Unit - III | Deposition of thin films - Physical methods: | 9+3 |
| Thermal evaporation – Electron beam evaporation – Pulsed laser deposition – Ion plating – DC sputtering – RF sputtering – Magnetron sputtering – Reactive sputtering - Molecular beam epitaxy - Demonstration of deposition of thin films by RF sputtering. | | |
| Unit - IV | Deposition of thin films – Chemical methods: | 9+3 |
| Chemical vapor deposition – Sol-gel method - Chemical bath deposition - Hydro thermal methods – Electroplating deposition - Electroless deposition - Spray Pyrolysis - Spin coating. | | |
| Unit - V | Characterization and Applications of thin films: | 9+3 |
| Characterization: X-ray diffraction, Energy dispersive X-ray analysis, Atomic probe microscopy, Scanning Tunneling Microscope, X-ray Photoemission Spectroscopy, UV-vis spectroscopy and Four probe resistivity – Applications (qualitative): Thin film solar cells, Thin film gas sensors, Thin films for information storage and Optical coatings. | | |

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

| | |
|----|---|
| 1. | Maissel L.I. and Glang R, Hand book of Thin Film Technology, Reprint, McGraw Hill Inc., New York, 1970 for Units I, II, III & IV. |
| 2 | Sam Zhang, Lin Li and Ashok Kumar, Materials Characterization Techniques, 1 st edition, CRC Press, Boca Raton, 2008, for Unit V. |

REFERENCES:

| | |
|----|--|
| 1. | Ohring M, Material Science of Thin Films, 2nd Edition, Academic Press, New Jersey, 2001 |
| 2. | Goswami A, Thin Film Fundamentals, Reprint, New Age International (P) Ltd, New Delhi, 2003 |
| 3. | Chopra K. L, Thin Film Phenomena, Illustrated, McGraw Hill Inc., New York, 1969 |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|--|--------------------------------------|
| CO1 | Utilize the appropriate theory and models to comprehend the thin film growth process. | Applying (K3) |
| CO2 | Apply the principle of vacuum pump to explain select methods to create vacuum and to make use of the principle of vacuum gauge to explain the measurement of vacuum by select methods. | Applying (K3) |
| CO3 | Describe the deposition of thin films by select physical methods using the principle of working of respective methods. | Applying (K3) |
| CO4 | Explain the deposition of thin films by select chemical methods using the principle of working of respective methods. | Applying (K3) |
| CO5 | Make use of select characterization techniques to comprehend the properties of thin films and also to illustrate the various device applications of thin films. | Applying (K3) |

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

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

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



20PHO02- HIGH ENERGY STORAGE DEVICES
(Common to all Engineering and Technology branches)

| Programme & Branch | All BE / BTech Branches | Sem. | Category | L | T | P | Credit |
|--------------------|-------------------------|------|----------|---|---|---|--------|
| Prerequisites | Nil | 5 | OE | 3 | 1 | 0 | 4 |

| | |
|----------|--|
| Preamble | This course aims to impart the essential knowledge on the fundamental principles and application areas of proven technologies and materials for energy storage solutions, together with an overview of development trends in this engineering field. |
|----------|--|

| | | |
|-----------------|--|------------|
| Unit - I | Introduction to Energy Storage: | 9+3 |
|-----------------|--|------------|

An overview of energy storage systems (qualitative): Thermal Energy Storage, Mechanical Energy Storage, Chemical Energy Storage, Electrical Energy Storage, Electrochemical Energy Storage, Electrostatic Energy Storage, Magnetic Energy Storage and Optical Energy Storage – General criteria of energy storage systems - Conventional batteries: fundamentals and applications - Grid connected and Off grid energy storage systems and requirements.

| | | |
|------------------|--|------------|
| Unit - II | Thermal storage and Mechanical Storage: | 9+3 |
|------------------|--|------------|

Thermal storage: Thermal properties of materials, Principle of operations, Efficiency factors, Large scale and Medium scale operations - Merits and demerits of thermal storage system - Recent development in thermal storage systems. Mechanical Storage: Types of mechanical storage systems, Principle of operations, Emerging advances and technologies in mechanical storage systems - Flywheel.

| | | |
|-------------------|---|------------|
| Unit - III | Magnetic storage, Electro-optic and Optical storage: | 9+3 |
|-------------------|---|------------|

Magnetic storage: Principle of operation, Emerging challenges and a review on devices and technology. Electro-optic and Optical storage: Principles of operation, Device fabrication, Emerging devices and Upcoming technologies.

| | | |
|------------------|---------------------------------|------------|
| Unit - IV | Electrochemical Storage: | 9+3 |
|------------------|---------------------------------|------------|

Materials, Principle of Operation, Positive electrode materials, negative electrode materials, electrolytes. Li-ion batteries: Principle of operation, Battery components, design of Electrodes, Cell and battery fabrications - Building block cells - Battery modules and packs - Li-polymer batteries – Applications - Future developments: Sodium-battery, Magnesium battery, Aluminum battery and Silicon battery.

| | | |
|-----------------|---|------------|
| Unit - V | Fuel Cells, Hydrogen storage and Super capacitors: | 9+3 |
|-----------------|---|------------|

Fuel Cells: Introduction to fuel cells, PEM (polymer electrolyte membrane), Hydrogen PEM fuel cell, Direct Methanol fuel cell, Alkaline fuel cells and Solid oxide fuel cells. Hydrogen storage systems: Solid state hydrogen storage tanks, Gas phase hydrogen storage tanks, Cryogenic hydrogen storage tanks, and Liquid phase hydrogen storage tanks. Super capacitors: Features of super capacitors, Basic principle of operation, Performance and technologies of super capacitors.

Lecture: 45, Tutorial: 15, Total: 60

TEXT BOOK:

| | |
|----|--|
| 1. | Robert A. Huggins, Energy Storage, Springer, 2010, (Unit I – V) |
| 2 | Ehsani, Y. Gao, S. Gay, A. Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles, CRC Press, New York, 2005 (Unit 1- V) |

REFERENCES:

| | |
|----|---|
| 1. | Yuping Wu, Lithium-Ion Batteries: Fundamentals and Applications(Electrochemical Energy Storage and Conversion), CRC Press, United Kingdom, 2015 |
| 2. | Trevor M. Letcher, Storing Energy: with Special Reference to Renewable Energy Sources, Elsevier, 2016 |
| 3. | D. Linden and T. S. Reddy, Handbook of Batteries, McGraw Hill, Newyork, 2002 |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|--|--------------------------------------|
| CO1 | Utilize the appropriate concepts and models to comprehend the basics of energy storage systems. | Applying (K3) |
| CO2 | Apply the principle of thermal and mechanical storage systems to explain the working and the recent advancements in thermal and mechanical storage systems. | Applying (K3) |
| CO3 | Utilize the principle of operation of magnetic storage systems, electro-optic and optical storage systems to illustrate the respective device fabrication techniques. | Applying (K3) |
| CO4 | Explain the principle of operation of electrochemical storage device and materials used, and to elucidate the construction and working of various types of high energy storage batteries. | Applying (K3) |
| CO5 | Make use of various techniques to construct different types of fuel cells and to explain the advanced techniques involved in hydrogen storage systems and also to explain the principle and working of super capacitors. | Applying (K3) |

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

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

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



20PHO03 - STRUCTURAL AND OPTICAL CHARACTERIZATION OF MATERIALS
(Common to all Engineering and Technology branches)

| | | | | | | | |
|-------------------------------|--------------------------------|-------------|-----------------|----------|----------|----------|---------------|
| Programme & Branch | All BE / BTech Branches | Sem. | Category | L | T | P | Credit |
| Prerequisites | Nil | 6 | OE | 3 | 0 | 0 | 3 |

| | | |
|---|--|---|
| Preamble | This course aims to impart the essential knowledge on the characterization of materials using X-ray diffraction, Raman spectroscopy, UV-visible spectroscopy, Electron microscopy and Scanning tunneling microscopy and their application in various engineering fields, and also provides motivation towards innovations. | |
| Unit - I | Introduction to Characterization Techniques and X-Ray Diffraction: | 9 |
| Importance of materials characterization - Classification of characterization techniques - Crystalline materials - Reciprocal lattice - Theory of X-ray diffraction - Powder and Single crystal X-ray diffraction: Instrumentation (qualitative), XRD pattern, Systematic procedure for structure determination (qualitative), Crystallite size determination, Strain calculation - Applications of X ray diffraction measurements. | | |
| Unit - II | Electron Microscopy: | 9 |
| Need of electron microscopy - Electron specimen interaction: Emission of secondary electrons, Backscattered electrons, Characteristic X-rays, Transmitted electrons, Specimen interaction volume - Resolution - Scanning electron microscope and Transmission electron microscope: Schematic diagram, Short details of each component and working – Field emission scanning electron microscope – Different types of filaments - Wavelength dispersive x-ray analysis – Three parameter equation for quantitative composition analysis. | | |
| Unit - III | Scanning Tunneling Microscopy: | 9 |
| Introduction to quantum mechanical tunneling - Basic principles of scanning tunneling microscopy - Two modes of scanning - Interpreting scanning tunneling microscopic images -Applications of scanning tunneling microscopy. | | |
| Unit - IV | Raman Spectroscopy: | 9 |
| Introduction – Pure rotational Raman spectra – Vibrational Raman spectra – Polarization of light and Raman effect – Structure determination – Instrumentation – Near-Infra-Red FT Raman Spectroscopy. | | |
| Unit - V | Ultra Violet &Visible Spectroscopy: | 9 |
| Regions of UV-Visible radiation - Colour and light absorption - The chromophore concept - Beer's and Lambert's laws – Theory of electronic transition - Frank Condon principle – Instrumentation and Working of UV vis spectrometer - Applications of UV visible spectroscopy. | | |

Total: 45**TEXT BOOK:**

| | |
|----|---|
| 1. | Cullity B. D. and Stock S. R, Elements of X-ray diffraction, 3 rd Edition, Pearson Education, India, 2003 (Unit I) |
| 2 | Banwell C. N, McCash E. M, Choudhury H. K, Fundamentals of Molecular Spectroscopy, 5 th Edition, Tata McGraw-Hill Publ., New Delhi, 2013 (Unit II-V) |

REFERENCES:

| | |
|----|---|
| 1. | Holt D. B. and Joy D. C, SEM micro characterization of semiconductors, 1 st Edition, Academic Press, New Delhi, 1989 |
| 2. | Willard H. H., Merritt L. L., John A Dean, and Settle Jr. F. A, Instrumental methods of Analysis 7 th Edition, Wadsworth Publishing Company, United States, 1988 |
| 3. | Elton N. Kaufman, Characterization of Materials (Volume1&2), 2 nd , Wiley-Interscience, New Jersey, 2012 |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|---|--------------------------------------|
| CO1 | Apply the concept of X-ray diffraction to determine the crystal structure and related structural parameters of materials. | Applying (K3) |
| CO2 | Determine the micro-structural parameters of materials and to perform surface analysis of materials using the concept of matter waves and electron microscopy. | Applying (K3) |
| CO3 | Utilize the concept and phenomenon of quantum mechanical tunneling to interpret the surface image recorded at atomic level using scanning tunneling microscopy. | Applying (K3) |
| CO4 | Make use of the concept of Raman effect and Raman spectroscopy to determine the crystal structure and related structural parameters of materials. | Applying (K3) |
| CO5 | Apply the theory of UV-Vis spectroscopy to comprehend the working of UV-Vis spectrophotometer. | 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 | 25 | 35 | 40 | | | | 100 |
| CAT3 | 30 | 30 | 40 | | | | 100 |
| ESE | 20 | 40 | 40 | | | | 100 |

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

**20CYO01 - INSTRUMENTAL METHODS OF ANALYSIS**

(Common to all Engineering and Technology branches)

| Programme & Branch | All BE / BTech Branches | Sem. | Category | L | T | P | Credit |
|--------------------|-------------------------|------|----------|---|---|---|--------|
| Prerequisites | Nil | 4 | OE | 3 | 1 | 0 | 4 |

| | | |
|--|--|------------|
| Preamble | Instrumental methods of analysis aim to prepare the students to have all-encompassing knowledge of spectral methods in order to identify the molecules and reaction mechanism for the process to enhance application towards the industries. | |
| Unit - I | Absorption and Emission Spectroscopy: | 9+3 |
| Basic concepts of Absorption and Emission Spectroscopy – representation of spectra – basic elements of practical spectroscopy – signal to noise ratio - techniques for signal to noise enhancement – resolving power – Fourier transform spectroscopy – evaluation of results – basic principles, instrumentation and applications of Atomic Absorption, Atomic Fluorescence and Atomic Emission Spectroscopy. | | |
| Unit - II | IR, Raman, and NMR Spectroscopy: | 9+3 |
| Infrared spectroscopy – correlation of IR Spectra with molecular structure, instrumentation, samplings technique and quantitative analysis. Raman Spectroscopy – Classical and Quantum theory instrumentation, Structural analysis and quantitative analysis. Nuclear magnetic resonance spectroscopy – basic principles – pulsed Fourier transform NMR spectrometer – elucidation of NMR spectra and quantitative analysis. | | |
| Unit - III | Surface Studies: | 9+3 |
| Surface Study – X-Ray Emission Spectroscopy (XES), X- Ray Photo Electron Spectroscopy (XPS) - Auger Emission Spectroscopy (AES) - Transmission Electron Microscopy (TEM) - Scanning Electron Microscopy (SEM) - Surface Tunneling Microscopy (STEM) - Atomic Force Microscopy (AFM). | | |
| Unit - IV | Mass spectroscopy: | 9+3 |
| Mass spectroscopy – Ionization methods in mass spectroscopy – mass analyzer – ion collection systems - correlation of molecular spectra with molecular structure. Instrumentation design and application of Fourier transform mass spectroscopy (FT-MS) and Ion microprobe mass analyzer (IMMA). | | |
| Unit - V | Thermal analysis: | 9+3 |
| Thermal analysis: principles and instrumentations and applications of thermogravimetry (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC), evolved gas detection, thermo mechanical analysis and Thermometric titration. | | |

Lecture: 45, Tutorial: 15, Total: 60**TEXT BOOK:**

| | |
|----|---|
| 1. | Chatwal. G. R., Anand, Sham K., "Instrumental Methods of Chemical Analysis" 5th Edition, Himalaya Publishing House, 2019. |
|----|---|

REFERENCES:

| | |
|----|---|
| 1. | B.K. Sharma, Instrumental Method of Chemical Analysis, Krishna Prakashan Media (P) Ltd. 2019. |
| 2. | Willard, H.H, Merritt, L.L, Dean, J.A, and Settle, F.A, "Instrumental methods of analysis" CBS Publishers & Distributors, 7 Ed, 2004. |
| 3. | Kaur. H, "Instrumental Methods of Chemical Analysis", XII Edition, Pragati prakashan, Meerat, 2018. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|--|--------------------------------------|
| CO1 | illustrate the basics of spectroscopy to understand the instrumentation of various spectral techniques | Understanding (K2) |
| CO2 | apply the IR, Raman and NMR for quantitative analysis of the sample. | Applying (K3) |
| CO3 | apply the various techniques for the better understanding of surface morphology | Applying (K3) |
| CO4 | explain the principle, instrumentation of mass spectroscopy for the analysis of organic sample | Understanding (K2) |
| CO5 | illustrate the thermal analysis for the identification of thermal stability of the compounds | Understanding (K2) |

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

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

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

**20CYO02 - CORROSION SCIENCE AND ENGINEERING**

(Common to all Engineering and Technology branches)

| Programme & Branch | All BE/BTech Branches | Sem. | Category | L | T | P | Credit |
|--------------------|-----------------------|------|----------|---|---|---|--------|
| Prerequisites | Nil | 5 | OE | 3 | 1 | 0 | 4 |

| | | |
|---|--|-----|
| Preamble | Corrosion science and engineering aims to equip the students to have a wide-range knowledge of corrosion and prevention methods in order to meet the industrial needs. | |
| Unit – I | Corrosion and its Units | 9+3 |
| Localized corrosion: electro chemical mechanism Vs. chemical mechanism - emf Series and Galvanic series – Galvanic Corrosion – Area effect in anodic and cathodic metal coatings – prediction using emf Series and Galvanic series - pilling Bedworth's ratio and its consequences (Problems) – units corrosion rate – mdd (milligrams per square decimeter per day), mmpy (Millie miles per year) and mpy (Mils per year) – Importance of corrosion prevention in various industries: direct and indirect effects of corrosion | | |
| Unit - II | Thermodynamics of corrosion | 9+3 |
| Electrode Potentials, Electrical Double Layer, Gouy–Chapman Model, Stern Model, Bockris – Devanathan–Müller Model - Free energy and oxidation potential criterion of corrosion (Problems) - Basis of Pourbaix Diagrams - Pourbaix diagrams of Water, Magnesium, Aluminium and Iron – Their and limitations–Methods of Determining Corrosion Rates - Weight Loss Method, Weight Gain Method and Chemical Analysis of Solution. | | |
| Unit - III | Types of Corrosion | 9+3 |
| Introduction - (i) Crevice - differential aeration corrosion, (ii) pitting – mechanism, factors (iii) intergranular- chromium depletion theory, weld decay and knife line attack, (iv) stress - SCC mechanism, and fatigue- Cavitation damage – Fretting damage, (v) stray current corrosion - causes and its control. | | |
| Unit - IV | Kinetics of Corrosion | 9+3 |
| Electrochemical Polarization – Evan's diagram – Activation polarization – Concentration polarization - Mixed potential theory(Wagner and Traud) – application of mixed potential theory – effect of Metal in acid solution – Cathodic protection of iron in acid solution – effect of cathodic reaction – effect of cathodic area – Passivity – Flade potential – Theories of Passivity - Adsorption theory – Oxide film theory – Film sequence theory. | | |
| Unit – V | Prevention of Corrosion | 9+3 |
| Inhibitors – types of inhibitors, chemisorption of inhibitors, effect of concentration, effect of molecular structure, V.P. inhibitors – Prevention of corrosion at the design stage and in service conditions – control of catastrophic oxidation and Hydrogen disease – Langelier saturation Index and its uses - Corrosion prevention by surface coatings – Phosphating and its uses -Principles and procedures of cathodic protection: Sacrificial anodes and external cathodic current impression | | |

Lecture: 45, Tutorial: 15, Total: 60**TEXT BOOK:**

| | |
|----|--|
| 1. | E. McCafferty, Introduction to Corrosion Science, 2 nd Edition, Springer, 2017. |
|----|--|

REFERENCES:

| | |
|----|--|
| 1. | R. Winston, Corrosion and Corrosion Control: An Introduction to Corrosion Science and Engineering, Revie 4 th Edition, Wiley publisher, 2008. |
| 2. | Fontanna, "Corrosion Engineering", (Materials Science and Metallurgy series), McGraw Hill international Ed., 2005. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|--|--------------------------------------|
| CO1 | illustrate the mechanism, expression of rate of corrosion and importance of corrosion studies to familiarize for industrial needs. | Understanding (K2) |
| CO2 | demonstrate the thermodynamics and kinetics of different models of corrosion with respect to the environment | Applying (K3) |
| CO3 | organize the various types of corrosion to understand the corrosion problems | Applying (K3) |
| CO4 | utilize the theories corrosion to interpret with the real time applications | Applying (K3) |
| CO5 | summarize the corrosion prevention methods to avoid corrosion related issues | Understanding (K2) |

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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



**20CYO03 - CHEMISTRY OF COSMETICS IN DAILY LIFE**

(Common to all Engineering and Technology branches)

| Programme& Branch | All BE/BTech Branches | Sem. | Category | L | T | P | Credit |
|-------------------|-----------------------|------|----------|---|---|---|--------|
| Prerequisites | Nil | 5 | OE | 3 | 1 | 0 | 4 |

| | | |
|--|---|-----|
| Preamble | This course aims to provide knowledge for engineering students on chemistry of cosmetics. | |
| Unit 1 | Formulation of Cosmetic Product | 9+3 |
| Introduction - basic sciences of cleansing – Surfactant and adsorption, Surfactant Micelles, Surfactants and Cleansing, Surfactants and Foam (foam formation, stability, drainage, Rupture and Collapse and defoaming) - Polymers in Cosmetics - Polymer Solubility and Compatibility, polymer conformation - Basics of Dispersions - Electrical Charges Associated With Surfaces and Barriers – Basics of emulsion (stability, Ostwald Ripening, Prevention of Creaming and Sedimentation). | | |
| Unit 2 | Structuring Materials for cosmetics | 9+3 |
| Introduction - Water/Hydrophilic Base Materials, Oleaginous/Hydrophobic Base Materials and Amphiphilic Substances - Adding Functions and Effects - Materials That Add or Improve Functional Value, Emotional Value and Materials for Quality Control - Precautions on Cosmetic Ingredients - Future Challenges in Cosmetics Material Development. | | |
| Unit 3 | Polymers in Cosmetic Products | 9+3 |
| Polymers that modify surfaces - Film-forming polymers in cosmetics and personal care products - Hair-conditioning polymers - Polymers for the treatment of skin - Polymers as controlled release matrices - Dendritic polymers - Polymeric antimicrobials and bacteriostats. | | |
| Unit 4 | Powders and Fragrance in Cosmetics | 9+3 |
| Inorganic Pigments – extender pigment, coloured pigment, white pigment, pearlescent Pigments – organic pigments - extender pigment, coloured pigment. Fragrance – Introduction – natural products – aroma chemicals - fragrance creation and duplication - fragrance applications - encapsulation and controlled release – malodor - natural, green, organic, and sustainable fragrances. | | |
| Unit 5 | Preparation of Cosmetics | 9+3 |
| Brief introduction of the following cosmetic preparation and a detailed study on their quality control: shampoo, tooth paste, skin powder, skin creams, hair creams, nail polish, after shave lotion, bath and toiletries, lipstick and hair dyes, perfumes, depilatories. | | |

Lecture: 45, Tutorial: 15, Total: 60**TEXT BOOK:**

| | |
|----|---|
| 1. | Kazutami Sakamoto, Robert Y. Lochhead, Howard I. Maibach, Yuji Yamashita, Cosmetic Science and Technology: Theoretical Principles and Applications, Elsevier, 2017, for Units- I, II, III, IV, V. |
| 2. | Gaurav Kumar Sharma, JayeshGadiya, MeenakshiDhanawat A text book of cosmetic formulation, 2018, for Unit V. |

REFERENCES:

| | |
|----|--|
| 1. | R.K. Nema, K.S. Rathore , B.K. Dubey, Textbook of Cosmetics, CBS Publishers and Distributors, 2017. |
| 2. | Bruno Burlando, Elisa Bottini-Massa, LuisellaVerotta, Laura Cornara, Herbal Principles in Cosmetics: Properties and Mechanisms of Action, CRC Press, 2010. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|---|--------------------------------------|
| CO1 | outline the formulation of cosmetics products | Understanding (K2) |
| CO2 | identify the structuring materials form cosmetics | Applying (K3) |
| CO3 | interpret the polymers in cosmetics | Understanding (K2) |
| CO4 | develop knowledge about Powders and Fragrance in Cosmetics | Applying (K3) |
| CO5 | apply the preparation methodology of cosmetics to explain the preparation and quality control of different cosmetic products used in day to day life. | Applying (K3) |

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

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

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

**20CYO04 - CHEMISTRY OF NUTRITION FOR WOMEN HEALTH**

(Common to all Engineering and Technology branches)

| Programme& Branch | All BE/BTech Branches | Sem. | Category | L | T | P | Credit |
|-------------------|-----------------------|------|----------|---|---|---|--------|
| Prerequisites | Nil | 5 | OE | 3 | 1 | 0 | 4 |

| | | | | | | | |
|----------|--|--|--|--|--|--|--|
| Preamble | This course aims to provide knowledge for engineering students on components of health and fitness and the role of nutrition for women health. | | | | | | |
|----------|--|--|--|--|--|--|--|

| | | |
|-----------------|------------------|------------|
| Unit - I | Nutrition | 9+3 |
|-----------------|------------------|------------|

Energy- Functions, sources and concept of energy balance, Functions, Recommended Dietary Allowances, dietary sources, effects of deficiency and/ or excess consumption on health of the following nutrients: • Carbohydrates and dietary fibre, Lipids, Proteins, Fat soluble vitamins-A, D,E and K, Water soluble vitamins – Thiamin, Riboflavin, Niacin, Pyridoxine, Folate, Vitamin B12 and Vitamin C, Minerals – Calcium, Iron, Zinc and Iodine

| | | |
|------------------|--|------------|
| Unit - II | Role of women in national development | 9+3 |
|------------------|--|------------|

Women in family and community: Demographic changes menarche, marriage, fertility, morbidity, mortality, life expectancy, sex ratio, aging, widowhood. Women in society: Women's role, their resources, and contribution to family, and effect of nutritional status.

| | | |
|-------------------|-------------------------|------------|
| Unit - III | Women and health | 9+3 |
|-------------------|-------------------------|------------|

Disease pattern and reproductive health- Menopause – Hypothyroid- PCOD-Diabetes - Policies and programs for promoting maternal and child nutrition and health - Concept of small family - Methods of family planning - Merits and demerits.

| | | |
|------------------|---|------------|
| Unit - IV | Nutrition during Lactation and for Infants | 9+3 |
|------------------|---|------------|

Physiology and psychology of lactation, hormonal control, composition of colostrums and breast milk, nutritional requirements of a nursing mother, advantages of breast feeding, food and nutritional requirements for infants, weaning and supplementary foods for infants and immunization.

| | | |
|-----------------|---------------------------------------|------------|
| Unit - V | Physical fitness and nutrition | 9+3 |
|-----------------|---------------------------------------|------------|

Significance of physical fitness and nutrition in the prevention and management of weight control, obesity, diabetes mellitus, CV disorders, bone health and cancer - Nutrition and exercise regimes for pre and postnatal fitness - Nutritional and exercise regimes for management of obesity - Critical review of various dietary regimes for weight and fat reduction. Prevention of weight cycling.

Lecture:45,Tutorial:15, Total: 60**TEXT BOOK:**

| | |
|----|---|
| 1. | Srilakshmi, B., Nutrition Science, New Age International (P) Ltd., New Delhi, 2017 for Units- I, IV, V. |
| 2. | Arpita Verma, Women's Health and Nutrition: Role of State and Voluntary Organizations, Rawat Publishers, 2017, for Units II, III, IV. |

REFERENCES:

| | |
|----|--|
| 1. | Shubhangini A Joshi , Nutrition and Dietetics, TataMacGraw Hill, 2010. |
| 2. | Rujuta Diwekar, Women and The Weight Loss Tamasha, Westland Ltd, 2010. |
| 3. | Swaminathan, M., Advanced Textbook on Food and Nutrition, Vol. 1, Second Edition, Bangalore Printing and Publishing Co. Ltd., Bangalore, 2012. |



| COURSE OUTCOMES: | | BT Mapped (Highest Level) |
|---|---|--------------------------------------|
| On completion of the course, the students will be able to | | |
| CO1 | Make use of the knowledge of dietary sources in day to day life | Applying (K3) |
| CO2 | Interpret the various role of women in society | Understanding (K2) |
| CO3 | Explain the disease pattern and policies towards women health | Understanding (K2) |
| CO4 | Develop knowledge about nutrition during lactation and for infants | Applying (K3) |
| CO5 | Utilize the knowledge of physical fitness and nutrition towards achieving a good health | 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 | 1 | | | | | | | | | | | | |
| CO3 | 3 | 1 | | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | | | | | | | | | | | |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy | | | | | | | | | | | | | | |

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

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

**20CYO05 - CHEMISTRY CONCEPTS FOR COMPETITIVE EXAMINATIONS**

(Common to all Engineering and Technology branches)

| Programme & Branch | All BE/BTech Branches | Sem. | Category | L | T | P | Credit |
|--------------------|-----------------------|------|----------|---|---|---|--------|
| Prerequisites | Nil | 6 | OE | 3 | 0 | 0 | 3 |

| | | | | | | | |
|----------|---|--|--|--|--|--|--|
| Preamble | This course aims to refresh the knowledge of chemistry required for competitive examinations and equip the students with a capacity to solve the problems in chemistry while participating various competitive examinations including TNFUSRC-FORESTER (paper-II: General science-chemistry), UPSC-IAS (prelims: General science-chemistry), GATE (thermodynamics concept for chemical & mechanical engineering). | | | | | | |
|----------|---|--|--|--|--|--|--|

| | | |
|-----------------|---|----------|
| Unit – I | Periodic Classification of Elements: | 9 |
|-----------------|---|----------|

Mendeleev's periodic table-Law and classification of elements- Modern periodic law-Modern periodic table and its characteristics - Periodic properties – important aspects of s, p & d block elements -Reactivity series and Uses - Alloys-Uses of Alloys- Properties of nano metals and oxides.

| | | |
|------------------|--|----------|
| Unit – II | Chemical Equations and Bonding: | 9 |
|------------------|--|----------|

Chemical Equations: Types of ions and radicals- oxidation and reduction-redox reactions - Balancing ionic equations.
Chemical Bonding: Octet rule -Types of Chemical bond -Formation of Ionic and Covalent bond- Common Properties of ionic and covalent compounds- Differences between Ionic and covalent Compounds-Coordinate covalent bond- Coordination compounds – nomenclature and isomerism. Application in analytical chemistry.

| | | |
|-------------------|--|----------|
| Unit – III | Acids, Bases, Salts and Metallurgy: | 9 |
|-------------------|--|----------|

Acid- base theory – Bronsted- Lowry theory- conjugate acid-base- Lewis concept- HSAB- applications- pH scale- Importance of pH in everyday life-Salts-Classification of salts-Uses of salts.

Metallurgy: Introduction-Terminologies in metallurgy-Differences between Minerals and Ores-Occurrence of metals- Metallurgy of Aluminum, Copper and Iron.

| | | |
|------------------|----------------------------------|----------|
| Unit – IV | Carbon and its Compounds: | 9 |
|------------------|----------------------------------|----------|

Introduction-Compounds of carbon-Modern definition of organic chemistry- Bonding in carbon and its compounds-Allotropy-Physical nature of carbon and its compounds-Chemical properties of carbon compounds-Homologous Series-Hydrocarbons and their Types- Functional groups- Classification of organic compounds based on functional group-Ethanol-Ethanoic acid.

| | | |
|-----------------|------------------------|----------|
| Unit – V | Thermodynamics: | 9 |
|-----------------|------------------------|----------|

Introduction- Some important terms in thermodynamics-thermodynamic system, process, properties and energy- First law of thermodynamics: Mathematical expression and interpretation- Applications of First law of thermodynamics-Molar heat capacity-Reversible isothermal expansion/compression of an ideal gas-Adiabatic expansion of an ideal gas-Isobaric and Isochoric Processes in Ideal Gases- Second laws of thermodynamics: Entropy- Entropy change for isolated system (system and surroundings)- Entropy change for system only (Ideal Gas)- Entropy change for mixing of ideal gases-Entropy of physical changes- Entropy of chemical changes-Maxwell Relations.

Total: 45**TEXT BOOK:**

| | |
|----|---|
| 1. | Steven S. Zumdahl, Susan A. Zumdahl and Donald J. DeCoste , “Chemistry”, 10th Edition, Cengage Learning, 2018, for Units-I, II, III, IV. |
| 2. | Wiley editorial board. "Wiley Engineering Chemistry". 2 nd Edition, Wiley India Pvt. Ltd, New Delhi, Reprint 2019, for Units- I, II, III, V. |

REFERENCES:

| | |
|----|---|
| 1. | B.R. Puri, L.R. Sharma, Principles of Inorganic Chemistry, 33 rd Edition, Vishal Publishing Co., 2020. |
| 2. | Paula Bruise, “Organic Chemistry”, 6th Edition, 8 th Edition, Pearson Education, 2020. |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | BT Mapped (Highest Level) |
|--|---|--------------------------------------|
| CO1 | apply the basic concept of periodic classification of elements to explain the periodic properties and reactivity series of s, p & d block elements. | Applying (K3) |
| CO2 | utilize the concepts of chemical equation and bonding to solve the problems in balancing ionic equation and differentiate ionic and covalent compounds. | Applying (K3) |
| CO3 | apply the concept of acid, base, salts and metallurgy to explain HSAB concepts, Importance of pH in everyday life, classification of salts and metallurgy of Al, Cu & Fe. | Applying (K3) |
| CO4 | make use of the concept of carbon its compounds to explain bonding and classification of carbon compounds. | Applying (K3) |
| CO5 | utilize the important terms and concepts of thermodynamics to explain the first law and second law of thermodynamics with examples. | Applying (K3) |

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

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

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

**20CYO06 - WASTE AND HAZARDOUS WASTE MANAGEMENT**

(Common to all Engineering and Technology branches)

| Programme & Branch | All BE/BTech Branches | Sem. | Category | L | T | P | Credit |
|--------------------|-----------------------|------|----------|---|---|---|--------|
| Prerequisites | Nil | 6 | OE | 3 | 0 | 0 | 3 |

| | |
|----------|--|
| Preamble | Waste and Hazardous waste management aims to equip the students to have a wide-range of knowledge on waste management. |
|----------|--|

| | | |
|-----------------|-------------------------------|----------|
| Unit - I | SOLID WASTE MANAGEMENT | 9 |
|-----------------|-------------------------------|----------|

Solid wastes: definition, sources, types, composition of solid waste- Solid waste management system: collection, separation, processing and transformation of solid waste – combustion, aerobic composting, vermicomposting, pyrolysis, landfill-classification, types, methods and control of leachate in landfills. Recycling of material found in municipal solid waste- recycling of paper and cardboard, recycling of plastics, recycling of glass.

| | | |
|------------------|-----------------------------------|----------|
| Unit - II | HAZARDOUS WASTE MANAGEMENT | 9 |
|------------------|-----------------------------------|----------|

Hazardous wastes: definition, nature and sources of hazardous waste, classification and characteristics of hazardous waste-chemical class of hazardous waste, segregation of waste-generation, treatment and disposal-waste reduction, waste minimization-recycling-chemical treatment: acid base neutralization, chemical precipitation, oxidation/reduction, hydrolysis, electrolysis, chemical extraction and leaching, ion exchange, photolytic reaction- thermal treatment methods: incineration – biodegradation of hazardous waste: aerobic, anaerobic, reductive dehalogenations-land treatment and composting.

| | | |
|-------------------|---|----------|
| Unit - III | E- WASTE & BIOMEDICAL WASTE MANAGEMENT | 9 |
|-------------------|---|----------|

E-Waste Management: Definition, sources, classification, collection, segregation, treatment and disposal.

Biomedical Waste Management : Introduction-definition –components of biomedical waste-waste generation –waste identification and waste control-waste storage-labeling and color coding-handling and transportation-waste treatment and disposal- autoclave, hydroclave , microwave treatments- chemical disinfection – sanitary and secure landfill.

| | | |
|------------------|---|----------|
| Unit - IV | POLLUTION FROM MAJOR INDUSTRIES AND MANAGEMENT | 9 |
|------------------|---|----------|

Introduction- sources and characteristics - waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Sugar, Petroleum refinery, fertilizer, dairy industries.

| | | |
|-----------------|---|----------|
| Unit - V | SOLID WASTE MANAGEMENT LEGISLATION | 9 |
|-----------------|---|----------|

Solid waste management plan - Solid Waste (Management and Handling) Rules - Biomedical Waste (Management and Handling) Rules- Plastic Waste Management Rules - E-Waste Management Rules - Hazardous and Other Wastes (Management and Transboundary Movement) Rules - Construction and Demolition Waste Management Rules..

Total: 45**TEXT BOOK:**

| | |
|----|--|
| 1. | George Tchobanoglous, Hillary Theisen, Samuel a Vigil, Integrated solid waste management (Engineering principle and management issues) McGraw hill Education (India) Pvt. Ltd., 2015, for Unit-I, II, V. |
| 2. | SC Bhatia, Handbook of Industrial pollution and control (Volume-1), CBS publisher and distributors, New delhi, 2002 for Units - II, III, IV & V. |

REFERENCES:

| | |
|----|--|
| 1. | Manual on Municipal Solid waste management, Central public Health and Environmental Engineering Organization (CPHEEO), Govt. of India, May 2000. |
| 2. | Michael D. LaGrega, Phillip L. Buckingham, Jeffrey C. Evans, Hazardous waste management, MEDTEC, 2015. |
| 3. | Majeti Narasimha Vara Prasad, Meththika Vithanage, Anwesha Borthakur, "Handbook of Electronic Waste Management: International Best Practices and Case Studies" 1 st Edition, Butterworth-Heinemann, 2019. |

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

| | | BT Mapped (Highest Level) |
|-----|---|--------------------------------------|
| CO1 | apply the technical points that are required to set up a solid waste management system. | Applying (K3) |
| CO2 | select the various disposal methods of hazardous wastes like radioactive wastes | Understanding (K2) |
| CO3 | organize the appropriate method for managing e-waste and biomedical waste | Applying (K3) |
| CO4 | identify to plan minimization of industrial wastes | Applying (K3) |
| CO5 | relate the legal legislation to solid waste management. | Understanding (K2) |

Mapping of COs with POs and PSOs

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

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

ASSESSMENT PATTERN - THEORY

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

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



KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE-638060
(AUTONOMOUS)
BOARD OF CIVIL ENGINEERING

DEGREE & PROGRAMME : BE CIVIL ENGINEERING
HONOURS DEGREE TITLE: CONSTRUCTION TECHNOLOGY

The following courses are identified to earn additional 18 credits to get a Honours degree with specialization in Construction Technology.

| S.No | Course Code | Course Title | Credits | Prerequisites | Semester |
|------|-------------|---------------------------------------|-----------|---------------|----------|
| 1. | 20CEH01 | Sustainable Construction Methods | 4 | Nil | 5 |
| 2. | 20CEH02 | Advanced Concrete Technology | 3 | Nil | 5 |
| 3. | 20CEH03 | Construction Project Planning Systems | 4 | Nil | 6 |
| 4. | 20CEH04 | Construction Cost Analysis | 4 | Nil | 6 |
| 5. | 20CEH05 | Project Formulation and Appraisal | 3 | Nil | 7 |
| | | TOTAL | 18 | | |



| 20CEH01 - SUSTAINABLE CONSTRUCTION METHODS | | | | | | | |
|--|--|-------|----------|---|---|---|--------|
| Programme & Branch | BE & Civil Engineering | Sem. | Category | L | T | P | Credit |
| Prerequisites | Nil | 5/6/7 | HN | 3 | 1 | 0 | 4 |
| Preamble | To impart the knowledge on benefits of sustainable construction and methods to Preserve and protect the natural resources that surround the construction site. | | | | | | |
| Unit – I | Introduction: | | | | | | 9+3 |
| Definitions of Sustainability - Various types of sustainability - Pillars of Sustainability - Circle of Sustainability - Need for Sustainability - systems and their sustainability - sustainability in the built environment context - Green Buildings -Difference between Green and Sustainability - Climate Change, Global warming - National and International policies and Regulations on sustainability | | | | | | | |
| Unit – II | Technology and its effects on the Environment: | | | | | | 9+3 |
| Global Warming, climate change loss of biodiversity - Technological advancements and their effects on the environment - Advancement in building and construction technologies such as steel and concrete technologies, Development of framed structures, multistoried buildings, large span structures, invention of plastics - Effects on the environment - Generation of waste, use of high manufacturing energy, peak oil, depletion of fossil and natural resources. | | | | | | | |
| Unit – III | Green Building Technologies: | | | | | | 9+3 |
| Introduction- Necessity - Concept of Green building. Principles of green building – Selection of site and Orientation of the building – usage of low energy materials – effective cooling and heating systems – effective electrical systems – effective water conservation systems - Certification systems- Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED), case studies | | | | | | | |
| Unit – IV | Sustainable Construction Techniques: | | | | | | 9+3 |
| Alternative construction techniques such as SMB, CSEB, and steam cured blocks, composite beam and panel, funicular shells, filler slabs, reinforced concrete masonry, vaulted roofs, ferrocement walls etc., - Case studies | | | | | | | |
| Unit – V | Waste As A Resource: | | | | | | 9+3 |
| Recycling industrial, agricultural and municipal waste - Recycling waste as alternative material for buildings, landscape and other products - Study of innovative practices for use of recycled material, specifications and construction methods for using recycled waste - Demonstrative architecture and landscape using waste, vermicomposting, biological and thermal energy options - Energy from sanitary landfills, refuse derived fuel and other options. | | | | | | | |
| Lecture:45, Tutorial:15, Total:60 | | | | | | | |
| TEXT BOOK: | | | | | | | |
| 1. | R.L.Rag, "Introduction to Sustainable Engineering", 1 st 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) | | | | | | | | | | | | | | |



| 20CEH02 - ADVANCED CONCRETE TECHNOLOGY | | | | | | | |
|--|---|-------|----------|---|---|---|--------|
| Programme & Branch | BE & Civil Engineering | Sem. | Category | L | T | P | Credit |
| Prerequisites | Nil | 5/6/7 | HN | 3 | 0 | 0 | 3 |
| Preamble | This course imparts knowledge on the microstructure of concrete, advances in concrete technology and non-destructive testing techniques for concrete | | | | | | |
| Unit – I | Microstructure and Properties of Hardened Concrete: | | | | | | 9 |
| Microstructure of aggregate phase – Microstructure of hydrated cement paste – Interfacial transition zone in concrete. Strength – porosity relationship – Failure modes in concrete – Compressive strength and factors affecting the compressive strength- Behavior of concrete under various stress states. Dimensional stability – Elastic behavior – Drying shrinkage & creep – Thermal shrinkage – Thermal properties of concrete. | | | | | | | |
| Unit – II | Concrete at Early Age: | | | | | | 9 |
| Workability -Slump loss – Segregation and bleeding – Early volume changes – Setting time – Temperature of concrete – Testing and control of concrete quality – Early age cracking in concrete. | | | | | | | |
| Unit – III | Durability of Concrete: | | | | | | 9 |
| Water as an agent of deterioration – Permeability – Classification of the causes of concrete deterioration – Surface wear – Crystallization of salts on the pores – Frost action – Effect of fire – Deterioration of concrete by chemical reactions – Sulfate attack – Alkali-aggregate reaction – Hydration of crystalline MgO and CaO – Corrosion of embedded steel in concrete - Concrete in the marine environment. | | | | | | | |
| Unit – IV | Advances in Concrete Technology: | | | | | | 9 |
| Structural light weight concrete – High-Strength concrete – 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. | | | | | | | |
| Total:45 | | | | | | | |
| TEXT BOOK: | | | | | | | |
| 1. | Mehta P. K., and Monteiro P. J. M., “Concrete: Microstructure, Properties, and Materials”, 4 th Edition, McGraw Hill Education, New Delhi, 2017. | | | | | | |
| REFERENCES: | | | | | | | |
| 1. | Neville A. M. & Brooks, J.J., “Concrete Technology”Pearson Education Limited, 2 nd Edition,Pearson Education Limited, Chennai, 2019. | | | | | | |
| 2. | Shetty M.S., “Concrete Technology Theory and Practice”, 8 th 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) | | | | | | | | | | | | | | | |



| 20CEH03 - CONSTRUCTION PROJECT PLANNING SYSTEMS | | | | | | | |
|---|---|-------|----------|---|---|---|--------|
| Programme & Branch | BE & Civil Engineering | Sem. | Category | L | T | P | Credit |
| Prerequisites | Nil | 5/6/7 | HN | 3 | 1 | 0 | 4 |
| Preamble | To enhance the knowledge among management tools and techniques for planning, scheduling, organizing, controlling and monitoring of construction projects. | | | | | | |
| Unit – I | Introduction to Project: | | | | | | 9+3 |
| Concept of a Project – Characteristic features – Project Life cycle – Phases – Project Management – Tools and techniques for project management – Role of project managers - Organization and project team – Communication in project management. | | | | | | | |
| Unit – II | Construction Planning: | | | | | | 9+3 |
| Introduction to Construction Projects - Project Categories - Project Participants - Project Life Cycle – Planning – Role of Planning Department in Construction- objectives – principles - stages of planning –Defining work task and precedence relationships among activities- Estimating durations and resources requirements- Coding system | | | | | | | |
| Unit – III | Project Scheduling: | | | | | | 9+3 |
| Construction scheduling - Work Breakdown Structure - Project Cost and Time Estimation - Bar Chart - Milestone Chart - CPM - PERT - RPM - LOB - Software’s in construction scheduling - Primavera - MSP. | | | | | | | |
| Unit – IV | Cost Control: | | | | | | 9+3 |
| Monitoring and control of construction projects – quality control- importance-objectives – methods - cost control –objectives – control systems – direct and indirect cost control – project budgetary control – Project risk analysis and mitigation. | | | | | | | |
| Unit – V | Organizing and Use of Project Information: | | | | | | 9+3 |
| Types of project information- accuracy – use of information – computerized information – uses – database – database models- relational model- centralized model- applications. | | | | | | | |
| Lecture:45, Tutorial:15, Total:60 | | | | | | | |
| TEXT BOOK: | | | | | | | |
| 1. | Dr. Seetharaman S., “Construction Engineering and Management”, 2 nd Edition, Umesh Publications, 2000. | | | | | | |
| REFERENCES: | | | | | | | |
| 1. | Chitkara K.K., “Construction Project Management Planning Scheduling and Controlling”, 18 th Reprint, Tata McGraw Hill, 2009. | | | | | | |
| 2. | Sengupta and Guha, “Construction Management and Planning”, 1 st 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) | | | | | | | | | | | | | | |



| 20CEH04 - CONSTRUCTION COST ANALYSIS | | | | | | | |
|--|--|-------|----------|---|---|---|--------|
| Programme & Branch | BE & Civil Engineering | Sem. | Category | L | T | P | Credit |
| Prerequisites | Nil | 5/6/7 | HN | 3 | 1 | 0 | 4 |
| Preamble | To improvise the installation and estimate procedure of various construction method and maintenance with effective cost analysis methods. | | | | | | |
| Unit – I | Cost Implications: | | | | | | 9+3 |
| Cost implications to different forms of construction and maintenance - Calculation of construction cost - Cost estimating - Investment Criteria - Discounting Criteria - Accounting -Concepts. | | | | | | | |
| Unit – II | Cost Installation: | | | | | | 9+3 |
| Installation and running - cost of service - capital investment in project- Labour cost for construction - Cost for general conditions and requirements - Calculation of project cost -Miscellaneous cost in project. | | | | | | | |
| Unit – III | Cost Analysis: | | | | | | 9+3 |
| Cost analysis by traders and functional element - Cost control during design and construction - Cost analysis methods - Break Even Analysis - Cash flow analysis - Risk analysis - Capitalized cost analysis - Benefit cost analysis | | | | | | | |
| Unit – IV | Cost and Finance: | | | | | | 9+3 |
| Financing of projects-means of finance - Financial institutions - Direct and Indirect cost- Project Crashing - Budgetary control - Need, Objectives -Essentials of Budgeting - Different types of budgets. | | | | | | | |
| Unit – V | Cost Estimates: | | | | | | 9+3 |
| Contracts - bonds - Insurance -cost estimates -Types of estimates - Life cycle cost - Strategic planning and cost programming -cost planning - cost curves. | | | | | | | |
| Lecture:45, Tutorial:15, Total:60 | | | | | | | |
| TEXT BOOK: | | | | | | | |
| 1. | Kumar Neeraj Jha, “Construction Project Management”, 2 nd Edition, Pearson India Education Services, New Delhi, 2018. | | | | | | |
| REFERENCES: | | | | | | | |
| 1. | Prasanna Chandra, “Projects - Planning Analysis Selection Implementation & Review”, 4th Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi.2005. | | | | | | |
| 2. | Joy P.K. “Total Project Management - The Indian Context (Chapters 3 7)”, New Delhi, Macmillan India Ltd., 2002. | | | | | | |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | | | | | | | | | | | BT Mapped (Highest Level) | | | |
|---|--|--------------------|-----|----------------------|-----|-----------------|-----|------------------|-----|-------------------|------|------------------------------|--------------------|---------|--|
| CO1 | infer the cost implications made to forms of construction | | | | | | | | | | | | Understanding (K2) | | |
| CO2 | calculate the serviceability cost of construction | | | | | | | | | | | | Applying (K3) | | |
| CO3 | analyse the different methods of cost during design and construction | | | | | | | | | | | | Analysing (K4) | | |
| CO4 | interpret the types of costs and budgets incurred for a construction project | | | | | | | | | | | | Understanding (K2) | | |
| CO5 | implement strategic planning for cost estimates and programming | | | | | | | | | | | | Applying (K3) | | |
| Mapping of COs with POs and PSOs | | | | | | | | | | | | | | | |
| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | |
| CO1 | 2 | 1 | | | | | | | | | | | 3 | 3 | |
| CO2 | 3 | 2 | 1 | | | | | | | | | | 3 | 2 | |
| CO3 | 3 | 2 | 2 | | | | | | | | | | 3 | 2 | |
| CO4 | 2 | 1 | | | | | | | | | | | 3 | 2 | |
| CO5 | 2 | 1 | | | | | | | | | | | 3 | 2 | |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy | | | | | | | | | | | | | | | |
| ASSESSMENT PATTERN - THEORY | | | | | | | | | | | | | | | |
| Test / Bloom's Category* | | Remembering (K1) % | | Understanding (K2) % | | Applying (K3) % | | Analyzing (K4) % | | Evaluating (K5) % | | Creating (K6) % | | Total % | |
| CAT1 | | 30 | | 40 | | 30 | | | | | | | | 100 | |
| CAT2 | | 20 | | 30 | | 30 | | 20 | | | | | | 100 | |
| CAT3 | | 10 | | 70 | | 20 | | | | | | | | 100 | |
| ESE | | 20 | | 60 | | 10 | | 10 | | | | | | 100 | |
| * ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks) | | | | | | | | | | | | | | | |



| 20CEH05 - PROJECT FORMULATION AND APPRAISAL | | | | | | | |
|---|---|-------|----------|---|---|---|----------|
| Programme & Branch | BE & Civil Engineering | Sem. | Category | L | T | P | Credit |
| Prerequisites | Nil | 5/6/7 | HN | 3 | 0 | 0 | 3 |
| Preamble | To assimilate the elements involved in costing and financial aspects of projects | | | | | | |
| Unit – I | Project Formulation: | | | | | | 9 |
| Generation and Screening of Project Ideas -Project identification –Preliminary Analysis, Market, Technical, Financial, Economic and Ecological -Pre-Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report –Different Project Clearances required. | | | | | | | |
| Unit – II | Project Costing: | | | | | | 9 |
| Project Cash Flows –Time Value of Money – Time lines and Notations -Cost of Capital - Present and future value of single amount - Simple Interest - Compound Interest- Project cash Flows - Principles of cash flow estimation. | | | | | | | |
| Unit – III | Project Appraisal: | | | | | | 9 |
| NPV–BCR –IRR –ARR –Urgency –Pay Back Period –Assessment of Various Methods –Indian Practice of Investment Appraisal – International Practice of Appraisal –Analysis of Risk –Different Methods –Selection of a Project and Risk Analysis in Practice. | | | | | | | |
| Unit – IV | Project Financing: | | | | | | 9 |
| Project Financing –Means of Finance –Financial Institutions –Special Schemes –Key Financial Indicators - Distinction between Management Accounting and Financial Accounting. | | | | | | | |
| Unit – V | Private Sector Participation: | | | | | | 9 |
| Private sector participation in Infrastructure Development Projects -BOT, BOLT, BOOT -Technology Transfer and Foreign Collaboration -Scope of Technology Transfer. | | | | | | | |
| | | | | | | | Total:45 |
| TEXT BOOK: | | | | | | | |
| 1. | Prasanna Chandra, "Projects -Planning Analysis Selection Implementation and Review", 21st Edition, Tata McGraw Hill, New Delhi, 2014. | | | | | | |
| REFERENCES: | | | | | | | |
| 1. | Shishir Dutta, "Project Management: Concepts and Guidance", 1st Edition, Excel India Publishers, New Delhi, 2019. | | | | | | |
| 2. | Joy P.K, "Total Project Management -The Indian Context", 2nd Edition, Macmillan India Ltd, New Delhi, 2002. | | | | | | |



| COURSE OUTCOMES: On completion of the course, the students will be able to | | | | | | | | | | | | | BT Mapped (Highest Level) | |
|---|--|--------------------|-----|----------------------|-----|-----------------|-----|------------------|-----|-------------------|------|-----------------|------------------------------|---------|
| CO1 | plan for clearances required for a project | | | | | | | | | | | | Applying (K3) | |
| CO2 | calculate the capital in-flow for a project | | | | | | | | | | | | Understanding (K2) | |
| CO3 | infer the appraisal methods and risk analysis for a project | | | | | | | | | | | | Applying (K3) | |
| CO4 | assimilate the funding patterns of financial Institutions for construction projects and the risks involved in it | | | | | | | | | | | | Understanding (K2) | |
| CO5 | interpret the need for technology transfer | | | | | | | | | | | | Applying (K3) | |
| Mapping of COs with POs and PSOs | | | | | | | | | | | | | | |
| COs/POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3 | 2 | 1 | | | | | | | | | | 2 | 2 |
| CO2 | 2 | 1 | | | | | | | | | | | 2 | 2 |
| CO3 | 3 | 2 | 1 | | | | | | | | | | 2 | 2 |
| CO4 | 2 | 1 | | | | | | | | | | | 2 | 2 |
| CO5 | 3 | 2 | 1 | | | | | | | | | | 2 | 2 |
| 1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy | | | | | | | | | | | | | | |
| ASSESSMENT PATTERN - THEORY | | | | | | | | | | | | | | |
| Test / Bloom's Category* | | Remembering (K1) % | | Understanding (K2) % | | Applying (K3) % | | Analyzing (K4) % | | Evaluating (K5) % | | Creating (K6) % | | Total % |
| CAT1 | | 33 | | 34 | | 33 | | | | | | | | 100 |
| CAT2 | | 33 | | 34 | | 33 | | | | | | | | 100 |
| CAT3 | | 33 | | 34 | | 33 | | | | | | | | 100 |
| ESE | | 33 | | 34 | | 33 | | | | | | | | 100 |
| * ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks) | | | | | | | | | | | | | | |