KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University Established under Section 3 of UGC Act 1956)

Eachanari, Coimbatore-641 021. INDIA

FACULTY OF ENGINEERING

DEGREE OF BACHELOR OF ENGINEERING / TECHNOLOGY

REGULAR PROGRAMME

REGULATIONS 2025

CHOICE BASED CREDIT SYSTEM

These regulations are effective from the academic year 2025 – 2026 and applicable to the candidates admitted to B. E. / B. Tech programmes. during 2025- 2026 and onwards.

1. ADMISSION

1.1 Candidates seeking admission to the first semester of the eight semesters B. E./B.Tech DegreeProgramme:

Should have passed the Higher Secondary Examination (10+2) prescribed by the State Government

/ Central Government with Mathematics/ Physics/ Chemistry/ Computer Science/ Electronics/ Information Technology/ Biology/ Informatics Practices/ Biotechnology/ Technical Vocational subject/ Agriculture/ Engineering Graphics/ Business Studies/ Entrepreneurship. (Any of the above three subjects) or any similar Examination of any other institution/ University or authority accepted by the Karpagam Academy of Higher Education as equivalent thereto).

Should have obtained at least 45% marks (40% marks in case of candidates belonging to SC / ST reserved category) in the above subjects taken together.

1.2 Lateral Entry Admission

Candidates who possess Diploma in Engineering / Technology (10+3 or 10+2+2) awarded by the Directorate of Technical Education with passed minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks in case of candidates belonging to SC / ST reserved category) in ANY branch of Engineering and Technology are eligible to apply for admission to the third semester of B. E./B. Tech., subject to vacancies in the First Year, in case the vacancies at lateral entry are exhausted. (The University will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme)

(OR)

B.Sc. Degree from a recognized University as defined by UGC, with at least 45% marks (40%

marks in case of candidates belonging to SC / ST reserved category) and passed 10+2 examination with Mathematics as a subject.

(OR)

Passed D.Voc. Stream in the same or allied sector.

(The University will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme)

Eligibility criteria for admission in the third semester is given in the table below.

<table>
<tr><th>S. No.</th><th>Programme</th><th>Eligibility criteria</th></tr>
<tr><td>1</td><td>B.E Bio Medical Engineering</td><td rowspan="11">Passed Minimum THREE years / TWO years (Lateral Entry) Diploma examination with at least 45% marks (40% marks in case ofcandidates belonging to reserved category) in ANY branch of Engineering and Technology.
OR
Passed B.Sc. Degree from a recognizedUniversity as defined by UGC, with at least 45%marks (40% marks in case of candidates belonging to SC / ST reserved category) and passed 10+2 examination with Mathematics as a subject.
OR
Passed D.Voc. Stream in the same or allied sector.
(The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to achieve desired learning outcomes of the programme)</td></tr>
<tr><td>2</td><td>B. E. Civil Engineering</td></tr>
<tr><td>3</td><td>B. E. Computer Science and Engineering</td></tr>
<tr><td>4</td><td>B. E. Computer Science and Engineering (Cyber security)</td></tr>
<tr><td>5</td><td>B. E. Electrical and Electronics Engineering</td></tr>
<tr><td>6</td><td>B. E. Electronics and Communications Engineering</td></tr>
<tr><td>7</td><td>B. E. Mechanical Engineering</td></tr>
<tr><td>8</td><td>B. Tech. Artificial Intelligence and Data Science</td></tr>
<tr><td>9</td><td>B. Tech. Computer Science and Business Systems</td></tr>
<tr><td>10</td><td>B. Tech Bio – Technology</td></tr>
<tr><td>11</td><td>B. Tech Food Technology</td></tr>
</table>

1.3 Migration from other University

Candidates who are willing to migrate to Karpagam Academy of Higher Education for admission to their next semester of B. E./B. Tech programme may get admitted from 2nd semester onwards upto 5th semester. The student will be exempted from appearing for Examination of the equivalent courses passed in the earlier programme and will have to appear for courses which he/she has not done during the period of his/her earlier programme. Along with the request letter and mark sheets,

he/she has to submit a copy of syllabus of the programme duly attested by the Competent authority, he/she has undergone. Programme Equivalence Certificate shall be given by the respective Head of the Department of Karpagam Academy of Higher Education, after verifying the credentials.

2. PROGRAMMES OFFERED

A candidate may undergo a programme in any one of the branches of study approved bythe University as given below.

List of B. E. and B. Tech. Degree Programmes

1. B.E Bio Medical Engineering
2. B. E. Civil Engineering
3. B. E. Computer Science and Engineering
4. B. E. Computer Science and Engineering (Cyber Security)
5. B. E. Electrical and Electronics Engineering
6. B. E. Electronics and Communications Engineering
7. B. E. Mechanical Engineering
8. B.Tech. Artificial Intelligence and Data Science
9. B. Tech. Computer Science and Business Systems
10. B. Tech. Bio-Technology
11. B. Tech Food Technology

3. MODE OF STUDY

3.1 Full-Time:

In this mode of study, the candidates are required to attend classes regularly on the specified working days of the University.

3.2 Change from one programme to another is not permitted.

4. STRUCTURE OF PROGRAMMES

4.1 Every programme will have a curriculum with syllabus consisting of theory and practical courses such as:

(i) General core courses comprising Mathematics, Basic Sciences, Engineering Sciences and Humanities.

(ii) Core courses of Engineering/Technology.

(iii) Elective courses for specialization in related fields.

(iv) Workshop practice, computer practice, engineering graphics, laboratory work, internship, seminar presentation, project work, industrial visits, camps, etc.

Every student is encouraged to participate in at least any one of the following programmes

- NSS / Sports/Physical exercise/NCC/YRC.
- Other Co-Curricular and Extra Curricular activities

(V) **Choice Based Credit System**

CBCS is introduced for students admitted in the academic year 2017-18 onwards. As per AICTE guidelines, CBCS is an approach in which students opt for courses of their choice. CBCS provides greater flexibility with multiple courses and enable students to undergo additional courses. CBCS is applicable to Full Time Undergraduate & Post Graduate Programmes of study. It provides a choice for students to select from the prescribed courses (Professional core, Professional Electives, Open Electives, Value added courses, Humanity Sciences, Basic sciences & Engineering sciences). A course designated as hard core for a particular programme of study must invariably be completed by the student to receive the degree in the programme. The Hardcore courses cannot be substituted by another courses. Students can exercise their choice among a set of soft core courses from the list of soft core courses specified for each Programme of study. **The student should meet the criteria for prerequisites to become eligible to register for that course. The student should request and register for the course for every semester within the first week of semester.** Maximum number of students to be registered in each course shall be decided by the HoD in consultation with the Dean. Registration of already requested courses by students in previous semester is not allowed.

4.2 Each course is normally assigned certain number of credits.

No. of credits per lecture period per week	: 1
No. of credits per tutorial period per week	: 1
No. of credits for 3 periods of laboratory course per week	: 2
No. of credits for 3 periods of project work per week	: 2
No. of credits for 2 weeks of field project/internship training during semester vacations	: 1

4.3 In every semester, the curriculum shall normally have a blend of theory courses not exceeding 6 and practical courses not exceeding 4.

4.4 The prescribed credits required for the award of the degree shall be within the limits specified below.

PROGRAMME	PRESCRIBED CREDIT RANGE
B. E./B. Tech.	160– 165

4.5 The medium of instruction for all Courses, Examinations, Seminar presentations and Project/ Thesis reports is English.

4.6 Value Added Course (VAC / Skill Development Course (SDC)

Besides core courses and elective courses, VAC / SDC are provided. The blend of different courses is so designed that the interested students would be trained for the holistic development to enhance employment opportunity. Upon completion of 30 Practical Hours / 15 Theory hours and evaluation, a student can claim for 1 additional credit.

4.7 Evaluation of the courses comprises of two parts, one is the Continuous Internal Assessment (CIA) and the other one is the End Semester Examination (ESE). Evaluation of a mandatory course may be by Internal Assessment only.

5. DURATION OF THE PROGRAMME

5.1 The prescribed duration of the programme shall be

Programme	Min. No. of semesters	Max. No. ofsemesters
B. E./B. Tech. (HSC Candidates)	8	14
B. E./B. Tech. (Lateral Entry Candidates)	6	12

5.2 Each semester shall normally consists of 90 working days or 540 hours.

5.3 Additional classes for improvement, conduct of model test, etc., over and above the specified periods shall be arranged, if required. But for the purpose of calculation of attendance requirement for eligibility to appear for the end semester Examinations (as per Clause 11) by the students, 540 hours conducted within the specified academic schedule alone shall be taken into account and the overall percentage of attendance shall be calculated accordingly.

6. REQUIREMENTS FOR COMPLETION OF THE SEMESTER

6.1 Ideally every student is expected to attend all classes and secure 100% attendance. However, in order to allow for certain unavoidable circumstances, the student is expected to attend at least75% of the classes and the conduct of the candidate has been satisfactory during the course.

6.2 A candidate who has secured attendance between 65% and 74.4% (both included), due to medical reasons (Hospitalization / Accident / Specific Illness) shall produce medical certificate and fitness certificate by a Registered Medical Practitioner. The Head of the Department has to verify and certify the genuineness of the case before recommending to the Dean concerned. However, the candidate has to execute a one-time bond in Stamp paper duly signed by the parent and the student.

6.3 Candidates who have not produced / submitted relevant documents for condonation will not

be permitted to proceed to the next semester and have to redo the course. However, they are permitted to write the arrear Examinations, if any.

7. Mentor

To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a Faculty of the Department who shall function as Mentor for those students throughout their period of study. Such Mentors shall advise the students and monitor the courses undergone by the students, check the attendance and progress of the students and counsel them periodically. If necessary, the Mentor may display the cumulative attendance particulars in the Department notice board and also discuss with or inform the Parents/Guardian about the progress of the students. Each student shall be provided with course plan for each course at the beginning of each semester.

8. CLASS COMMITTEE

8.1. The class committee for a class under a particular branch is normally constituted by the Head of the Department. However, if the students of different branches are mixed in a class (like the first semester which is generally common to all branches), the class committee is to be constituted by the Dean.

8.2. Every class shall have a class committee consisting of teachers of the class concerned, Maximum of six student representatives [boys and girls] and the concerned Head of the Department. It is like the 'Quality Circle' with the overall goal of improving the teaching-learning process. The functions of the class committee include

- Clarifying the regulations of the degree programme and the details of rules therein particularly Clause 4 and 5 which should be displayed on Department Notice-Board.
- Informing all the students, the details of Regulations regarding weightage used for each assessment. In the case of practical courses (laboratory / drawing / project work / seminar, etc.) the breakup of marks for each experiment / exercise /module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Solving problems experienced by students in the class room and in the laboratories.
- Informing the student representatives, the academic schedule, including the dates of assessments and the syllabus coverage for each assessment.
- Analyzing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.
- Identifying the weak students, if any and requesting the teachers concerned to provide some additional academic support.

8.3 The class committee shall be constituted within the first week of each semester.

8.4 The Chairperson of the Class Committee may convene the meeting of the class committee.

8.5 The Dean may participate in any Class Committee of the Faculty.

8.6 The Chairperson is required to prepare the minutes of every meeting, submit the same to Dean through the HOD within two days of the meeting and arrange to circulate it among the students and teachers concerned. If there are some points in the minutes requiring action by the Executive Council, the same shall be brought to the notice of the Registrar/VC by the HoD through Dean.

8.7 The first meeting of the Class Committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weightage of assessments within the framework of the regulations. Two subsequent meetings may be held in a semester at suitable intervals. During these meetings the student members representing the entire class, shall meaningfully interact and express their opinions and suggestions of the other students of the class in order to improve the effectiveness of the teaching-learning process.

9. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one discipline or one batch of students shall have a "Course Committee" comprising of all the faculty teaching the common course with one of them nominated as Course Coordinator. The nomination of the Course Coordinator shall be made by the Head of the Department/Dean depending upon whether all the faculty teaching the common course belong to a single department or several departments. The "Course committee" shall meet at least three times and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the course committee may also prepare a common question paper for the assessment test(s). The letter "**G**" is to be mentioned in the course code for the common course.

10. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

10.1 Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' (Log book) which consists of attendance marked in each theory or practical or project work class, the test marks and the record of class work (topic covered), separately for each course.

10.2 Continuous Internal Assessment (CIA): The performance of students in each course will becontinuously assessed by the respective teachers as per the guidelines given below:

a. THEORY COURSES

S. No.	CATEGORY	MAXIMUM MARKS
1.	Assignment	5
2.	Seminar *	5
3.	Attendance	5
4.	Test – I	12.5
5.	Test – II	12.5
Continuous Internal Assessment: TOTAL		40

*Evaluation shall be made by a seminar committee.

PATTERN OF TEST QUESTION PAPER (Test I & II)

INSTRUCTION	REMARKS
Maximum Marks	100
Duration	3 Hours
Part – A	Question no. 1 to 10 Two Mark Questions, covering 2.5 units of the syllabus. **(10 x 2= 20 Marks)**
Part- B	Question 11 to 15 will be of either-or type, covering 2.5 units of the syllabus. Each Question may have subdivision. **(5 x 16=80 Marks)**

b. PRACTICAL COURSES

S. No	CATEGORY	MAXIMUM MARKS
1.	Attendance	5
2.	Observation work	5
3.	Record work	5
4.	Internal Practical Assessment	15
5.	Viva – Voce [Comprehensive]	10
Continuous Internal Assessment: TOTAL		40

Every practical exercise / experiment shall be evaluated based on the conduct of exercise/ experiment and records maintained.

c. INTEGRATED THEORY AND PRACTICAL COURSES

The Continuous Internal Assessment for Integrated Theory and Practical Course is awarded for 40 Marks with mark split up similar to regular theory course. But Assignment and Seminar components are replaced by Observation and Record marks.

S.No.	CATEGORY	MAXIMUM MARKS
1.	Observation	5
2.	Record	5
3.	Attendance	5
4.	Test –I	12.5
5.	Test –II	12.5
Continuous Internal Assessment: TOTAL		40

The end semester evaluation of integrated practical component is for 50 Marks and it is scaled down to 15 Marks. Similarly, the end semester evaluation for integrated theory is 100 Marks and it is scaled down to 45 Marks. Hence, the external evaluation of integrated theory and practical elements accounts for 60 marks.

For the integrated course, the ESE mark distribution is as follows:

Theory	Practical	Total
45 marks	15 Marks	60 Marks

10.3 ATTENDANCE

Attendance carries a maximum of 5 marks and the distribution is as under:

S. No.	Attendance %	Marks
1	91 and above	5.0
2	81-90	4.0
3	76-80	3.0

10.4 PROJECT WORK/ INTERNSHIPS

10.4.1 Project Work

Final year project work will be normally in-house. However, as a special case, if a student is able to get a project from a government organization or private or public sector company, the student may be permitted to do his/her project work in that institution/research organization/industry.

The evaluation of Project phase I shall be through Continuous Internal assessment mode and Project phase II evaluation shall be through continuous assessments (Three reviews), evaluation of

project thesis report and viva-voce examination. Continuous assessment shall have the weightage of 40%. Evaluation of Project thesis report and viva-voce examination shall have the weightage of 60% each. Break-up of marks is as shown below:

Project Phase I Evaluation:

Continuous Internal Assessment (100 marks)		
Review I	**Review II**	**Review III**
30 marks	30 marks	40 marks

Project Phase II Evaluation:

Continuous Internal Assessment (40 marks)			**ESE (60 marks)**			
			Project Report (30 marks)		**VIVA VOCE (30 marks)**	
Review I	**Review II**	**Review III**	**Supervisors**	**External**	**Internal**	**External**
5 marks	15 marks	20 marks	15 marks	15 marks	15 marks	15 marks

10.4.2 Internships

Students must complete Internship for the duration specified in the program's corresponding curriculum. The industry in which the student intends to undergo internship should be aligned in line with the programme of study. The student must submit a report detailing observations, skills learned, usefulness, etc., together with the attendance certificate granted by the relevant industry after completing the internship or industrial training. A committee made up of three faculty members, appointed by the department head, will review this report. One faculty member will be designated as the coordinator. A student can claim one credit if he/she completes one week of training as per curriculum

Weightage for Assessment for Internship

Report	**Presentation**	**Viva-Voce**
30 Marks	40 Marks	30 Marks

11. REQUIREMENTS FOR APPEARING FOR END SEMESTER EXAMINATION(ESE)

A candidate shall normally be permitted to appear for the ESE of any semester commencing from I semester if he/she has satisfied the semester completion requirements (Subject to Clause 5.2) and has registered for Examination in all courses of the semester. Registration is mandatory for

Semester Examinations as well as arrear Examinations failing which the candidate will not be permitted to attend the next semester. A candidate already appeared for a course in a semester and passed the Examination is not entitled to reappear in the same course of the semester for improvement of grade.

12. END SEMESTER EXAMINATION

ESE will be held at the end of each semester for each course, for 100 marks, it is scaled down to 60 marks.

12.1 ONLINE EXAMINATIONS

The students who are going for Project / Internship / Coursework at National level are permitted to write their CIA test through Online Mode and ESE in Offline/Online mode. When they go for an International Project / Internship / Coursework, both the CIA and ESE shall be conducted through online mode.

PATTERN OF ESE QUESTION PAPER:

INSTRUCTION	REMARKS
Maximum Marks	100
Duration	3 Hours
Part – A	Question no. 1 to 10 Two Mark Questions, covering all the 5 units. **(10 x 2= 20 Marks)**
Part- B	Question 11 to 15 will be of either or type, covering Fiveunits of the syllabus. Each Question may have subdivision. **(5 x 16=80 Marks).**

13. PASSING REQUIREMENTS

13.1 Minimum marks to pass: The minimum marks to pass for CIA is 20 (i.e. out of 40 marks). The minimum marks to pass for ESE is 30 (i.e. out of 60 marks). The overall minimum marks to pass for theory/laboratory course is 50 (Sum of his/her score in CIA and ESE) out of 100 marks.

13.1.1 The minimum marks to pass for the Value Added Course /Skill Development is 50 marks out of 100marks. There will be two tests, the first covering 50% of syllabus for 50 marks and the other for 50 marks.

13.2 If the candidate fails to secure a pass in ESE of a particular course, it is mandatory that candidate shall register and reappear for the Examination in that course during the subsequent

semester when Examination is conducted in that course. Further the candidate should continue to register and reappear for the Examination till a pass is secured in such supplementary Examination within the stipulated maximum duration of the programme (Clause 5.1).

The CIA marks obtained by the candidate in his/her first or subsequent appearance where he/she secures a pass shall be retained by the office of the Controller of Examinations and considered valid for all remaining attempts till the candidate secures a pass in his/her ESE.

13.3 If the candidate fails to secure a pass in CIA of a particular course, it is mandatory that candidate shall register and reappear for the CIA in that course during the subsequent semester when CIA is conducted in that course by the faculty member assigned for that particular course during that semester by the concerned HOD. Further, the candidate should continue to register and reappear for the CIA till a pass is secured in such subsequent Examination within the stipulated maximum duration of the programme (Clause 5.1). The Evaluation for the CIA reappearance is as follows:

Test 1	Test 2	Assignment	Total
15 marks	15 marks	10 marks	40 marks

13.4 CREDIT TRANSFER THROUGH ONLINE PLATFORM / INTERNATIONAL STUDIES

The MOOC coordinator shall assist the students for the online courses offered by the NPTEL/SWAYAM/Other online platforms periodically and also monitor their course.

Students are encouraged to enroll in courses offered by NPTEL/Swayam/ Swayam Plus platforms and international institutions of higher learning, either virtually or in person. The equivalent credits for these courses will be determined by a committee named Subject & Grade Equivalence Committee comprising the Dean of the Faculty as Chairman, Dean (R&D, Industrial Relations), Head of the Department (HoD) and one faculty member nominated by the Vice Chancellor as members. The committee's decision will be submitted for ratification/approval by the Board of Studies (BoS) and the Academic Council.

13.4.1 Online Courses / Self Study Courses

Students may be permitted to earn credit through online courses (which are provided with certificate) with the approval of Head of the Department and Dean. The credit may be transferred with the due approval for either programme core, elective or open elective course and complete at any time within the duration of the programme before the last semester.

13.4.2 One credit course

One credit elective course shall be offered by the department in collaboration with the industry/research organizations / higher learning institutions. A student shall be permitted to register for the one-credit courses offered by other departments with approval of both the Heads of the departments. A student shall replace a three credit programme elective / open elective course if he / she registered for three one credit courses and appear for the examination of the courses and get qualified in the examination. Three elective courses of 1 credit shall replace a 3-credit elective course as given in Table.

REPLACEMENTS OF ONE CREDIT COURSES

Number of credits earned		**Eligible to replace**	
Core electives	**Interdisciplinary electives**	**PEC**	**OEC**
3	0	1	-
2	1	1	-
1	2	-	1
0	3	-	1

Refer the Annexure I for NPTEL Course Durations and credit Equivalence. The Registration / Application form for Credit Transfer of SWAYAM-NPTEL / MOOC Courses shall be submitted as shown in Annexure I.

14. AWARD OF LETTER GRADES

14.1 All assessments of a course will be done on absolute mark basis. However, for the purpose of reporting the performance of a candidate letter grades, each carrying certain number of points will be awarded as per the range of total marks (out of 100) obtained by the candidate in each subject as detailed below:

Letter grade	**Marks Range**	**Grade Point**	**Description**
O	91 – 100	10	OUTSTANDING
A+	81- 90	9	EXCELLENT
A	71-80	8	VERY GOOD
B+	61- 70	7	GOOD
B	56-60	6	AVERAGE
C	50-55	5	PASS
RA	Below 50	-	REAPPEARANCE
AAA	-	-	ABSENT

14.2 GRADE SHEET

After results are declared, Grade sheet will be issued to each student which will contain the following details:

i. The list of courses enrolled during the semester and the grade scored

ii. The Grade Point Average (**GPA**) for the semester and

iii. The Cumulative Grade Point Average (**CGPA**) of all courses enrolled from first semester onwards.

GPA is the ratio of the sum of the products of the number of Credits (**C**) of courses enrolled and the Grade Points (**GP**) corresponding to the grades scored in those courses, taken for all the courses to the sum of the number of credits of all the courses in the semester.

$$\text{GPA} = \frac{\text{Sum of [C} * \text{GP]}}{sum\ of\ c}$$

CGPA will be calculated in a similar manner, considering all the courses enrolled from First semester **RA** grade and value added course will be excluded for calculating **GPA** and **CGPA**.

14.3 REVALUATION

Revaluation and Re-totaling are allowed on representation. A candidate can apply for revaluation of his/her semester Examination answer paper in a theory course, within 2 weeks from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of the Department and Dean. A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate through the Head of the Department and Dean. Revaluation is not permitted for Supplementary Examinations, Practical Examinations, Technical Seminars, In-plant Training and Project Work.

14.4 TRANSPARENCY AND GRIEVANCE COMMITTEE

A student may get the Photostat copy of the answer script on payment of prescribed fee, if he/she wishes. The students can represent the grievance, if any, to the Grievance Committee, which consists of Dean of the Faculty, (if Dean is HoD, the Dean of another Faculty nominated by the University), HoD of the Department concerned, the faculty of the course and Dean from other discipline nominated by the University and the CoE. If the Committee feels that the grievance is genuine, the script may be sent for external valuation; the marks awarded by the External Examiner will be final. The student has to pay prescribed fee for the same.

15. ELIGIBILITY FOR AWARD OF DEGREE

A student shall be declared to be eligible for award of Degree if he/she has

- Successfully gained the required number of total credits as specified in the curriculum corresponding to his/her programme within the stipulated time.
- The award of the degree must be approved by the Board of Management of Karpagam Academy of Higher Education.

16. CLASSIFICATION OF THE DEGREE AWARDED

16.1A candidate who qualifies for the award of the Degree (vide Clause 15) having passed the Examination in all the courses in his/her first appearance within the specified minimum numberof semesters (vide Clause 5.1) securing a CGPA of not less than **7.5** shall be declared to have passed the Examination in First Class with Distinction.

16.2 A regular candidate/lateral entrant is eligible to register for B.E. (Honours)/ B.Tech.(Honours), if he/she has passed all the courses in first attempt from first/third semester onwards and holds / maintains a CGPA of 7.5 in III and IV Semester. Prior approval of the concerned Head of the Department and respective Dean for the enrolment into Honours degree before the commencement of V semester is mandatory. A candidate is eligible for the award of BE(Honours) / B.Tech.(Honours), if he/she earns an additional 18 credits by undergoing additional courses over and above the courses prescribed in the respective curriculum. The opted additional courses shall be Emerging / Multidisciplinary /MOOC /NPTEL courses which are related to the major discipline of study. All these 18 credits need to be completed in III year and IV year only. However, if he/she fails to secure 18 additional credits but maintains a CGPA of 7.5 and above is not eligible for Honours degree but eligible for First class with Distinction.

16.3 A candidate who qualifies for the award of the Degree (vide Clause 15) having passed the Examination in all the courses within the specified minimum number of semesters (vide Clause 5.1) plus one year (two semesters), securing CGPA of not less than 6.5 shall be declared to have passed the Examination in First Class.

16.4 All other candidates (not covered in Clauses 17) who qualify for the award of the degree (vide Clause 15) shall be declared to have passed the Examination in Second Class.

17. SUPPLEMENTARY ESE

After the publication of VIII semester results, if a student has **ONE** arrear in any theory course of the entire programme, he/she will be permitted to apply within 15 days of the publication of results, and appear for supplementary Examination.

18. DISCIPLINE

Every student is required to observe discipline and decorous behavior both inside and outside the University and not to indulge in any activity which will tend to bring down the prestige of the University. The erring student will be referred to the Disciplinary Committee constituted by the University, to enquire in to acts of indiscipline and recommend to the University about the disciplinary action to be taken.

If a student indulges in malpractice in any of the ESE/CIA he/she shall be liable for punitive action as prescribed by the University from time to time.

19. ADVANCED LEARNERS & ON-DEMAND EXAMINATION

Students

1. Who secure 7.5 CGPA and maintain an attendance of 75% in every semester
2. Clear all the courses in their first appearance itself

are referred to as advanced learners.

When a student fails to maintain any of the above conditions at any given time, he cannot be an advanced learner further.

These advanced learners can request for an on-demand examination for the courses from IV semester onwards. These students on prior permission can appear for such examinations well in advance and complete the entire courses well before the prescribed period of study and can progress for a full time Research Project/Internship/Minor Project during the remaining prescribed period of study. The Internal and External examinations will be conducted for these courses as like the other courses. One or more faculty mentors will be allocated based on the number of students/courses enrolled for the on-demand examination.

Also, these advanced learners can also register for online courses from NPTEL/Swayam/Swayam Plus portals on prior and proper approval from the department. The credits earned from those courses will be transferred to the mark statement of the students.

20. REVISION OF REGULATION AND CURRICULUM

The University may from time-to-time revise, amend or change the Regulations, Scheme of Examinations and syllabi, if found necessary on the recommendations of Board of Studies, Academic Council and Executive council of Karpagam Academy of Higher Education.

21. KARPAGAM INNOVATION AND INCUBATION COUNCIL (KIIC)

(A Section 8 Company)

Based on the 2019 National Innovation and Startup Policy and the 2019–2023 Tamil Nadu Startup Policy, KIIC has recommended to the KAHE students who are affiliated with the KIIC that it be incorporated in the university Program Regulations 2023-24 onwards and implement from this academic year.

21.1 Norms to Student Start-Ups

a) Any (UG/PG /(Ph.D.) Research scholars, student, right from the first year of their programme is allowed to setup a startup (or) to work as part time in a startup or work as intern in a startup.

b) Any (UG/PG / (Ph.D.) Research scholars) student right from the first year of their programme is allowed to earn credit for working on Innovative prototypes/business Models/ Pre incubation (case to case basis). Start Up activities will be evaluated based on the guidelines being given by the expert committee of the KIIC.

c) Student Entrepreneurs may use the address of incubation center (KIIC) to register their venture while studying in KAHE.

d) Students engaged in startups affiliated with the KIIC or those who work for them, their attendance may be accepted by KAHE for KAHE's attendance requirements for academic courses under current regulations, up to a maximum of 30% attendance per semester, including claims for ODs and medical emergencies. Potential Students who have been incubated at KIIC may be permitted to take their university semester exams even provided by the KIIC's attendance report, with the proper authorization from the head of the institution.

(On case-to-case basis depends upon the applicability strength, societal benefits and quality of the Innovation and Subsequent engagement of the students with the/ her business)

e) Any Students Innovators/entrepreneurs are allowed to opt their startup in place of mini project/ major project, /seminar and summer training etc. (In plant training, Internship, value added Course.). The area in which the student wishes to launch a Startup may be interdisciplinary or multidisciplinary.

f) Student's startups are to be evaluated by Expert committee, formed by KIIC and KAHE.

22.2 Guide lines to award Credits/ Marks to a Student startup

S. No.	Description/Startup phases	In place of the Subject / Coursetitle	Grades/Credits /Marks
1	Idea stage/Problem Identification	Seminar/Presentation of concept	Same Marks/ Credits can be awarded thatare listed in the course title's curriculum for the respective startup phases.
2	Proof of Concept (POC) /Solutiondevelopment	In-plant training /Internship	
3	Product Development (Lab scale) /Prototype Model/ Company Registered	Mini Project/Value added Course	
4	Validation/Testing	Main Project phase I	
5	Business Model / Ready for Commercialization/ Implementation	Main Projectphase II	

Student's startup stages are divided into five phases and these startup phases can be considered equally in place of the course title as mentioned below with the same credits allotted to the course title in university curriculum.

PROGRAM OUTCOMES (POS)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering
problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.
(WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for

i) independent and life-long learning

ii) adaptability to new and emerging technologies

and iii) critical thinking in the broadest context of technological change. (WK8)

KNOWLEDGE AND ATTITUDE PROFILE (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost,reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

PROGRAMME EDUCATIONAL OBJECTIVES(PEOs):

1. To impart skill-based training to apply engineering practices to design, implement model and analyse real time problems and interpret the result.
2. To impart students with strong fundamental knowledge in the field of Electronics and Communication Engineering to meet the emerging industrial needs and to promote Research
3. To build and lead cross-functional teams upholding the professional responsibilities & ethical values.

PROGRAMME SPECIFIC OUTCOMES(PSOs)

Engineering Graduates will be able to

1) Design and Develop solutions for present-day problems with the continuous learning in the field of Embedded systems, VLSI design, Communication and Signal Processing and hold expertise in the modern tools for quenching the techno-thirsty society.

2) Contribute to the society as a socio-responsible electronics and communication engineer with leadership, teamwork skills and adaptable to the lifelong learning in multidisciplinary environment

Annexure I

Credit Transfer of Online Courses (SWAYAM / NPTEL)

1. The credit transfer shall be applicable to the students of UG programme from 2022 Batch onwards

The proposed conversion from percentage marks given by (SWAYAM NPTEL) to the corresponding grades shall be as follows: -

NPTEL Course Durations and credit Equivalence		
S. NO	**Course Duration**	**Credit Equivalence for Transfer of Credits**
1	4 Weeks	1 Credit
2	8 Weeks	2 Credit
3	12 Weeks	3 Credit
4	16 Weeks	4 Credit

Type of NPTEL certificate	NPTEL Score	Equivalent Grade (KAHE)	KAHE Score
Elite + Gold	>=90	O	91-100
Elite + Silver	75-89	A+	81-90
Elite	60-74	A	71-80
Successfully completed	40-59	B+	66-70
No certificate	< 40	-	-

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University Established Under Section 3 of UGC Act 1956)

Pollachi Main Road, Eachnari Post, Coimbatore – 641 021

Registration / Application form for Credit Transfer of SWAYAM-NPTEL / MOOC Courses (Academic Year 2025-2026)

1. Name of Student: _____
2. Register No : _____

3. Faculty :

	FOE		FASCM		FOP		FADP

4. Department/Centre _____
5. Name of the programme : _____ 5. Year/Semester:_____

6. Details of SWAYAM-NPTEL / MOOC Courses:

S. No.	NPTEL Course Title	Duration (In Weeks)	NPTEL Roll No	Month & Year of Exam	Registered Against			PE/OE (KAHE Course Code)
					PE	OE	EX	

PE: Professional Elective, OE: Open Elective, EX: Extra / add- on Course

Declaration by the Student:

I hereby declare that all the information given by me in this application are true and correct to the best of my knowledge and belief. I will comply with the all rules and regulations of SWAYAM NPTEL/MOOC's courses notified by the Course. I also undertake that after completion of the registered course/s, it's my duty to submit the course completion certificate to HOD otherwise my Marks / Grades shall not be incorporated in Grade Statement of the respective Semester.

Date:_____ **Signature of candidate**

For Dean / HoD Office:

As per the student application and provision in Academic Regulations, the courses of the above student is /are approved for Registration / Transfer of credits:

Sl. No	Course Title	Registered Apporved			Semester (I / II / III /IV / V / VI / VII / VIII	Course Code Assigned	Name of Course Coordinator (If applicable)
		PE	OE	EX			

NPTEL Certificate verified by**: Name:** _____ **Signature:** _____

Approved by:

Coordinator **HoD** **Dean**

For Controller of Examinations Office:

NPTEL Course Durations and credit Equivalence (As per Regulation)		
S. No	Course Duration	Credit Equivalence for Transfer of Credits
1	4 Weeks	1 Credit
2	8 Weeks	2 Credit
3	12 Weeks	3 Credit
4	16 Weeks	4 Credit

Type of NPTEL certificate	NPTEL Score	Equivalent Grade (KAHE)	KAHE Score
Elite + Gold	>=90	O	91-100
Elite +Silver	75-89	A+	81-90
Elite	60-74	A	71-80
Successfully completed	40-59	B+	66-70
No certificate	< 40	-	-

S. No	Course Code (KAHE)	Course Title (KAHE)	NPTEL Certificate /Roll No	Duration	Credits	Marks	Grade Awarded

Grades to be incorporated in the Semester:

I		II		III		IV		V		VI		VII		VIII	

For Scrutiny and Tabulation Section:

Grades Incorporated in the Semester: _____ **Grade Awarded: _____**

CONTROLLER OF EXAMINATION

KARPAGAM ACADEMY OF HIGHER EDUCATION
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(Accredited with A+ Grade by NAAC in the Second Cycle)
FACULTY OF ENGINEERING
COURSE OF STUDY AND SCHEME OF EXAMINATION
(2025 BATCH ONWARDS)

B.E - CIVIL ENGINEERING

Semester – I												
Course code	**Course Title**	**Category**	**Objectives & Outcomes**		**Instruction hours/week**			**Credits**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
25BEHS101G	Technical English-I	HS	5,7,8,9,11	3	3	0	0	3	40	60	100	1
25BEHS103G	Matrices and Calculus	BS	1,2,3,11	1,2	3	1	0	4	40	60	100	3
25BEHS107G	Environmental Studies	BS	1,2,6,7,11	1	3	0	0	3	40	60	100	5
25BEHS141G	Engineering Physics	BS	1,2,3,6,8,11	1	3	0	2	4	40	60	100	7
25BTAD141G	Python Programming	ES	1,2,3,4,8,9,11	-	3	0	2	4	40	60	100	9
25BEME111G	Workshop Practices Laboratory	ES	1,2,3,5,8,9,11	1,3	0	0	4	2	40	60	100	11
25BEMC151G	Women Safety and Security	MC	-	-	1	0	0	0	100	-	100	13
25BEMC152G	தமிழர் மரபும் பண்பாடும்	MC	-	-	1	0	0	0	100	-	100	14
	TOTAL				**17**	**1**	**8**	**20**	**440**	**360**	**800**	

Semester -II												
Course code	**Course Title**	**Category**	**Objectives & Outcomes**		**Instruction hours/week**			**Credits**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
25BEHS201G	Technical English-II	HS	5,7,8,9,11	3	3	0	0	3	40	60	100	16
25BEHS202CG	Transforms and Its Applications	BS	1,2,3,11	1,2	3	1	0	4	40	60	100	18
25BEHS205	Physics for Civil Engineers	ES	1,2,3,9,11	1,2	3	0	0	3	40	60	100	20
25BEME201G	Engineering Graphics	BS	1,2,3,5,8,9,11	1,2,3	3	0	0	3	40	60	100	22
25BEEE202G	Basics of Electrical and Electronics Engineering	ES	1,2,3	1,2	3	0	0	3	40	60	100	24
25BEHS245G	Engineering Chemistry	ES	1,2,3,4,6,7,8, 11	1,2	3	0	2	4	40	60	100	26
25BEHS211G	Communication Skills Laboratory	HS	5,7,8,9,11	3	0	0	2	1	40	60	100	29
25BEHS246G	Yoga	SD	-	-	0	0	4	2	100	-	100	30
25BEMC251G	Vedic Mathematics	MC	-	-	1	0	0	0	100	-	100	31
	TOTAL				**19**	**1**	**8**	**23**	**480**	**420**	**900**	

Semester – III												
Course code	**Course Title**	**Category**	**Objectives & Outcomes**		**Instruction hours/week**			**Credits**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
25BEHS302G	Numerical Methods	BS	1,2,3,11	1,2	3	1	0	4	40	60	100	32

			PO	PSO	L	T	P		CIA	ESE	TOTAL	
25BECE302	Engineering Mechanics for Civil Engineers	PC	1,2,3,6,8,9, 11	1,2	3	1	0	4	40	60	100	34
25BECE303	Mechanics of Fluids	ES	1,2,3,6,7,10	1,2	3	0	0	3	40	60	100	36
25BECE304	Building Information Modelling in Construction	PC	1,2,3,4,5,6, 7,8,11	1,2,3	3	0	0	3	40	60	100	38
25BECE341	Surveying	PC	1,2,3,6,8,9, 11	1,2,3	3	0	2	4	40	60	100	41
25BECE342	Concrete Technology	PC	1,2,3,6,8,9, 11	1,2,3	3	0	2	4	40	60	100	43
25BECE391	Internship-1	PW	1,2,3,4,5,6, 8,9,10,11	1,2,3	0	0	2	1	100	-	100	45
25BECE311	Skill Development- I	SD	-	-	0	0	2	1	100	-	100	46
25BEMC351G	Aptitude and Reasoning	MC	-	-	1	0	0	0	100	-	100	47
	TOTAL				**19**	**2**	**8**	**24**	**540**	**360**	**900**	

Semester -IV

Course code	**Course Title**	**Category**	**Objectives & Outcomes**		**Instruction hours/week**			**Credits**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
25BECE401	Geology and Disaster Management for Civil Engineers	PC	1,2,6,9, 11	1,2	3	0	0	3	40	60	100	49
25BECE402	Design of Reinforced Concrete Structural Elements	PC	1,2,3,6, 9,11	1,2	3	0	0	3	40	60	100	51
25BECE441	Mechanics of Solids	PC	1,2,3,6, 8,9	1,2	3	0	2	4	40	60	100	53
25BECE442	Soil Mechanics	ES	1,2,3,6, 8,9,11	1,2	3	0	2	4	40	60	100	55
25BECE443	Water Supply and Wastewater Engineering	PC	1,2,3,6, 8,9,11	1,2,3	3	0	2	4	40	60	100	58
25BECE4E**	Professional Elective – I	PE	-	-	3	0	0	3	40	60	100	60
25BECE411	Skill Development - II	SD	-	-	0	0	2	1	100	-	100	61
25BECE451	Design Thinking	PC	1,2,3,4, 6,7,9	-	0	0	2	1	100	-	100	62
25BEMC452G	Essence of Traditional Indian Knowledge and Heritage	MC	-	-	1	0	0	0	100	-	100	64
	TOTAL				**19**	**0**	**10**	**23**	**540**	**360**	**900**	

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Semester – V												
Course code	**Course Title**	**Category**	**Objectives & Outcomes**		**Instruction hours/week**			**Credits**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
25BECE501	Structural Analysis	PC	1,2,3,6,9	1,2	3	0	0	3	40	60	100	65
25BECE502	Foundation Engineering	PC	1,2,3,6,8,9, 11	1,2	3	0	0	3	40	60	100	67
25BECE503	Highway Planning, Design and Operation	PC	1,2,3,4,5,6, 8,9,10	1,2,3	3	0	0	3	40	60	100	69
25BECE504	Hydrology and Water Resources Engineering	PC	1,2,3,6,9,11	1,2	3	0	0	3	40	60	100	72
25BECE5E**	Professional Elective – II	PE	-	-	3	0	0	3	40	60	100	74
25BECE541	Hydraulic Engineering	PC	1,2,3,6,8,9, 11	1,2,3	3	0	2	4	40	60	100	75
25BECE511	Building Drawing and Detailing Laboratory	PC	1,2,3,6,7,9, 10	1,2,3	0	0	4	2	40	60	100	78
25BECE512	Community Engagement and Social Responsibility	ES	1,2 ,6,8,9,11	-	1	0	2	2	100	-	100	79
25BECE591	Internship-II	PW	1,2,3,4,5,6, 7, 8,9,10,11	1,2,3	0	0	2	1	100	-	100	81
	TOTAL				**19**	**0**	**10**	**24**	**480**	**420**	**900**	

Semester -VI												
Course code	**Course Title**	**Category**	**Objectives & Outcomes**		**Instruction hours/week**			**Credits**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
25BECE601	Design of Steel Structures	PC	1,2,3,4,6 ,9,10,11	1,2,3	3	0	0	3	40	60	100	82
25BECE602	Estimation, Costing and Valuation Engineering	PC	1,2,3,4,6 ,8,9,11	1,2	3	0	0	3	40	60	100	84
25BECE603	Professional Practice Law and Ethics	PC	1,2,6,7, 9,11	1,2	3	0	0	3	40	60	100	86
25BECE6E**	Professional Elective – III	PE	-	-	3	0	0	3	40	60	100	89
25BECE6E**	Professional Elective – IV	PE	-	-	3	0	0	3	40	60	100	90
25BECE6E**	Professional Elective – V	PE	-	-	3	0	0	3	40	60	100	91
25BEHS601G	Universal Human Values	HS	1,2,7,8, 11	-	2	0	0	2	100	-	100	92
25BECE611	Mini Project - I	PC	-	-	0	0	2	1	100	-	100	94
25BECE612	Survey Camp	PC	1,2,3,4, 5,6,7,8, 9,10,11	1,2,3	0	0	2	1	100	-	100	95
	TOTAL				**20**	**0**	**4**	**22**	**540**	**360**	**900**	

Semester – VII												
Course code	**Course Title**	**Category**	**Objectives & Outcomes**		**Instruction hours/week**			**Credits**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
25BECE7E**	Professional Elective – VI	PE	-	-	3	0	0	3	40	60	100	96
25BECE7E**	Professional Elective – VII	PE	-	-	3	0	0	3	40	60	100	97
25BECE791	Mini Project – II/ Design Project	PW	1,2,3,4,5,6, 8,9,10,11	1,2,3	0	0	8	4	80	120	200	98
	TOTAL				**6**	**0**	**8**	**10**	**160**	**240**	**400**	
Semester -VIII												
Course code	**Course Title**	**Category**	**Objectives & Outcomes**		**Instruction hours/week**			**Credits**	**Maximum Marks**			**Page No.**
			PO	**PSO**	**L**	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
25BECE891	Project Work	PW	1,2,3,4,5,6,8, 9,10,11	1,2,3	0	0	16	8	120	180	300	99
	TOTAL				**0**	**0**	**16**	**8**	**120**	**180**	**300**	
OPEN ELECTIVE												
25BEOE	Open Elective I (Swayam/ NPTEL)	OE	-	-	-	-	-	3	-	100	100	-
25BEOE	Open Elective II (Swayam /NPTEL)	OE	-	-	-	-	-	3	-	100	100	-
SEMESTER TOTAL					**0**	**0**	**0**	**6**	**-**	**200**	**200**	
PROGRAM TOTAL												

Total No of Credits = 160

Total Marks = 6200

Note*: Students should clear any 2 Swayam/ NPTEL courses between 3rd to 7th semester.

PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE-I								
Course Code	**Course Title**	**Instruction Hours/Week**			**Credits**	**Maximum Marks**			**Page.No**
		L	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
25BECE4E01	Airports and Seaports Engineering	3	0	0	3	40	60	100	101
25BECE4E02	Environmental Soil Pollution	3	0	0	3	40	60	100	103
25BECE4E03	Earth Reinforcement	3	0	0	3	40	60	100	105
25BECE4E04	Air and Noise Pollution and its Control	3	0	0	3	40	60	100	107

PROFESSIONAL ELECTIVE-II									
Course Code	Course Title	Instruction Hours/Week			Credits	Maximum Marks			Page.No
		L	T	P		CIA	ESE	TOTAL	
25BECE5E01	Design and Execution of Pile Foundation	3	0	0	3	40	60	100	109
25BECE5E02	Environmental Geotechnology	3	0	0	3	40	60	100	111
25BECE5E03	Transport of Water and Wastewater	3	0	0	3	40	60	100	113
25BECE5E04	Building Construction Practice	3	0	0	3	40	60	100	115
PROFESSIONAL ELECTIVE-III									
Course Code	Course Title	Instruction Hours/Week			Credits	Maximum Marks			Page.No
		L	T	P		CIA	ESE	TOTAL	
25BECE6E01	Metros Rail Transportation System and Construction	3	0	0	3	40	60	100	117
25BECE6E02	Construction Project Planning and Systems	3	0	0	3	40	60	100	120
25BECE6E03	Sustainable Construction Methods	3	0	0	3	40	60	100	122
25BECE6E04	Advanced Structural Analysis	3	0	0	3	40	60	100	124
PROFESSIONAL ELECTIVE-IV									
Course Code	Course Title	Instruction Hours/Week			Credits	Maximum Marks			Page.No
		L	T	P		CIA	ESE	TOTAL	
25BECE6E05	Construction Techniques and Management	3	0	0	3	40	60	100	126
25BECE6E06	Solid Waste Management	3	0	0	3	40	60	100	128
25BECE6E07	Design of Concrete Structures-I	3	0	0	3	40	60	100	130
25BECE6E08	Contracts Management	3	0	0	3	40	60	100	132
PROFESSIONAL ELECTIVE-V									
Course Code	Course Title	Instruction Hours/Week			Credits	Maximum Marks			Page.No
		L	T	P		CIA	ESE	TOTAL	
25BECE6E09	Ground Improvement Techniques	3	0	0	3	40	60	100	134
25BECE6E10	Irrigation Engineering	3	0	0	3	40	60	100	136
25BECE6E11	Advanced Construction Techniques	3	0	0	3	40	60	100	138
25BECE6E12	Design of Concrete Structures-II	3	0	0	3	40	60	100	140

PROFESSIONAL ELECTIVE-VI									
Course Code	**Course Title**	**Instruction Hours/Week**			**Credits**	**Maximum Marks**			**Page.No**
		L	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
25BECE7E01	Bridge Engineering Design Practices	3	0	0	3	40	60	100	142
25BECE7E02	Biological Processes for Contaminant Removal	3	0	0	3	40	60	100	144
25BECE7E03	Instrumentation and Sensor Technologies for Civil Engineering Applications	3	0	0	3	40	60	100	146
25BECE7E04	Rural Water Supply and Onsite Sanitation Systems	3	0	0	3	40	60	100	148
PROFESSIONAL ELECTIVE-VII									
Course Code	**Course Title**	**Instruction Hours/Week**			**Credits**	**Maximum Marks**			**Page.No**
		L	**T**	**P**		**CIA**	**ESE**	**TOTAL**	
25BECE7E05	Prefabricated Structures	3	0	0	3	40	60	100	150
25BECE7E06	Environmental Impact Assessment	3	0	0	3	40	60	100	152
25BECE7E07	Repair and Rehabilitation of Structures	3	0	0	3	40	60	100	154
25BECE7E08	Pre-Stressed Concrete Structures	3	0	0	3	40	60	100	156

25BEHS101G	TECHNICAL ENGLISH-I	SEMESTER I 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	**Marks: Internal:40 External:60 Total:100**	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To acquire the fundamental reading and writing skills, proper grammar usage, listening, and speaking
- To understand and improve skills in listening and speaking, in expressing oneself formally in writing, and in deducing meaning from what one reads
- To apply one's receptive (reading and listening) and productive (writing and speaking) language skills.

COURSE OUTCOMES:

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

CO1	Replicate grammar usage in reading, speaking, and writing skills	P2
CO2	Describe precise transitions while reading, writing, and speaking to enhance communication coherence and clarity	A2
CO3	Report the interpretation of linguistic parameters in day-to-day reading, listening, and speaking interactions	A2
CO4	Point out errors to restructure paragraphs, compose, compile, and synthesize documents for presentations	P2
CO5	Demonstrate proficiency in reading, writing, and critical listening and the ability to interpret and articulate complex ideas persuasively in written and oral forms	A3

***P- Psychomotor skills, A-Affective Domain Skills**

UNIT I **9**

Grammar **:** Parts of Speech – Gerunds and infinitives – Sentence Pattern
Reading **:** Reading comprehension: (vocabulary, referents, and inferences/conclusions)
Writing **:** Business letter – e-mail Writing
Listening **:** Listening to different short recordings – Listen to a longer recording
Speaking **:** Introduction to Phonetics, Diphthongs

UNIT II **9**

Grammar **:** Tenses: Simple Tenses – Concord – Types of Sentences
Reading **:** Identifying main and secondary information
Writing **:** Check lists – Building Itineraries
Listening **:** Listening Comprehension – Job Description
Speaking **:** Pronunciation – Describing people, places, jobs and things – Asking and answering questions

UNIT III **9**

Grammar **:** Tenses: Progressive Tenses – Direct and Indirect speech – Concord
Reading **:** Identifying, organizing, comparing and Interpreting information
Writing **:** Writing Articles – Paragraph Writing
Listening **:** Telephonic conversation
Speaking **:** Stress, Intonation – Self Introduction

UNIT IV **9**

Grammar **:** Tenses: Perfect Tenses – Active and Passive voice
Reading **:** Reading Comprehension (Reconstruction, Rewording)

Writing **:** Memo – Notice – Agenda
Listening **:** Critical Listening
Speaking **:** Oral presentation

UNIT V **9**

Grammar **:** Tenses: Perfect Continuous Tenses – Reported Speech
Reading **:** Reading Comprehension (Cause and Effect identification)
Writing **:** Creative writing – Copy Writing
Listening **:** Listening and Interpretation of ideas
Speaking **:** Group Discussion

TOTAL: 45

TEXT BOOKS:

1. Richards J C, Hull J, et al., "Interchange 2 Student's Book", 5th Edition, Cambridge University Press, 2022.
2. Kumar Sanjay and Pushp Latha, "English Language and Communication Skills for Engineers", 1st Edition, Oxford University Press, 2018.

REFERENCE BOOKS:

1. Swan Michael and Walter Catherine, "Oxford English Grammar Course", 1st Edition, Oxford University Press, 2019.
2. Sudharshana N P and Savitha C, "English for Engineers", 1st Edition, Cambridge University Press, 2018.
3. Brook-Hart G, "Business Benchmark: Upper intermediate: Business Vantage: Student's Book", 2nd Edition,
   Cambridge University Press, 2021.

WEB URLs:

1. www.onestopenglish.com
2. www.britishcouncil.org
3. www.cambridgeenglish.org/learning-english/

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	2	-	2	2	3	-	2	-	-	1
CO2	-	-	-	-	2	-	2	2	3	-	2	-	-	1
CO3	-	-	-	-	2	-	2	2	3	-	2	-	-	1
CO4	-	-	-	-	2	-	2	2	3	-	2	-	-	1
CO5	-	-	-	-	2	-	2	2	2	-	2	-	-	1
Avg.	-	-	-	-	2	-	2	2	2.8	-	2	-	-	1

25BEHS103G	MATRICES AND CALCULUS	SEMESTER I 4H-4C
Instruction Hours/Week: L:3 T:1 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To provide sufficient knowledge in calculus and matrix algebra in the respective fields
- To find an extremum value for a function of several variables subject to a given constraint.
- To provide knowledge in evaluating double and triple integrals
- To apply mathematical tools to solve second and higher order ODE and PDE with constant coefficients.

COURSE OUTCOME:

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

CO1	Make use of orthogonal transformation to reduce the quadratic form to canonical form.	K3
CO2	Utilize differential calculus of multivariable to optimization problems.	K3
CO3	Apply multiple integrals for finding area and volume	K3
CO4	Solve the n^{th} order Ordinary Differential Equations (ODE) and Homogeneous equation of Euler's type	K3
CO5	Solve the n^{th} order Partial Differential Equations	K3

UNIT I MATRICES 12

Eigenvalues and Eigenvectors of a real matrix– Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II DIFFERENTIAL CALCULUS OF MULTIVARIABLE FUNCTIONS 12

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions –Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT III MULTIPLE INTEGRAL 12

Definite and Indefinite Integrals – Double integrals – Change of order of integration – Double integrals in polar coordinates – Area using double integrals – Evaluation of Triple Integrals- Volume of Solids.

UNIT IV ORDINARY DIFFERENTIAL EQUATIONS 12

Linear differential equation of second and higher order with constant coefficients –Cauchy-Euler linear differential equation – Method of Variation of parameters.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS 12

Homogeneous linear partial differential equations of second and higher order with constant coefficients – Classification of partial differential equations.

TOTAL: 45+15

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Hass, Heil and Weir	Thomas Calculus	14th Edition, Pearson Education	2018
2	Dennis G. Zill	Advanced Engineering Mathematics	7th Edition, Jones & Bartlett Learning	2022

REFERENCE BOOKS:

1. Rogawski, Adams and Franzosa, “Calculus”, 4th Edition, W. H. Freeman, 2019.
2. Boyce, DiPrima and Meade, “Elementary Differential Equations and Boundary Value Problems”, 12th Edition, John Wiley & Sons, 2021.
3. Alexander Graham, “Matrix Theory and Applications for Scientists and Engineers”,1st Edition, Dover Publications Inc.,2018.
4. Grewal, B. S.,Higher engineering mathematics. 2018, Khanna Publishers, New Delhi.

WEBSITES:

1. www.classcentral.com/course/matrix-methods-13644
2. www.classcentral.com/course/brilliant-calculus-ii-59290
3. www.classcentral.com/course/differential-equations-engineers-13258

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	1	2	1	-
CO2	3	2	1	-	-	-	-	-	-	-	1	2	1	-
CO3	3	2	1	-	-	-	-	-	-	-	1	2	1	-
CO4	3	2	1	-	-	-	-	-	-	-	1	2	1	-
CO5	3	2	1	-	-	-	-	-	-	-	1	2	1	-
Avg.	3	2	1	-	-	-	-	-	-	-	1	2	1	-

25BEHS107G	ENVIRONMENTAL STUDIES	SEMESTER I 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is to:

- Create a basic understanding about ecosystem and natural resources.
- Acquire knowledge on biodiversity conservation and pollution eradication.
- Introduce the roles and responsibilities about social issue and improvement in the interconnected world

COURSE OUTCOMES:

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

CO1	Outline the ecological processes supporting the life system	K2
CO2	Infer the importance of environment and impact of human activities on natural resources	K2
CO3	Demonstrate the levels and values of biodiversity and its conservation	K2
CO4	Summarize the problems of environmental pollution and its control measures	K2
CO5	Interpret the remediation methods for social issues and degraded environment	K2

UNIT I ENVIRONMENT & ECOSYSTEMS 9

Environment Definition, Scope and importance; layers of atmosphere-Ecosystem, Structure and functions of ecosystem. Energy flow, Food chains and food webs, Ecological succession. Classification of ecosystem. Forest ecosystem, Grassland Ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT II NATURAL RESOURCES 9

Natural resources - Renewable and Non - Renewable resources. Land resources and land use change, Land degradation, soil erosion and desertification. Forest resources- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water resources- Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water. Use of alternate energy sources, growing energy needs, case studies. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT III BIODIVERSITY AND ITS CONSERVATION 9

Levels of biological diversity – genetic, species and ecosystem diversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value. Bio-geographical classification of India. Biodiversity patterns (global, National and local levels). Hot-spots of biodiversity. India as a mega-diversity nation. Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT IV ENVIRONMENTAL POLLUTION 9

Definition, causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, E-pollution. Nuclear hazards and human health risks. Solid waste management and control

measures of urban, industrial and e-wastes. Role of an individual in prevention of pollution. Case studies.

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT 9

Concept of sustainability, Goals and sustainable development-circular economy- Water conservation - Rain water harvesting, watershed management. Climate change, global warming, ozone layer depletion, acid rain and its impacts on human communities and agriculture. Disaster management (floods, earthquake, cyclones and landslides). Environmental Movements (Chipko Silent valley, Bishnois of Rajasthan). Environmental ethics: Human population growth- Impacts on environment, human health and welfare-Variation among nations.

TOTAL HOURS: 45

TEXT BOOKS:

1. Anubha Kaushik., and Kaushik, C.P. 7th Edition, 2021. Perspectives in Environmental Studies. New Age International Pvt. Ltd. Publications, New Delhi.
2. Prabhakar S Mithra, "Methodologies for environmental studies", 1st Edition, Academic Aspirations, 2021.
3. Arvind Kumar. 2004. A Textbook of Environmental Science. APH Publishing Corporation, New Delhi.
4. Erach Bharucha, "A Textbook of Environmental Studies for UG Courses" 3rd Edition, University Press India ltd, 2021.
5. Uberoi, N.K. 2005. Environmental Studies. Excel Books Publications, New Delhi.

REFERENCE BOOKS:

1. G.Tyler Miller and Scott Spoolman, "Living in the Environment", 20th Edition, Cengage Learning, 2021.
2. Linda D Williams, "Environmental Science" 1st Edition, Tata McGraw Hill, 2017.
3. Sing, J.S., Sing. S.P. and Gupta, S.R. 2022. Ecology, Environmental Science and Conservation. S. Chand & Publishing Company, New Delhi.
4. Mishra, D.D. 2010. Fundamental Concepts in Environmental Studies. S. Chand& Company Pvt. Ltd., New Delhi.
5. Singh, M.P., Singh, B.S., and Soma, S. Dey. 2004. Conservation of Biodiversity and Natural Resources. Daya Publishing House, New Delhi.

WEB REFERENCES:

1. https://www.insightsonindia.com/2013/09/06/environment-biodiversity
2. https://www.nptelvideos.in/2012/11/energy-resources-and-technology.html
3. https://www.msubbu.in/ln/environment/

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	3	3	-	-	-	2	2	-	-
CO2	2	1	-	-	-	3	3	-	-	-	2	2	-	-
CO3	2	1	-	-	-	3	3	-	-	-	2	2	-	-
CO4	2	1	-	-	-	3	3	-	-	-	2	2	-	-
CO5	2	1	-	-	-	3	3	-	-	-	2	2	-	-
Avg.	2	1	-	-	-	3	3	-	-	-	2	2	-	-

25BEHS141G	ENGINEERING PHYSICS (Theory & Laboratory)	SEMESTER I 5H-4C
Instruction Hours/Week: L:3 T:0 P:2	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES

The goal of this course is to

- Introduce the concepts of quantum mechanics and crystal for diverse applications.
- Understand the basics of laser and optical fiber with appropriate applications.
- Inculcate the basics of properties of matter and its applications.

COURSE OUTCOMES

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

CO1	Outline the basics of crystals, structures and its defects	K2
CO2	Examine the performance of light and laser	K3
CO3	Identify the numerical aperture and acceptance angle of an optical fibre	K3
CO4	Relate the quantum concepts in electron microscope	K2
CO5	Apply the elastic properties of the materials to understand the modulus of the material	K3

(i) THEORY

UNIT I CRYSTAL PHYSICS 9

Classification of solids: Crystalline and amorphous solids – crystal structure - unit cell, primitive cell – seven crystal systems, Bravais lattices, Miller indices – inter-planar distances (Qualitative) - Coordination number and atomic packing factor for Simple Cubic, Body Centered Cubic, Face Centered Cubic– Defects in crystal: Point & Line defect.

UNIT II LASERS 9

LASER: Introduction - characteristics – Absorption- spontaneous emission- stimulated emission- Einstein's co-efficients derivation- principle of laser action- population inversion- pumping methods - Types of lasers - Nd: YAG, Semiconductor Laser (Homo Junction Laser)- Applications of LASER in industry and medicine.

UNIT III FIBRE OPTICS 9

Fiber optics – principle and propagation of light in optical fibers – numerical aperture and acceptance angle – types of optical fibers (Material, refractive index and mode) – types of losses in optical fibers - fiber optical communication system (block diagram).

UNIT IV QUANTUM PHYSICS 9

Black body radiation - Energy Distribution laws (Qualitative): Stefan Boltzmann's law, Wein's Displacement law-Rayleigh Jeans Law. Photo electric effect (Qualitative) – Compton effect (Qualitative) – De Broglie hypothesis - uncertainty principle – physical significance of wave function - Schrödinger's Time dependent wave equation - Schrödinger's Time independent wave equation – Particle in one dimensional box- Scanning Electron Microscope and Transmission Electron Microscope.

UNIT V PROPERTIES OF MATTER 9

Elasticity – stress – strain – Hookes law- classification of elastic modulus -Poisson's ratio - Stress-Strain diagram and its uses - factors affecting elastic modulus and tensile strength - Moment, Couple and Torque– Twisting couple on a wire – bending moment – cantilever- young's modulus uniform bending – I- shaped girders and its applications.

TOTAL HOURS: 45

(ii) LABORATORY

LIST OF EXPERIMENTS – PHYSICS

1. Determination of Band gap of a semiconductor.
2. Uniform bending – Determination of young's modulus.
3. Non-uniform Bending – Determination of young's modulus.
4. Laser - Determination of the wave length of the laser using grating
5. Laser – Determination of Particle size
6. Optical Fiber – Determination of Numerical Aperture and Acceptance angle of the optical fiber.
7. Air wedge – Determination of thickness of a thin sheet/wire.

TOTAL HOURS: 30

TEXT BOOKS:

1. Bhattacharya D.K. & Poonam T., Engineering Physics, Oxford University Press, 2015.
2. Gaur R.K. and Gupta S.L, Engineering Physics, Dhanpat Rai Publications, 2012.
3. Pandey. B.K. & Chaturvedi. S, Engineering Physics, Cengage Learning India, 2012.
4. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
5. P.M. Mathews, K.Venkatesan, A text book of Quantum Mechanics, 2/e, Mc Graw Hill Education, 2017.
6. Laser Fundamentals, William T Silfvast, Cambridge Univ Press. 2012.
7. Fiber Optics and Optoelectronics, R P Khare, Oxford, 2012.
8. D.S. Mathur, Elements of properties of matter, S.Chand, 2010.

REFERENCES:

1. Halliday.D. Resnick R. & Walker. J, Principles of Physics, Wiley, 2015.
2. Daniel V.Schroeder, An Introduction to Thermal Physics, Pearson, 2014.

WEBLINKS:

1. www. nptel.ac.in/courses/122/103/122103011/
2. www.nptel.ac.in/courses/113/104/113104081/
3. www.hyperphysics.phy-astr.gsu.edu/hbase/optmod/lascon.html

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	-	1	-	-	1	2	-	-
CO2	3	2	1	-	-	1	-	1	-	-	1	2	-	-
CO3	3	2	1	-	-	1	-	1	-	-	1	2	-	-
CO4	2	1	-	-	-	1	-	1	-	-	1	2	-	-
CO5	3	2	1	-	-	1	-	1	-	-	1	2	-	-
Avg.	2.6	1.6	1	-	-	1	-	1	-	-	1	2	-	-

25BTAD141G	**PYTHON PROGRAMMING (Theory and Laboratory)**	**SEMESTER I 5H-4C**
Instruction Hours/Week: L:3 T:0 P:2	**Marks: Internal:40 External:60 Total:100**	
		End Semester Exam: 3Hours

COURSE OBJECTIVES

The goal of this course is to

- To learn about basic python syntax and semantics like control structures and functions
- To develop logical thinking abilities and to propose novel solutions for real world problems through object–oriented programming concepts
- To deepen the empirical knowledge on applying programming on business domains

COURSE OUTCOMES:

Upon completion of this course the students will be able to

CO1	Interpret the basic representation of the data structures and sequential programming	K2
CO2	Solve the problems using list, dictionaries, tuples, and sets core data structures	K3
CO3	Build applications using functions, modules and packages	K3
CO4	Examine the error-handling constructs for unanticipated states/inputs.	K4
CO5	Analyze the applications on real-world problems using object-oriented concepts	K4

(i) THEORY

UNIT I PYTHON BASICS 9

Fundamentals of Computing - Building blocks of algorithms - Introduction to Programming - Elements of python - Variables - Data Types - Operators - Operator Precedence - Expressions - Conditional statement - Loops - Break, Continue and Pass - Illustrative problems: square root, GCD, LCM, Sum an array of numbers, Linear search, Binary search.

UNIT II PYTHON DATA STRUCTURES 9

Mutable vs immutable data types - String - Indexing and slicing - String functions - List - List slices - List methods - Iterate over a list - Mutability - Aliasing - Cloning lists - List parameters - List comprehension- Tuples- Tuple assignment - Tuple as return value - Dictionaries - Operations and methods - Set - Set operations - Illustrative programs: Simple sorting, pattern matching, Fibonacci, Factorial, Prime numbers.

UNIT III FUNCTIONS, MODULES AND PACKAGES 9

Built-in functions - User defined functions - Creating function - Calling functions - Types of function arguments - Recursion and lambda or anonymous functions - Packages: Defining - Creating and accessing a package - Python libraries NumPy, pandas, Matplotlib - Flask/Django.

UNIT IV FILE HANDLING, CLASS AND OBJECT 9

Introduction to files - File path - Opening and closing files - Reading and writing files - File position - Decorators - Introduction to elements of OOP - Class - Object - Inheritance - Data abstraction - Encapsulation - Polymorphism - UML class diagram - Access specifiers - Creating classes - Creating object - Accessing members – init () method - Instance, static and class methods - Importance of self - Implementing encapsulation. Illustrative programs: File operations on TEXT and CSV, Scientific calculator using class and objects.

UNIT V ERROR HANDLING, TESTING 9

Exception handling with try, except, finally - Exception handling: Errors vs exceptions - Handling exceptions - Raising exception - Creating user defined exception - Debugging techniques- Unit testing with unit test - Writing test cases - web scraping - Data analysis project - Automation script.

TOTAL HOURS: 45

(ii) LABORATORY

LIST OF EXPERIMENTS – PHYSICS

1. Write conditional and looping statements in Python.
2. Create and manipulate strings using indexing, slicing, and various string functions.
3. Create and manipulate lists using operations, slices, methods, list comprehension, and looping.
4. Create and manipulate tuples, dictionaries, and sets, and understand the differences between mutable and immutable types.
5. Implement user-defined functions and understand the different types of function arguments, such as positional, keyword, and default arguments.
6. Implement inheritance and understand the different types of inheritance.
7. Implement polymorphism through method overloading, overriding, and operator overloading.

TOTAL HOURS: 30

TEXT BOOKS:

1. Allen B Downey, Jeffrey Elkne, Chris Meyers, “How to Think Like a Computer Scientist: Learning with Python 3 Documentation”, 3rd Edition, Green Tea Press, 2020.
2. Steven F. Lott, Dusty Phillips, “Python Object-Oriented Programming: Build robust and maintainable object-oriented Python applications and libraries”4th Edition, Packt Publishing Limited, 2021.

REFERENCES:

1. R. Nageswara Rao,” Core Python Programming”, 3rd Edition, Dream tech Press, 2022.
2. Mark Lutz, “Learning Python”, 5th Edition, O’Reilly Publication, 2018.
3. Mark and Summerfield, “Programming in Python 3”, 2nd Edition, Dorling Kindersley India Pvt. Ltd, 2019.

WEBLINKS:

1. https://realpython.com/
2. www.programiz.com/python-programming
3. https://www.geeksforgeeks.org/python-programming-language/
4. https://www.pythonspot.com/

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	2	2	-	3	-	-	-
CO2	3	2	1	-	-	-	-	2	2	-	3	-	-	-
CO3	3	2	1	-	-	-	-	2	2	-	3	-	-	-
CO4	3	3	2	1	-	-	-	2	2	-	3	-	-	-
CO5	3	3	2	1	-	-	-	2	2	-	3	-	-	-
Avg.	2.8	2.4	1.4	1	-	-	-	2	2	-	3	-	-	-

25BEME111G	WORKSHOP PRACTICES LABORATORY	SEMESTER I 4H-2C
Instruction Hours/Week: L:0 T:0 P:4	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES

The goal of this course is to

- To know the usage of appropriate tools used in foundry and sheet metal
- To provide the practical experience on basic machining operations and metal joining process
- To understand the household plumbing, electrical wiring and assembly works

COURSE OUTCOMES:

Upon completion of this course the students will be able to

CO1	Prepare green sand mould using the tool and equipment	K3
CO2	Perform basic secondary manufacturing processes like sheet metal cutting, machining and joining processes	K3
CO3	Carryout common household plumbing works	K3
CO4	Assemble common household equipment	K3
CO5	Carryout soldering and electrical wiring	K3

LIST OF EXPERIMENTS:

FOUNDRY:

1. Study of tools
2. Preparation of green sand mould with a solid pattern
3. Preparation of green sand mould with a split pattern

SHEET METAL:

1. Study of tools and equipment's
2. Model making – Rectangular Tray
3. Model making – Funnel

BASIC MACHINING:

1. Step Turning
2. Taper Turning
3. Drilling practice

WELDING:

1. Study of Gas welding and its equipment's
2. Study of Arc welding and its equipment's
3. Welding of Lap joint
4. Welding of Butt joint
5. Welding of T-Joint

PLUMBING:

1. Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances

ASSEMBLY:

1. Assembly of a centrifugal pump

SOLDERING AND ELECTRICAL WIRING:

1. Safety aspects of electrical wiring
2. Soldering of small electrical and electronic Circuits
3. Study of electrical materials and wiring components
4. Wiring circuit for a lamp using single and stair case switches
5. Wiring circuit for fluorescent lamps
6. Calculation of power and energy

TOTAL HOURS: 60

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	1	-	-	2	1	-	1	1	-	3
CO2	3	2	1	-	1	-	-	2	1	-	1	1	-	3
CO3	3	2	1	-	-	-	-	2	1	-	1	1	-	3
CO4	3	2	1	-	-	-	-	2	1	-	1	1	-	3
CO5	3	2	1	-	-	-	-	2	1	-	1	1	-	3
Avg.	3.0	2.0	1.0	-	1.0	-	-	2.0	1.0	-	1.0	1.0		3.0

25BEMC151G	WOMEN SAFETY AND SECURITY	SEMESTER I 1H-0C
Instruction Hours/Week: L:1 T:0 P:0	Marks: Internal:100 External:- Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students to

- Highlight the social construction of gender in Indian society and the role of social institutions in the socialization process.
- Make aware about the practical issues concerning gender and politics.
- Classify the students in engendering national policies and programmes.
- Observe the liability of women and women's work in the context of globalization.
- Acquaint knowledge about the political participation of women and the gendered structures of governance and polity.

COURSE OUTCOMES:

Upon completion of this course the students will be able to

- Infer into the basic concepts related to sex, gender, femininity etc.
- Demonstrate the rationale for women's studies
- Compare Gender Equality Issues and Movements in Women's Studies
- Summarize the Social construction of Gender, Gender Roles and Gender stereotyping.
- Illustrate Social Structures, Changing Status of Women in India.

UNIT I FUNDAMENTAL CONCEPTS OF WOMEN'S STUDIES

Definition- Objectives of Women's Studies; Importance of Women's Studies; Women's Studies as an Academic Discipline; Role of UGC Centre for Women's Studies

UNIT II SOCIAL EMPOWERMENT

Women in Higher Education; Gender issues in Health, Environment, Family welfare measures, Indecent representation of Women in media; Women in Difficult circumstances; Constitutional.

UNIT III POLITICAL EMPOWERMENT

Women leaders in politics- Women in Local Governance- Barriers- Reservation policies- Women's Political Rights, Property Rights - Violence against Women - Women's work

TEXT BOOKS:

1. Amy S. Wharton. (2005). "The Sociology of Gender: An Introduction to Theory and Research". (Key Themes in Sociology) Blackwell Publishing, UK, Indian Reprint, Kilaso Books, New Delhi.
2. Devaki Jain and Pam Rajput (Ed). (2003). "Narratives from the Women‟s Studies Family: Recreating Knowledge, Sage, and New Delhi.
3. Jasbir Jain (Ed). (2005). "Women in Patriarchy: Cross Cultural". Rawat Publication Jaipur.

25BEMC152G	தமிழர் மரபும் பண்பாடும்	SEMESTER I 1H-0C
Instruction Hours/Week: L:1 T:0 P:0		Marks: Internal:100 External:- Total:100
		End Semester Exam: 3Hours

பாடத்திட்ட பயன் விளைவு:

- வரலாற்றிற்கு முற்பட்ட தமிழகத்தை மாணவர்களுக்கு அறிமுகப்படுத்துதல்
- பழந்தமிழர் பண்பாடு சார்ந்த வாழ்க்கை முறையை மாணவர்கள் அறிய ஊக்குவித்தல்
- தமிழ் மொழியின் பழைமையும், திராவிட மொழிகளில் தமிழ்மொழியின் தனிச்சிறப்பையும் மாணவர்களுக்கு அறிமுகப்படுத்துதல்.
- தமிழர்களின் வாழ்வியல், தமிழர்கலைகள், ஆற்றங்கரைப்பண்பாடுகள் குறித்து மாணவர்கள் அறியச்செய்தல்.
- இந்தியக்குடியுரிமைப்பணி முதலான போட்டித்தேர்வுகளில் விருப்பப்பாடமாக இடம்பெறுகின்ற தமிழ்நாகரிகமும் பண்பாடும் குறித்த முழுமையான அறிமுகம் பெற்றிருத்தல்

பாடத்திட்டப் பொதுநோக்கம்:

1. இந்தியக்குடியுரிமைப்பணி முதலான போட்டித்தேர்வுகளில், விருப்பப்பாடமாக இடம்பெறுகின்ற, 'தமிழ்இலக்கியவரலாறு' குறித்த முழுமையான அறிமுகம் பெற்றிருத்தல்.
2. கல்வெட்டியல், ஓலைச்சுவடியியல் மற்றும் தொல்லியல் சார்ந்த ஆவணத்தேடலுக்குரிய ஆய்வுமனப்பான்மையுடன், இலக்கியங்களை அணுகுதல்.
3. தமிழின்வளர்ச்சித்துறையாகிய,'அறிவியல்தமிழ்';'இணையதமிழ்' குறித்த பன்நோக்கு அணுகுமுறையிலான ஆய்வுச்சிந்தனை மேம்பாடு.
4. வேலைவாய்ப்புக்குரிய சுயதிறன் மேம்பாட்டுடன், படைப்பாக்கத்திறன் மேம்பாடும் பெற்றிருத்தல் .
5. சமுதாய மற்றும் வாழ்வியல் மதிப்புகளைப்பேணுவதற்குக்கருவியாக இலக்கியங்களை நாடுகின்ற மனப்பான்மைவளர்ச்சி. மொழிபெயர்ப்புத்துறை சார்ந்த வேலைவாய்புத்திறன் பெற்றிருத்தல்.

அலகு:1 தமிழர் மரபு

மரபு-விளக்கம்-சங்ககால தமிழர் மரபு – திணைப்பகுப்பும் தமிழர் மரபும்-உலகப்பொதுமை – அகத்திணை மரபு – புறத்திணை மரபு-இடைக்காலத்தமிழர் மரபு – பிற்கால மரபும் மாற்றமும் – தற்கால தமிழர்மரபு - வளர்ச்சி.

அலகு: 2 தமிழர் பண்பாடு

பண்பாடு – விளக்கம் – பழந்தமிழர் பண்பாடு – இயற்கை சார்ந்த வாழ்வியல் – தமிழர் சமயம் – அரசியல் நிலை–சமூகப் பழக்கவழக்கங்கள் – நம்பிக்கைகள் – வாழ்வியல் அறங்கள் – வணிகம் போன்றவை.

அலகு:3 தமிழர் கலைகள்

தமிழகத்தில் கலைகளின் வளர்ச்சி – சிற்பக்கலை வளர்ச்சி –கோயில் கலை – கற்கோவில்கள் - ஓவியக்கலை – அழகுக்கலைகள் - கூத்துக்கலை – மருத்துவக்கலை – நாடகக்கலை– இசைக்கலை போன்றவை.

அலகு: 4 தமிழர் சமயம்

பழந்தமிழரின் சமயம் – சங்ககால சமயம் – தொல்காப்பியத்தில் சமயம் – சைவ சமயம் – வைணவம் – தமிழ்ப் பண்பாட்டில் பௌத்தம் – தமிழ்ப் பண்பாட்டில் சமணத்தின் தாக்கம்–தமிழ்ப் பண்பாட்டில் இசுலாம் மற்றும் கிறித்துவ சமயத்தின் தாக்கம்- தமிழர் பண்பாட்டில் விழாக்கள்- கோயில்களும் விழாக்களும்- சமூக ஒருங்கிணைப்பில் விழாக்களின் பங்கு- சங்க இலக்கியத்தில் விழாக்கள் பற்றிய குறிப்புகள்-இடைக்கால இலக்கியங்களில் விழாக்கள் பற்றிய செய்திகள் – விழாக்களின் சமூகப்பங்களிப்பு – தற்காலத்தில் தமிழர் விழாக்கள் - விளையாட்டும் விழாக்களும்.

அலகு: 5 இலக்கியங்களில் தமிழர் பண்பாட்டுப் பதிவுகள்

சங்க இலக்கியமும் வாழ்வியலும்-திருக்குறளில் வாழ்வியல் நெறிகள் – இரட்டைக் காப்பியங்களும் வாழ்வியலும் – சிற்றிலக்கியங்களில் வாழ்வியல் பதிவுகள்-இக்கால இலக்கியமும் வாழ்வியலும்.

பார்வை நூல்கள்:

1. தமிழ் இலக்கிய வரலாறு – தமிழண்ணல், மீனாட்சி புத்தக நிலையம்-மதுரை-இரண்டாம் பதிப்பு-ஜூலை – 2000.
2. தமிழர் நாகரிகமும் பண்பாடும், அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், சென்னை, திருத்திய பதிப்பு – 2022.
3. தமிழர் வரலாறும் பண்பாடும், நா. வானமாமலை, நியூசெஞ்சுரி புக் ஹவுஸ், சென்னை, ஆறாம்பதிப்பு - 2007 .
4. தமிழக வரலாறு மக்களும் பண்பாடும், கே.கே. பிள்ளை, உலகத் தமிழராய்ச்சி நிறுவனம், சென்னை.

25BEHS201G	TECHNICAL ENGLISH-II	SEMESTER II 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To acquire the context of grammar and the importance of Listening, Speaking, Reading and Writing
- To understand and develop critical Listening, Speaking, Reading, and Writing skills
- To apply students' capability to listen vigilantly, read proficiently, innovative writing, and speak fluently

COURSE OUTCOMES:

Learners will be able to

CO1	Demonstrate the aspects of writing, speaking, reading, and listening with grammar.	P2
CO2	Refine speaking, listening, reading, and writing skills in the social milieu.	P3
CO3	Justify the text critically in reading, writing, speaking, and listening.	A3
CO4	Differentiate grammatical structures in reading and listening and apply the structure in speaking and writing.	A3
CO5	Adapt writing, reading, listening, and speaking rules in formal and informal situations.	P3

UNIT I **9**

Grammar : Prepositions – Adjectives – Adverbs
Reading : Reading comprehension: Skimming and Scanning
Writing : Letter writing (Formal and Informal) – Letter to Editor
Listening : Listening to Business talks – TED Talks

UNIT II **9**

Grammar : Use of sequence words – Modal Verbs
Reading : Mind Mapping (Structured thinking and related ideas)
Writing : Interpreting visual materials – Note Making – Recommendations
Listening : Listening to specific tasks – Focused Listening – Note Taking.
Speaking : Making presentations on given topics – Speaking in formal Situations

UNIT III **9**

Grammar : Contextual usage of Tenses – Connectives
Reading : Cohesion and Coherence in Reading
Writing : Paragraph writing: Compare and Contrast – Cause and Effect – Jumbled Sentences
Listening : Listening and responding to video lectures
Speaking : Role-play – Group Interaction

UNIT IV **9**

Grammar : WH Questions – Identifying Common Errors
Reading : Critical Reading Shifting facts from opinions
Writing : Resume writing with cover letter – Free writing
Listening : Watching videos or documentaries and answering
Speaking : Responding to questions – Mock Interviews

UNIT V **9**

Grammar : Use of Imperatives – Confusing words in English
Reading : Reading and making inference

Writing : Essay writing – Report – Proposals
Listening : Listening to different accents – Listening to Speeches
Speaking : Impromptu Speeches – Describing a process

TOTAL: 45

TEXT BOOKS:

1. Richards J C, Hull J, et al. "Interchange 3 Student's Book", 5th Edition, Cambridge University Press, 2022.
2. Harding, Keith, and Appleby, Rachel, "International Express: Pre-Intermediate: Student's Book", 3rd Edition, Oxford University Press, 2019.

REFERENCE BOOKS:

1. Swan, Michael and Walter Catherine, "Oxford English Grammar Course", 1st Edition, Oxford University Press, 2019.
2. Sudharshana N P and Savitha C, "English for Engineers", 1st Edition, Cambridge University Press, 2018.
3. Brook-Hart G, "Business benchmark: Upper intermediate: Business vantage: Student's book", 2nd Edition, Cambridge University Press, 2021.

WEBSITE URLs:

1. www.myenglishpages.com
2. www.cambridgeenglish.org/learning-english/
3. www.eslvideo.com/index.php

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	2	-	2	2	2	-	2	-	-	1
CO2	-	-	-	-	2	-	2	2	2	-	2	-	-	1
CO3	-	-	-	-	2	-	2	2	2	-	2	-	-	1
CO4	-	-	-	-	2	-	2	2	2	-	2	-	-	1
CO5	-	-	-	-	2	-	2	2	2	-	2	-	-	1
Avg.	-	-	-	-	2	-	2	2	2	-	2	-	-	1

25BEHS202CG	TRANSFORMS AND ITS APPLICATIONS	SEMESTER II 4H-4C
Instruction Hours/Week: L:3 T:1 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand the concept of periodic functions and represent it as Fourier series.
- To provide knowledge of Fourier series techniques in solving heat flow problems and wave equations.
- To acquaint Fourier transforms techniques used in various applications.
- To impart the knowledge of Laplace Transforms and Inverse Laplace Transforms techniques and its applications.

COURSE OUTCOME:

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

CO1	Illustrate Fourier series representation of periodic functions	K2
CO2	Apply Fourier series in one dimensional heat flow and wave equation	K3
CO3	Make use of Fourier transform for converting elementary functions into frequency domain	K3
CO4	Utilize Laplace Transform to convert time-domain systems into frequency-domain systems	K3
CO5	Apply Inverse Laplace Transform in linear differential equations	K3

UNIT I FOURIER SERIES 12

Dirichlet's conditions – General Fourier series in the interval (0,2l) & (-l,l) – Half range sine series – Half range cosine series –Parseval's Identity – Harmonic analysis.

UNIT II APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Fourier series solution for one dimensional wave equation – Fourier series solution for one dimensional heat equation with zero end conditions.

UNIT III FOURIER TRANSFORMS 12

Fourier Integral Theorem – Fourier transform pair –Fourier sine and cosine transforms –Properties – Convolution theorem – Parseval's identity of Fourier transform.

UNIT IV LAPLACE TRANSFORM 12

Transforms of standard functions – Properties of Laplace transform – Transforms of derivatives and integrals –Initial and final value theorem – Transforms of periodic functions.

UNIT V INVERSE LAPLACE TRANSFORM 12

Inverse Laplace transforms of standard functions – Inverse Laplace transform using second shifting theorem – Method of partial fractions– Convolution– Solution of ordinary differential equations with constant coefficients using Laplace transforms.

TOTAL: 45+15

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Boyce, Diprima and Meade	Elementary Differential Equations and Boundary Value Problems	12th Edition, John Wiley & Sons	2021
2	Erwin Kreyszig	Advanced Engineering Mathematics	10th Edition, John Wiley and Sons	2017

REFERENCE BOOKS:

1. T. Hillen, “Partial Differential Equations”, 2nd Edition, Friesen Press, 2019.
2. Dennis G. Zill, “Advanced Engineering Mathematics”, 7th Edition, Jones and Bartlett Publishers, 2020.
3. Richard Haberman, “Applied Partial Differential Equations with Fourier Series and Boundary Value Problems”, 5th Edition, Pearson, 2021.
4. Grewal B.S., “Higher Engineering Mathematics", 44thEdition, Khanna Publishers, New Delhi, 2018.

WEBSITES:

1. www.infocobuild.com/education/audio-video-courses/mathematics/Transform TechniquesForEngineers-IIT-Madras/lecture-01.html
2. www.infocobuild.com/education/audio-video-courses/mathematics/ordinary-and-partial-differential-equations-iit-roorkee.html
3. www.electrical4u.com/laplace-transformation/

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	1	1	1	-
CO2	3	2	1	-	-	-	-	-	-	-	1	1	1	-
CO3	3	2	1	-	-	-	-	-	-	-	1	1	1	-
CO4	3	2	1	-	-	-	-	-	-	-	1	1	1	-
CO5	3	2	1	-	-	-	-	-	-	-	1	1	1	-
Avg.	2.8	1.8	1	-	-	-	-	-	-	-	1	1	1	-

25BEHS205	PHYSICS FOR CIVIL ENGINEERS	SEMESTER II 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for students to

- To understand the fundamentals of thermal performance of buildings
- To enhance the knowledge about elastic behavior of materials and know the fundamentals of microscope and applications
- To empathize importance of materials, characterization, and applications

COURSE OUTCOMES:

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

CO1	Recognize the thermal performance of buildings	K2
CO2	Comprehend the basics of acoustic properties of buildings	K2
CO3	Elucidate the production and properties of ultrasonic	K2
CO4	Identify the classification of the advanced materials ceramics, composites	K3
CO5	Construct the relevant materials in the emerging field of engineering	K3

UNIT I THERMAL PROPERTIES OF BUILDING MATERIALS 9

Heat transfer through fenestrations, thermal insulation and its benefits – Heat gain and heat loss estimation – Factors affecting the thermal performance of buildings – Thermal measurements – Thermal comfort – Indices of thermal comfort – Climate and design of solar radiation – Shading devices – Central heating.

UNIT II ACOUSTICS 9

Classification of sound – Decibel – Weber Fechner law – Sabine's formula – Derivation of reverberation time – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies.

UNIT III ULTRASONICS 9

Ultrasonic – Production – Magnetostriction effect – Magnetostriction generator – Piezoelectric effect – Piezoelectric generator – Detection of ultrasonic waves – Cavitation – Velocity measurement of ultrasonic waves – Acoustic grating –Non-destructive testing – Pulse echo system through transmission and reflection modes – A, B and C – Scan displays.

UNIT IV SMART MATERIALS 9

Composites – Definition and classification – Fiber Reinforced Plastics (FRP) and Fiber Reinforced Metals (FRM) Metallic glasses – Shape memory alloys – Pseudo elasticity materials – Ferromagnetic materials, applications of smart materials.

UNIT V CERAMIC MATERIALS 9

Ceramics – Classification – Crystalline – Non-Crystalline – Bonded ceramics – Manufacturing methods – Slip casting – Isostatic pressing – Gas pressure bonding – Properties – Thermal, mechanical, electrical

and chemical ceramic fibers –Nano materials – Properties – Applications – Specialized paints and sealing products.

TOTAL: 45

TEXT BOOKS:

1. K.G. Budinski and M.K. Budinski, "Engineering Materials Properties and Selection", 9th Edition. Pearson Education India, 2016.
2. Gaur R.K. and Gupta S.L, Engineering Physics, Dhanpat Rai Publications, 2012.
3. S.O. Pillai, "Solid State Physics", 9th Edition. New Age International Publishers, 2020.
4. Marko Pinteric, "Building Physics", 2nd Edition. Springer, 2021.

REFERENCES:

1. R.K. Gaur and S.L. Gupta, "Engineering Physics", Dhanpat Rai publishers, 8th Edition 2021.
2. B Agarwal, "Introduction to Engineering material", 1st Edition, McGraw Hill Education, 2017
3. Peter A. Claisse, "Civil Engineering Materials", 2nd Edition. Elsevier, 2016.

WEB URLs:

1. www.gosmartbricks.com/building-thermal-performance-optimisation/
2. www.www.brainkart.com/article/Characteristics-and-Classification-of-Sound_6867/
3. www.www.britannica.com/science/ultrasonics

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	1	-	1	1	1	-
CO2	2	1	-	-	-	-	-	-	1	-	1	1	1	-
CO3	2	1	-	-	-	-	-	-	1	-	1	1	1	-
CO4	3	2	1	-	-	-	-	-	1	-	1	1	1	-
CO5	3	2	1	-	-	-	-	-	1	-	1	1	1	-
Avg.	2.4	1.4	1	-	-	-	-	-	1	-	1	1	1	-

25BEME201G	ENGINEERING GRAPHICS	SEMESTER II 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is to

- To introduce the concepts of geometrical construction to construct projection of curves, points, lines and plane surfaces
- To understand the basic principles in projections of solids, section of solids and development of surfaces
- To familiarize with isometric and perspective projections

COURSE OUTCOMES:

After completing this course, the students will be able to

CO1	Construct various conical sections	K3
CO2	Apply the concepts of drawing conventions, standards and projections in a drawing	K3
CO3	Develop simple solids and surface	K3
CO4	Construct the projection of sectioned solids and development of surfaces	K3
CO5	Design simple solids using CAD packages	K3

CONCEPT AND CONVENTIONS (Not for Examinations)

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and Dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING 6

Basic Geometrical constructions, Curves used in Engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – Construction of involutes of Square, Pentagon, Hexagon and Circle – Drawing of tangents and normal to the above curves – Orthographic projection – First angle projection – Free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES 6

Projection of points – Projection of straight lines (only First angle projections) inclined to both the principal planes.

Determination of true lengths and true inclinations by rotating line method and traces – Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 6

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – Obtaining true shape of section – Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6

Principles of isometric projection – Isometric scale – Isometric projections of simple solids and truncated solids – Prisms, pyramids, cylinders, cones – Combination of two solid objects in simple vertical position – Perspective projection of simple solids – Prisms, pyramids and cylinders by visual

ray method – Practicing three-dimensional modelling of isometric projection of simple objects by CAD software (Not for examination).

TOTAL: 30+15 PERIODS

TEXT BOOKS:

1. K V Natarajan, "A Text book of Engineering Graphics", 5th Edition, Dhanalakshmi Publishers, 2020.
2. K Morling, "Geometric and Engineering Drawing", 4th Edition, Routledge Publications, 2022.

REFERENCE BOOKS:

1. K Venugopal and V Prabhu Raja, "Engineering Drawing and Graphics", 6th Edition, New Age, 2022.
2. Dhananjay Jolhe, "Engineering Drawing with an introduction to AutoCAD", 1st Edition, McGraw Hill, 2018.
3. Basant Agarwal and C M Agarwal, "Engineering Drawing" 3rd Edition, McGraw Hill, 2019.
4. S N Lal, "Engineering Drawing with an Introduction to AutoCAD: First-angle Projection", 1st Edition,Cengage Learning India, 2018.
5. Colin Simmons, Dennis Maguire and Neil Phelps, "Manual of Engineering Drawing", 5th Edition, Butterworth-Heinemann, 2020.

WEBSITES:

1. www.iitg.ernet.in/rkbc/me111.htm
2. www.iitg.ac.in/rkbc/ME111/Lecture14 Development of surfaces-pkghosh.pdf
3. www.iitg.ac.in/dsharma/me111/Lecture 1 Introduction.pdf

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	2	1	-	1	2	1	1
CO2	3	2	1	-		-	-	2	1	-	1	2	1	1
CO3	3	2	1	-	-	-	-	2	1	-	1	2	1	1
CO4	3	2	1	-	-	-	-	2	1	-	1	2	1	1
CO5	3	2	1	-	1	-	-	2	1	-	1	2	1	1
Avg.	3	2	1	-	1	-	-	2	1	-	1	2	1	1

25BEEE202G	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	SEMESTER II 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is to

- To understand the concept of electric circuits and analysis
- To impart knowledge in the basics of working principles and application of electrical machines, analog devices and their characteristics.
- To introduce the fundamental concepts of digital electronics and functional elements and working of measuring instruments.

COURSE OUTCOMES:

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

CO1	Compute the electric circuit parameters for simple problems	K3
CO2	Explain the working principle and applications of electrical machines	K2
CO3	Analyze the characteristics of analog electronic devices	K3
CO4	Illustrate the basic concepts of digital principles and design	K2
CO5	Understand the operating principles of measuring instruments	K2

UNIT I ELECTRICAL CIRCUITS 9

DC Circuits: Circuit Components: Conductor – Resistor – Inductor – Capacitor – Ohm's Law – Kirchhoff's Laws – Independent and Dependent Sources – Simple problems – Nodal Analysis – Mesh analysis with Independent sources only (Steady state) – Introduction to AC Circuits and Parameters: Waveforms – Average value – RMS Value – Instantaneous power – Real power – Reactive power – Apparent power – Power factor – Steady state analysis of RLC circuits (Simple problems only).

UNIT II ELECTRICAL MACHINES 9

Construction and Working principle of DC Generator – EMF equation – Types and Applications – Working Principle of DC motors – Torque Equation – Types and Applications – Construction and Working principle: Transformer – Single phase Induction Motor – Three Phase Induction Motor – Applications.

UNIT III ANALOG ELECTRONICS 9

Semiconductor Materials: Silicon & Germanium – PN Junction Diodes – Rectifiers: Half wave and Full wave – Zener Diode – Operation and characteristics: BJT – FET – SCR – Transistor as switch – Applications.

UNIT IV DIGITAL ELECTRONICS 9

Review of number systems, binary codes – Error detection and correction codes – Representation of logic functions and basic gates – SOP and POS forms – K-map representations – Minimization using K maps (Simple Problems only) – Half, Full adder and Subtractor – Multiplexers (4:1) and de-multiplexers (1:4).

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Functional elements of an instrument – Standards and calibration – Operating Principle – types – Moving Coil and Moving Iron meters – Measurement of three phase power – Single phase Energy Meter – Basics of smart sensor – Data loggers – Megger.

TOTAL HOURS: 45

TEXT BOOKS:

1. Charles K. Alexander and Mathew N. O. Sadiku, "Fundamentals of Electric Circuits", 7th Edition, Tata McGraw Hill, 2022.
2. S.K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Education, 2nd Edition, 2019.

REFERENCE BOOKS:

1. Kothari D P and Nagrath I J, "Basic Electrical Engineering", 4th Edition, Tata McGraw Hill Education, 2019.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2nd Edition, 2019.
3. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th Edition, 2017.
4. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

WEB URLs:

1. https://archive.nptel.ac.in/courses/108/105/108105159/
2. https://archive.nptel.ac.in/courses/108/105/108105112/
3. https://archive.nptel.ac.in/courses/108/101/108101091/

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	1	1	-
CO2	2	1	-	-	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	1	-
CO4	2	1	-	-	-	-	-	-	-	-	-	1	1	-
CO5	2	1	-	-	-	-	-	-	-	-	-	1	1	-
Avg.	2.4	1.4	1	-	-	-	-	-	-	-	-	1	1	-

25BEHS245G	ENGINEERING CHEMISTRY (Theory & Laboratory)	SEMESTER II 5H-4C
Instruction Hours/Week: L:3 T:0 P:2	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is to

- Summarize water treatment process and engineering materials.
- Acquire knowledge on fuels, lubricants and principles of corrosion.
- Explain the concepts of analytical techniques and its applications.

COURSE OUTCOMES:

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

CO1	Identify the quality of water and its treatment methodologies	K3
CO2	Interpret the basics of engineering materials and its applications	K2
CO3	Outline the methods to enhance the quantity & quality of fuels and Lubricants	K2
CO4	Illustrate the types of corrosion and its prevention techniques	K2
CO5	Demonstrate the principle and working of analytical techniques	K3

(i) THEORY

UNIT I WATER TECHNOLOGY 9

Sources-Characteristics - Specification for drinking water, BIS &WHO-Alkalinity- Types of alkalinities and determination - Hardness - Types and estimation by EDTA method - Domestic water treatment - Disinfection methods (Chlorination, Ozonation. UV treatment) - Boiler feed water - Requirements - Disadvantages of using hard water in boilers - Internal conditioning (Phosphate, Calgon and Carbonate conditioning methods) - External conditioning - Demineralization process - Desalination - Reverse osmosis.

UNIT II ENGINEERING MATERIALS 9

Plastics – Thermoplastics & Thermosets. Preparation, properties and engineering applications of Poly vinyl chloride and Bakelite. Alloys – Introduction – Definition – Properties of alloys – Significance of alloying, functions and effect of alloying elements – Nichrome and stainless steel (18/8) – Heat treatment of steel. Refractories – Definition, classification, properties (refractoriness, refractoriness under load, porosity and thermal spalling), failure of refractories. Composites– Properties and applications of Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites.

UNIT III – FUELS AND LUBRICANTS 9

Fuels – Introduction- Analysis of coal (proximate and ultimate), Carbonization- Manufacture of metallurgical coke (Otto Hoffmann method) – Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking – Octane number– Cetane number- Power alcohol and biodiesel. Lubricants – Introduction – Characteristics of a good lubricant – Classification, Physical and Chemical Properties – Mechanism of lubricants – Applications.

UNIT IV - CORROSION AND ITS CONTROL 9

Chemical and Electrochemical corrosion - Galvanic corrosion - Differential aeration corrosion- Factors influencing the rate of corrosion-Corrosion control - Sacrificial anode and impressed current cathodic

methods - Corrosion inhibitors - Protective coatings - Organic coatings-Paints - Constituents and functions Inorganic coatings- Metallic coatings - Electroplating (Au) and Electro less plating (Ni) - Surface conversion coating - Hot dipping.

UNIT V ANALYTICAL TECHNIQUES AND APPLICATIONS 9

Introduction-Instrumentation and applications of Colorimetry, Flame Photometry, Potentiometry, Conductometry (Strong acid with strong base, Mixture of acids with strong base, precipitation titrations)-Electronic spectroscopy- Vibrational spectroscopy-Atomic Absorption spectroscopy.

TOTAL HOURS: 45

(ii) LABORATORY

LIST OF EXPERIMENTS – CHEMISTRY

1. Determination of Ca / Mg using complexometric titration
2. Determination of chloride content of water
3. Determination of the rate of corrosion by weight loss method
4. Conductometry - Determination of conductance of solutions (strong acid Vs strong base)
5. pH Metry - Determination of Acid/Base
6. Potentiometry - Estimation of iron content in a water sample.
7. Estimation of Copper and Zinc in Brass

TOTAL HOURS: 30

TEXT BOOKS:

1. P C Jain & Monica Jain, (2022). Engineering Chemistry, 18th edition, Dhanpat Rai Publishing Company
2. Shivani Jaggi Guleria, “Engineering Chemistry”, Concept for engineers, 1st Edition, Atlantic, 2021.
3. S S Dara, S S Umare, “A Text book of Engineering Chemistry”, 12th Edition, S Chand, 2015.
4. B. H. Mahan, (2010). University chemistry, Pearson Education.
5. R V Gadag, A Nithyananda Shetty, “Engineering Chemistry”, 3rd Edition, Wiley India Pvt, 2019.

REFERENCE BOOKS:

1. M. J. Sienko and R. A. Plane, (1976) Chemistry: Principles and Applications. 5th edition, McGraw-Hill Higher Education.
2. C. N. Banwell, (2001) Fundamentals of Molecular Spectroscopy, McGraw-Hill.
3. P. W. Atkins, (2022) Physical Chemistry, Oxford University Press.
4. B. L. Tembe, Kamaluddin and M. S. Krishnan, Engineering Chemistry (NPTEL Web- book)
5. K. P. C. Volhardt and N. E. Schore, (2014). 5th Edition, Organic Chemistry: Structure and Function, W.H. Freeman Publications.

WEB REFERENCES:

1. https://www.bspublications.net/downloads/0523ff2e4a5331_chemistry_ch_01_JNTUK.pdf
2. https://www.uobabylon.edu.iq/eprints/publication_10_31957_6172.pdf
3. https://www.researchgate.net/publication/265602506_chapter_engineering_materials_and_engineering_plastics

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	1	1	1	-	-	1	2	1	-
CO2	2	2	1	1	-	1	1	1	-	-	1	2	1	-
CO3	2	2	1	1	-	1	1	1	-	-	1	2	1	-
CO4	2	1	-	-	-	1	1	-	-	-	1	2	1	-
CO5	2	1	-	-	-	1	1	-	-	-	1	2	1	-
Avg.	2.2	1.6	1	1	-	1	1	1	-	-	1	2	1	-

25BEHS211G	COMMUNICATION SKILLS LABORATORY	SEMESTER II 2H-1C
Instruction Hours/Week: L:0 T:0 P:2	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

- To acquire different listening techniques for understanding different kinds of audio content, including lectures, conversations, videos, etc. and to effectively communicate their ideas using a variety of media
- To understand the "English language skills" by engaging them in listening and reading activities that are relevant to authentic contexts and to help learners use language effectively in academic /work contexts
- To apply the communicative competence of learners in listening, speaking, reading and writing.

COURSE OUTCOMES:

Learners will be able to

CO1	Organize the context, topic, and pieces of specific information of English through all four skills.	P1
CO2	Identify the purpose and clarity of facts and reflect their thoughts, opinions, and knowledge through all the language skills.	A1
CO3	Put together skimming, scanning, and listening techniques effectively to acquire the gist from the context.	P2
CO4	Demonstrate in communication more effectively with their peers, instructors, and colleagues.	A2
CO5	Master public speaking techniques, business writing, and listening with professional speaking techniques.	P3

LIST OF EXPERIMENTS:

S.No.	SKILLS	TOPICS
1	Listening	Dialogues from TV/radio/Ted talk/Podcast
2	Listening	Listening for gist
3	Reading	Reading for detail, global understanding
4	Speaking	Presentations and interactive communication – Pair presentations
5	Listening	Listen and respond appropriately
6	Reading	Reading different genres
7	Writing	Documentary and Movie review
8	Writing	Informational or Analytical Reports
9	Speaking	Mock Interview
10	Speaking	Group Discussion

TOTAL HOURS: 30

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	2	-	2	3	3	-	2	-	-	1
CO2	-	-	-	-	2	-	2	3	3	-	2	-	-	1
CO3	-	-	-	-	1	-	2	3	3	-	2	-	-	1
CO4	-	-	-	-	1	-	1	2	3	-	2	-	-	1
CO5	-	-	-	-	1	-	1	2	3	-	2	-	-	1
Avg.	-	-	-	-	1.4	-	1.6	2.6	3	-	2	-	-	1

25BEHS246G	YOGA	SEMESTER II 4H-2C
Instruction Hours/Week: L:0 T:0 P:4	Marks: Internal:100 External:- Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course, is for the students:

- To have knowledge of Physical fitness and exercise management to lead better quality life
- To enable to officiate, supervise various sports events and
- organize sports events
- To acquire the knowledge of Physical Education, Sports and Yoga and understand the purpose and its development
- To gain knowledge to plan, organize and execute sports events

COURSE OUTCOMES:

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

- Practice physical activities and yoga for strength, flexibility and relaxation.
- Use techniques for increasing concentration and decreasing anxiety for stronger academic performance.
- Perform yoga exercises in various combination and forms.
- Improve personal fitness through participation in sports and yoga activities.
- Follow sound nutritional practices for maintaining good health and physical performance.

UNIT I INTRODUCTION TO PHYSICAL FITNESS

Explain importance of physical education - Describe importance of Physical Fitness & Wellness - Explain the components of physical fitness - Demonstrate healthy life style - Prevent health threats by changing life style

UNIT II FUNDAMENTALS OF ANATOMY & PHYSIOLOGY IN SPORTS & YOGA

Explain importance of anatomy and physiology - Describe effects of exercise in various body systems - Describe concept of correct posture - Explain corrective measures for posture deformities.

UNIT III YOGA & PRANAYAMA

Explain importance of yoga - Perform various pranayama for increasing concentration - Use meditation and other relaxation techniques for improving concentration.

TEXT BOOKS:

1. Ajmer Singh, Modern Trends and Physical Education class 11 & class 12, Kalyani Publication, New Delhi ISBN: 9789327264319.
2. B.K.S. Iyengar, Light on Yoga, Thomson's Publication, New Delhi ISBN: 8172235011
   V.K.Sharma, Health and Physical Education, NCERT Books; Class11,12 Saraswati House Publication, New Delhi
3. Acharya Yatendra, Yoga and Stress Management, Fingerprint Publishing ISBN: 938905303X
4. Swami Vivekanand, Patanjali Yoga Sutras, Fingerprint Publishing ISBN 9389567351.
5. Ramdev, Pranayam Rahasya, Patanjali-Divya Prakashan, Haridwar ISBN: 9788189235017
6. Ramdev, Yoga its Philosophy & Practice, Divya Prakashan, Haridwar.

25BEMC251G	VEDIC MATHEMATICS	SEMESTER II 1H – 0C
Instruction Hours/Week: L:1 T:0 P:0	Marks: Internal:100 External:0 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To overcome the fear of maths, acquire knowledge in Logical thinking, increase concentration and improve critical thinking.
- To build the skill to perform basic math fast and accurately with confidence.
- To enhance computation skills through Vedic Mathematics

COURSE OUTCOMES:

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

CO1	Apply Vedic sutras for arithmetic computation.	K3
CO2	Utilize Urdhva Tiryagbhyam for solving complex multiplication problems.	K3
CO3	Make use of Vedic division method for basic word problems.	K3

UNIT I **5**

Application of vedic sutras, Arthimetic computation, Shudh method for a list of number, Rapid Addition- Single to Double-Digit, Subtraction using Nikliam 3 Digit

UNIT II **5**

Multiplication by Thumb Rule, Multiplication Vertically and cross wise, Urdhvatiryagbhyam, Anurupyena.

UNIT III **5**

Squaring numbers, Traditonal Division, Straight Division, Facts of Division, Basic Word Problems.

REFERENCES:

1.Jagadguru swami sri Bharathi krsnatirthaji maharaja,"Vedic Mathematics", International Best seller, New Revised Edition.

2. Sri Bharati Krsna Tirthaji, "Vedic Mathematics", published by Motilal Banarsidass, 1965.

3. Williams K.R. "Discover Vedic Mathematics." Vedic Mathematics Research Group, 1984.

4. Rajesh Kumar Thakur, "Advanced Vedic Mathematics", Rupa Publications India Pvt. Ltd 2019.

WEBSITES:

1. www.nptel.ac.in/courses/111101080
2. www.https://vedicmathworld.com/

25BEHS302G	NUMERICAL METHODS	SEMESTER III 4H-4C
Instruction Hours/Week: L:3 T:1 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

Pre-Requisites: Transforms and its Applications

COURSE OBJECTIVES:

The goal of this course is for the students:

- To inculcate the basic concepts of solving algebraic and transcendental equations.
- To understand the numerical techniques of interpolation in various intervals
- To develop proficiency on numerical differentiation and integration
- To provide the knowledge of solving ordinary differential equations and partial differential equations numerically

COURSE OUTCOME:

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

CO1	Solve the systems of linear and nonlinear equations by iterative methods.	K3
CO2	Make use of interpolation methods for finding the missing terms	K3
CO3	Apply numerical methods for finding differentiation and integration of a given function	K3
CO4	Solve ordinary differential equations using Euler's, Taylor's, Runge Kutta and Milne Thomson's method	K3
CO5	Utilize implicit and explicit methods in heat and wave equations	K3

UNIT I SOLUTION OF EQUATIONS 12

Regula Falsi Method - Newton Raphson method for solving algebraic and transcendental equations - Solution of system of linear equations - Gauss elimination method - Gauss Jordan method -Gauss Seidel method.

UNIT II INTERPOLATION 12

Interpolations with unequal intervals-Lagrange's interpolation -Newton's divided interpolation - Interpolation with equal intervals-Newton's forward and backward interpolation.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Approximation of derivatives using Newton's forward and backward interpolation - Numerical integration using Trapezoidal, Simpson's 1/3 and 3/8 rule.

UNIT IV NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

Single step method- Euler's method-Taylor's series method-Fourth order Runge – Kutta method –Multi step method-Milne's predictor corrector method.

UNIT V NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Solutions of one-dimensional heat equation by Bender-Schmidt and Crank Nicholson methods – Numerical solutions of one-dimensional wave equation by explicit method.

TOTAL: 60

TEXT BOOKS

1. Steven C.Chapra, Raymond P.Canale, Numerical Methods for Engineers,8thEdition , Tata McGraw Hill Education,2021.
2. Curtis F. Gerald and Patrick O. Wheatley, Applied Numerical Analysis,Addison Wesley, Thirteenth Edition,2004.

REFERENCE BOOKS

1. Richard L. Burden and J. Douglas Faires, Numerical Methods, 4th Edition, Brooks/Cole 2012.
2. Boyce, Di Prima and Meade, “Elementary Differential Equations and Boundary value problem”, 12th Edition, John Wiley & Sons, 2021.
3. Steven Chapra, “Applied Numerical Methods with MATLAB”, 5th Edition, Mcgraw-Hill Education, 2022.
4. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley and Sons, Tenth Edition, 2011.

WEBSITES

1. www.classcentral.com/course/numerical-methods-engineers-32822
2. http://www.infocobuild.com/education/audio-video-courses/mathematics/numerical-analysis-iit-madras.html
3. http://www.infocobuild.com/education/audio-video-courses/mathematics/NumericalMethods-FiniteDifference-IIT-Roorkee/lecture-06.html

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	1	1	1	-
CO2	3	2	1	-	-	-	-	-	-	-	1	1	1	-
CO3	3	2	1	-	-	-	-	-	-	-	1	1	1	-
CO4	3	2	1	-	-	-	-	-	-	-	1	1	1	-
CO5	3	2	1	-	-	-	-	-	-	-	1	1	1	-
Avg.	3	2	1	-	-	-	-	-	-	-	1	1	1	-

25BECE302	ENGINEERING MECHANICS FOR CIVIL ENGINEERS	SEMESTER III 4H-4C
Instruction Hours/Week: L:3 T:1 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand the basic concept of equilibrium of particles and rigid bodies.
- To gain knowledge on the stresses, strains, shear force and bending moment diagram.
- To get basic idea of the moment of inertia of a section.

COURSE OUTCOME:

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

CO1	Summarize the fundamental concepts of force systems and apply equilibrium conditions	K2
CO2	Apply the laws of friction to evaluate static and dynamic conditions in mechanical systems	K3
CO3	Determine the centroid, center of gravity, and moment of inertia for simple and composite sections	K3
CO4	Use the principle of virtual work and energy methods to evaluate equilibrium and mechanical efficiency in systems with conservative and non-conservative forces.	K3
CO5	Utilize dynamics and D'Alembert's principle to solve rigid body plane motion problems.	K3

UNIT I INTRODUCTION TO ENGINEERING MECHANICS 12

Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.

UNIT II FRICTION 12

Introduction to friction- Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; Basic Structural Analysis: Equilibrium in three dimensions; Method of Joints; Simple Trusses; Zero force members; Beams & types of beams; Frames.

UNIT III CENTROID AND CENTRE OF GRAVITY 12

Centroid of simple figures, composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

UNIT IV VIRTUAL WORK AND ENERGY METHOD 12

Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium- Stability of equilibrium.

UNIT V INTRODUCTION TO KINETICS OF RIGID BODIES 12

Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected

bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

TOTAL: 60

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ramamurtham S and Narayanan R	Strength of Materials	Dhanpat Rai Publishing Company Pvt Ltd	2020
2	Bansal R.K	A Text Book of Engineering Mechanics	Laxmi Publications	2010

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Vela Murali	Engineering Mechanics-Statics and Dynamics	Oxford University Press	2019
2	Rajput R K	Strength of Materials (Mechanics of Solids)	Chand and Company Ltd.	2020

WEBSITES:

1	www.coursera.org/learn/engineering-mechanics-statics
2	www.worldscientific.com/doi/suppl/10.1142/p187/suppl_file/p187_chap01.pdf

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	1	1	-	2	2	2	-
CO2	3	2	1	-	-	2	-	1	1	-	2	2	2	-
CO3	3	2	1	-	-	2	-	1	1	-	2	2	2	-
CO4	3	2	1	-	-	2	-	1	1	-	2	2	2	-
CO5	3	2	1	-	-	2	-	1	1	-	2	2	2	-
Avg.	2.8	1.8	1	-	-	2	-	1	1	-	2	2	2	-

25BECE303	MECHANICS OF FLUIDS	SEMESTER III 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To provide exposure on fluid statics, kinematics and dynamics.
- To measure the pressure and computations of hydrostatic forces on structural components.
- To explain the concepts of buoyancy in various engineering problems.

COURSE OUTCOME:

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

CO1	Classify the principles of fluids and solids	K2
CO2	Illustrate the effect of fluid statics on a flow system	K2
CO3	Compare fluid kinematics in different measuring devices	K2
CO4	Contrast Euler equation and Bernoulli equation in fluid dynamics	K3
CO5	Apply dimensional analysis and dynamic similitude using Buckingham's π-Theorem	K3

UNIT I INTRODUCTION TO FLUIDS 9

Definition: Ideal fluids, real fluids, Newtonian and Non-Newtonian fluids; Properties of Fluids: Units of measurement, Mass density, Specific weight, Specific volume, Specific Gravity, Viscosity, Surface tension and Capillarity, Compressibility and Elasticity, Control volume concept, Boiling point, cavitation, surface tension, Capillarity, Bulk modulus of elasticity, Compressibility.

UNIT II FLUID STATICS 9

Fluid Pressure-Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micro manometer. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT III FLUID KINEMATICS 9

Classification of fluid flow- steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one-, two- and three-dimensional flows; Streamline, path line, streak line and stream tube; stream function, velocity potential function. One, two- and three - dimensional continuity equations in Cartesian coordinates, Vortex Flow: Types and equation of motion, Flow net its characteristic and utility.

UNIT IV FLUID DYNAMICS 9

Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: venturi meter, orifice meter and pitot tube; Flow measurement, momentum of fluid in motion, momentum equation and momentum correction factor.

UNIT V DIMENSIONAL ANALYSIS AND FLOW THROUGH PIPES 9

Definitions of Reynolds Number, Froude Number, Mach number, Weber Number and Euler Number; Buckingham's π-Theorem, Major and Minor Losses of energy in pipes, Hydraulic gradient, Pipes in parallel and series, Flow through branched pipes.

TOTAL: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	S.P.Ojha, R. Berndtsson and P. N. Chadramouli	Fluid Mechanics and Machinery	Oxford University Press	2010
2	P M Modi and S M Seth	Hydraulics and Fluid Mechanics	Standard BookHouse	2002

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	K. Subramanya	Theory and Applications of Fluid Mechanics	Tata Mc GrawHill	2007
2	R.L. Daugherty, J.B. Franzini and E.J. innemore	Fluid Mechanics with Engineering Applications	International Student Edition, Mc GrawHill	2002

WEBSITES:

1	NPTEL :: Mechanical Engineering - NOC:Introduction to Fluid Mechanics

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	1	-	-	1	-	1	2	-
CO2	2	1	-	-	-	1	1	-	-	1	-	1	2	-
CO3	2	1	-	-	-	1	1	-	-	1	-	1	2	-
CO4	3	2	1	-	-	1	1	-	-	1	-	1	2	-
CO5	3	2	1	-	-	1	1	-	-	1	-	1	2	-
Avg.	2.4	1.4	1	-	-	1	1	-	-	1	-	1	2	-

25BECE304	BUILDING INFORMATION MODELLING IN CONSTRUCTION	SEMESTER III 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:-100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- The concept of Building Information Modelling.
- The workflow followed in industry during creation of BIM 3D model which includes building the discipline-based model and create the federated models.
- The Discipline based modelling of a building using Revit tool.
- The detection of clashes during design co-ordination using software tool.
- The various emerging trends of BIM & concept of digital twin.

COURSE OUTCOME:

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

CO1	Interpret the basic principles of BIM evolution and concept of BIM in lifecycle of project	K2
CO2	Understand the workflows of Design authoring followed in industry during creation of 3D model	K2
CO3	Create the discipline-based model of the building using Revit Software tool	K6
CO4	Evaluate the developed model for Clashes and rectify them using software tool	K5
CO5	Illustrate the various emerging trends of BIM & concept of digital twin	K2

UNIT I INTRODUCTION TO BIM 9

Building Information Modelling - Evolution of Engineering from 2D drawings to BIM Model, Isometric view – Examples and Limitation, Building Information Modelling – Introduction & Process, Application.

Design Authoring – Concepts and workflow, Introduction to stages of BIM Modelling process as per ISO 19650.

Introduction to Revit, User Interface in Revit - Architecture, Structure, Systems, Insert, Annotate, View, Manage, Modify.

UNIT II DESIGN AUTHORING IN REVIT TOOL 9

Revit Architecture – File setup, creating levels and grids, Modelling Architectural elements, Schedules and Annotation, Sheet creation, Parameter creation.

Revit Structure - File setup, creating levels and grids, modelling structural elements, Schedules and Annotation, Sheet creation, Parameter creation, Remove warnings.

Revit Systems - File setup, creating levels and grids, HVAC, plumbing and piping, Fire line and sprinklers, Electrical lightings, Cable trays and parametric creation.

Federated model – Concept, Strategy and benefits, Linking of Revit files and Reload of links in Revit, Exporting file formats, Rendering and Animation.

UNIT III VISUALIZATION, CLASH CHECK AND LOD 9

Views in BIM Model, Visualization Modes, Walkthrough of the Model, Fly through the model, Layers & Properties, Concept of viewpoints, Sectioning and Visualization through Tablet and Mobile, Concept

of BIM Kiosk & BIM Rooms, Visualization through Augment Reality (AR), Virtual Reality (VR) & Mixed Reality (MR).

Clash Check – Types, Clash avoidance process, Clash Detection Process, Clash Detection Priority Matrix and Report generation, Clash Detection Rules, Report, Grouping, Clash Detection using software tool.

Documentation and CDE (Common Data Environment) - Concept of Cloud Computing, Concept and Application of CDE, Setting up the workflow and process for CDE.

Concept of LOD (Level of Development), preparation of LOD matrix and Progression matrix, LOD-Chart, Matrix, and Model Progression Matrix.

UNIT IV 4D / FIELD BIM & ITS APPLICATIONS 9

Introduction to 4D / Field BIM - Concept of 4D, Project scheduling using Gantt Chart and its limitation, Demo - Synchronization of 4D BIM Model with project schedule, reviewing project progress w.r.t planned dates and actual dates, Generation of Reports

Application of Field BIM/ 4D BIM - Understanding concept and usage of BIM in field for coordination3D Coordination and Visual Communication, Site utilization planning and Construction analysis, Application of wearables in coordination. 3D Control and planning.

Other Applications of Field BIM/ 4D BIM - Concept and usages of BIM in field for safety, disaster and risk analysis, digital fabrication and scan to BIM, Existing Condition Modeling, Phase Planning, As-built/ Record Models.

UNIT V SPECIAL CONCRETE 9

5D BIM - Introduction concepts of 5D BIM, BIM Maturity LOD and General Practice of QTO, Cost Breakup structures, 5D BIM and cost control.

AIM: Introduction to Asset Information Model (AIM), COBie structures and Asset requirement, Discipline wise Infrastructure System, Classification code and Information Exchange, Information Exchange with Facility Management.

Beyond BIM - Concepts of Industrialisation, IoT, Big Data, Data Analytics and their applications in BIM: Industrialisation of Construction through BIM- DfMA, IoT in BIM, BIM and Big data, Data Analytics using AI & ML.

Future scope of BIM Applications: Smart Infrastructure and the need for connected infrastructure, Digital twins- Concepts and benefits, National Digital Twin or a City level Digital Twin in a Smart City, Fundamental requirements for the success of a Digital Twin and its uses, Digital Twin applications in diverse industries.

TOTAL: 30+15

BOOKS:

	Reference Books:
1.	ISO 19650 Building Information Modelling (BIM)
	E-resources
1.	L&T EduTech LMS

SOFTWARE		
S.No	**Software Taught**	**Versions available (Student/Paid/Free)**
1	Autodesk Revit	2023 (Student version – Free for 3 years)
S.No	**Software Required**	**Versions available (Student/Paid/Free)**
1	Autodesk Revit	2023 (Student version – Free for 3 years)

PROJECT		
S.No	**Project objectives***	**Project outcomes***
1	Create a workflow for a building with all required deliverables to be covered in the project output	Identify the clashes and forming of clash priority index matrix to avoid clashes in the project

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	3	1	2	1	2	-	1	2	2
CO2	2	1	-	-	-	3	1	2	1	2	-	1	2	2
CO3	3	3	3	3	2	3	1	2	1	2	-	1	2	2
CO4	3	3	3	2	1	3	1	2	1	2	-	1	2	2
CO5	2	1	-	-	-	3	1	2	1	2	-	1	2	2
Avg.	2.4	1.8	3	2.5	1.5	3	1	2	1	2	-	1	2	2

25BECE341	SURVEYING (Theory & Laboratory)	SEMESTER III 5H-4C
Instruction Hours/Week: L:3 T:0 P:2	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To impart the rudiments of plane surveying and geodetic principles to Civil Engineers
- To classify the various methods of plane and geodetic surveying to solve real-world problems.
- To outline the concepts of Control Surveying.

COURSE OUTCOME:

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

CO1	Illustrate the rudiments of various surveying and its principles.	K2
CO2	Interpret knowledge in computation of levels of terrain and ground features.	K2
CO3	Outline concepts of Theodolite Surveying for complex surveying operations.	K2
CO4	Make use of the knowledge on volume calculation and modern surveying.	K3
CO5	Identify the procedure for establishing horizontal and vertical control angles and distances.	K3

(i). THEORY:

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING 9

Importance of surveying – Classifications – Principles, Chain and tape measurement – Chain traversing – Compass – Meridians, Azimuths and bearings – Problems on fore bearing and back bearing – Plane table surveying.

UNIT II LEVELLING 9

Level line – Horizontal line – Datum – Benchmarks – Levels and staves – Temporary and Permanent adjustments – Methods of levelling – Procedure in levelling – Booking – Reduction – Curvature and refraction – Reciprocal levelling – Contouring.

UNIT III THEODOLITE SURVEYING AND TACHEOMETRIC SURVEYING 9

Horizontal and vertical angle measurements – Temporary and permanent adjustments – Heights and distances – Tacheometric surveying – Stadia Tacheometry – Tangential Tacheometry – Trigonometric levelling – Single Plane method – Double Plane method.

UNIT IV VOLUME CALCULATION AND CURVE SURVEYING 9

Area – Computation, measurements from cross section – volume calculation from spot levels, earth work calculations – Definitions & designation of curve, elements of simple curve – setting out of curves: Simple curve (theory only) - Modern Surveying (Theory only).

UNIT V CONTROL SURVEYING AND ADJUSTMENT 9

Horizontal and vertical control – Methods – Specifications – Triangulation – Baseline – Satellite stations – Reduction to centre – Trigonometrical levelling – Single and reciprocal observations – Traversing – Gale's table – Errors Sources – Precautions and corrections – Classification of errors – True and most probable values – Weighed observations – Method of equal shifts – Principle of least squares – Normal equation – Correlates – Level nets – Adjustment of simple triangulation networks.

TOTAL: 45

(ii). LABORATORY:

LIST OF EXPERIMENTS:

1. Study of Chain Surveying, Compass Surveying and Total Station
2. Calculate the reduced level of points by rise and fall method and height of collimation method using dumpy level
3. Longitudinal and Cross Sectional levelling of a given road segment using dumpy level
4. Horizontal & Vertical Angle measurement using Theodolite
5. Determination of elevation of an object using single plane method when base is Accessible/inaccessible
6. Heights and distances by stadia Tacheometry and tangential Tacheometry
7. Setting out of a Simple Circular Curve

TOTAL: 30

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain	Surveying Vol. I & II	Lakshmi Publications Pvt Ltd, New Delhi, Sixteenth Edition	2016
2	T. P. Kanetkarand S. V. Kulkarni	Surveying and Levelling, Parts 1 & 2	Pune Vidyarthi Griha Prakashan, Pune	2008

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	R. Subramanian	Surveying and Levelling	Oxford University Press	2019
2	James M. Anderson and Edward M. Mikhail	Surveying	12th Edition, Mc Graw Hill	2012

WEBSITES:

1	www.coursera.org/learn/surveying
2	NPTEL: Civil Engineering - Surveying

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	1	1	-	1	2	1	1
CO2	2	1	-	-	-	2	-	1	1	-	1	2	1	1
CO3	2	1	-	-	-	2	-	1	1	-	1	2	1	1
CO4	3	2	1	-	-	2	-	1	1	-	1	2	1	1
CO5	3	2	1	-	-	2	-	1	1	-	1	2	1	1
Avg.	2.4	1.4	1	-	-	2	-	1	1	-	1	2	1	1

25BECE342	CONCRETE TECHNOLOGY (Theory & Laboratory)	SEMESTER III 5H-4C
Instruction Hours/Week: L:3 T:0 P:2	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To impart knowledge on the properties of materials for concrete by suitable tests, mix design for concrete.
- To acquire fundamental knowledge in the fresh and hardened properties of concrete.
- To design a concrete mix which fulfils the required properties for fresh and hardened concrete

COURSE OUTCOME:

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

CO1	Explain composition and properties of materials of concrete as per IS specification.	K2
CO2	Interpret the effects of chemical and mineral admixtures in the concrete	K2
CO3	Apply the principles to design the nominal mix of the concrete	K3
CO4	Outline the properties of fresh and hardened concrete.	K2
CO5	Summarize the properties and test foe special concrete.	K2

(i). THEORY:

UNIT I CONSTITUENT MATERIALS 9

Cement-Different, types-Chemical composition and Properties -Tests on cement- IS Specifications-Aggregates-Classification-Mechanical properties and tests as per BIS Grading requirements- Water-Quality of water for use in concrete

UNIT II CHEMICAL AND MINERAL ADMIXTURES 9

Accelerators-Retarders- Plasticizers- Super plasticizers- Water proofers – Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaolin - Their effects on concrete properties.

UNIT III PROPORTIONING OF CONCRETE MIX 9

Principles of Mix Proportioning-Properties of Concrete Related to Mix Design Physical Properties of materials required for Mix Design – Design Mix and Nominal Mix-BIS Method of Mix Design – Mix Design Examples.

UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE 9

Workability-Tests for workability of concrete-Slump Test and Compacting factor Test- Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS – Properties of Hardened Concrete-Determination of Compressive and Flexural Strength- Stress-strain curve for concrete Determination of Young's Modulus

UNIT V SPECIAL CONCRETE 9

Light weight concretes – High strength concrete – Fibre reinforced concrete – Ferro cement – Ready mix concrete – SIFCON-Shotcrete – Polymer concrete – High performance concrete- Geopolymer Concrete – Self Healing Concrete.

TOTAL: 45

(ii). LABORATORY:

LIST OF 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. Workability of fresh concrete
   i) Slump Value,
   ii) Compaction factor
   iii) Vee-Bee Consistometer
6. Compressive Strength of Concrete, Split Tensile Strength of Concrete and Flexural Strength of Concrete
7. NDT on Concrete (Rebound Hammer)

TOTAL: 30

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Gupta.B.L., Amit Gupta	Concrete Technology	Jain Book Agency	2010
2	Shetty, M.S	Concrete Technology	S.Chand and Company Ltd, New Delhi	2003

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Santhakumar,A.R	Concrete Technology	Oxford University Press, New Delhi	2007
2	Neville, A.M	Properties of Concrete	Pitman Publishing Limited, London	2007

WEBSITES:

1	www.coursera.org/learn/concrete-technology
2	https://archive.nptel.ac.in/courses/105/102/105102012/

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	3	-	1	1	-	2	2	1	1
CO2	2	1	-	-	-	3	-	1	1	-	2	2	1	1
CO3	3	2	1	-	-	3	-	1	1	-	2	2	1	1
CO4	2	1	-	-	-	3	-	1	1	-	2	2	1	1
CO5	2	1	-	-	-	3	-	1	1	-	2	2	1	1
Avg.	2.2	1.2	1	-	-	3	-	1	1	-	2	2	1	1

25BECE391	INTERNSHIP I	SEMESTER III 2H-1C
Instruction Hours/Week: L:0 T:0 P:2	Marks: Internal:100 External:- Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students to:

- To train the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks.
- To develop skills in facing and solving field problems.

COURSE OUTCOMES:

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

CO1	Compile the intricacies of textbook knowledge in fieldwork.	K5
CO2	Develop and estimate new techniques using textbook and field concepts	K5

STRATEGY

The students individually undertake training in reputed civil engineering companies for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

TOTAL: 30

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	2	-	1	1	2	3	2	2	1
CO2	3	3	3	2	1	2	-	1	1	2	3	2	2	1
Avg.	**3**	**3**	**3**	**2**	**1**	**2**	-	**1**	**1**	**2**	**3**	**2**	**2**	**1**

25BECE311	SKILL DEVELOPMENT I	SEMESTER III 2H-1C
Instruction Hours/Week: L:0 T:0 P:2	Marks: Internal:100 External:- Total:100	
	End Semester Exam: 3Hours	

Students will undergo 30 hours of skill development training, with internal examiners evaluating skills one hundred percentage for the End Semester Examination, based on report submission and internal examination marks.

25BEMC351G	APTITUDE AND REASONING	SEMESTER III 2H-0C
Instruction Hours/Week: L:2 T:0 P:0	Marks: Internal:100 External:- Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students to:

- Prepare and explain the fundamentals related to various possibilities and probabilities related to quantitative aptitude.
- Critically evaluate numerous possibilities related to puzzles.
- Understand and solve puzzle-related questions from specific and other competitive tests.

COURSE OUTCOMES:

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

CO1	Apply the thought processes to distinguish between concepts of Quantitative methods.	K3
CO2	Utilize the fundamentals related to various possibilities and probabilities related to quantitative aptitude.	K2
CO3	Identify satisfactory competency in the use of reasoning	K3

UNIT – I QUANTITATIVE ABILITY (BASIC MATHEMATICS)

1.1. Number Systems

1.2. LCM and HCF

1.3. Decimal Fractions

1.4. Simplification

1.5. Square Roots and Cube Roots

1.6. Problems on Ages

1.7. Surds & Indices

1.8. Percentages

UNIT – II QUANTITATIVE ABILITY (APPLIED & ENGINEERING MATHEMATICS)

2.1. Logarithm

2.2. Permutation and Combinations

2.3. Probability

2.4. Profit and Loss

2.5. Simple and Compound Interest

2.6. Time, Speed and Distance

2.7. Time & Work

2.8. Ratio and Proportion

2.9. Area

2.10 Mixtures and Allegation

UNIT – III VERBAL - APTITUDE

3.1 Words

3.2 Idioms

3.3 Phrases in Context

3.4 Reading comprehension techniques

3.5 Narrative sequencing

3.6 Data interpretation

TEXTBOOKS:

1.A Modern Approach to Verbal & Non-Verbal Reasoning by R S Agarwal

2.Analytical and Logical Reasoning by Sijwali B S

3.Quantitative aptitude for Competitive examination by R S Agarwal

4.Analytical and Logical Reasoning for CAT and other management entrance tests by Sijwali B S

5.Quantitative Aptitude by Competitive Examinations by Abhijit Guha 4th edition

WEBSITE

1.https://prepinsta.com/

2.https://www.indiabix.com/

3.https://www.javatpoint.com/

25BECE401	GEOLOGY AND DISASTER MANAGEMENT FOR CIVIL ENGINEERS	SEMESTER IV 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3 Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To identify the main and most common igneous, sedimentary, and metamorphic rocks encountered by foundations and construction
- To establish and describe topographical and geological sections
- To infer knowledge and expertise in catastrophe risk reduction

COURSE OUTCOMES:

CO1	Explain the site characteristics and utilizing engineering practice standards to gather, evaluate, and report geologic data	K2
CO2	Relate soil and fluid mechanics and their impact on liquefaction, settlement, and soil slope stability.	K2
CO3	Interpret the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities	K2
CO4	Classify the different aspects of emergencies and disaster events	K2
CO5	Summarize field of emergencies and impacts of Disasters Key Skills	K2

UNIT I GENERAL GEOLOGY 9

Geology in Civil Engineering – Branches of geology – Earth Structures and composition –Earth processes – Weathering – Work of rivers, wind, sea and groundwater and their engineering significance – Earthquakes - Seismo-tectonics of Indian plates, seismic zones of India.

UNIT II MINERALOGY AND PETROLOGY 9

Mineralogy: Physical properties of minerals- Study of the different rock forming minerals-their properties and significant- Coal and petroleum, Petrology- Classification of rocks- Distinction between igneous, sedimentary and metamorphic rocks.

UNIT III STRUCTURAL GEOLOGY AND INVESTIGATIONS IN CIVIL ENGINEERING 9

Attitude of beds – study of structures – Folds, faults and joints. Remote sensing techniques – Interpretation for Civil Engineering projects – Geological conditions necessary for construction of Dams, Tunnels, Buildings, Road cuttings - Causes and preventions - coastal protection structure.

UNIT IV INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire – Classification, Causes, Impacts, Dos and Don‘ts during various types of Disasters.

UNIT V DISASTER MANAGEMENT IN INDIA 9

National Policy for disaster management- Vision and objective Disaster cycle – Phases, Culture of safety, prevention, mitigation and preparedness , Organisational Structure for disaster management – central level and State level-stakeholders and Technological Tools- remote sensing and GIS, Early Warning System..

TOTAL:45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Pradeep Sahni	Disaster Risk Reduction	South Asia, PrenticeHall	2004
2	S K Kataria &Sons	Engineering and General Geology	Parbin Singh, 8th Edition (2010),	2010

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ghosh G.K	Disaster Management	APH Publishing Corporation	2006
2	J.C.Harvey	Geology for Geotechnical Engineers	Cambridge University Press	(1982)

WEBSITES:

1	https://archive.nptel.ac.in/courses/105/104/105104183/
2	https://nptel.ac.in/courses/105105106

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	-	-	1	-	2	1	1	-
CO2	2	1	-	-	-	1	-	-	1	-	2	1	1	-
CO3	2	1	-	-	-	1	-	-	1	-	2	1	1	-
CO4	2	1	-	-	-	1	-	-	1	-	2	1	1	-
CO5	2	1	-	-	-	1	-	-	1	-	2	1	1	-
Avg.	**2**	**1**	-	-	-	**1**	-	-	**1**	-	**2**	**1**	**1**	-

25BECE402	DESIGN OF REINFORCED CONCRETE STRUCTURAL ELEMENTS	SEMESTER IV 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To introduce the different design philosophy for reinforced concrete
- To discuss the limit state method of design of RC rectangular beams
- To learn the concept in the design of RC flanged beams and design for shear and torsion.

COURSE OUTCOME:

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

CO1	Make use of various principles for designing the structural members as per Indian standard	K3
CO2	Solve the flanged beam's shear and tension using limit state method	K3
CO3	Utilize the limit state concept for designing slabs and staircases	K3
CO4	Apply the concepts of limit state method for designing the RCC structural columns	K3
CO5	Identify the design of footings using limit state method.	K3

UNIT I METHODS OF DESIGN OF CONCRETE STRUCTURES 9

Concept of Elastic method, ultimate load method and limit state method – Working stress method as detailed in IS code - Limit State philosophy as detailed in IS code - Advantages of Limit State Method over other methods - Analysis and design of singly and doubly reinforced rectangular beams by limit State Method

UNIT II LIMIT STATE METHOD - FLANGED BEAM, SHEAR &TORSION 9

Analysis and design of flanged beams – Use of design aids for Flexure - Behaviour of RC members in bond and Anchorage - Design requirements as per current code - Behaviour of RC beams in shear and torsion - Design of RC members for combined bending, shear and torsion - serviceability.

UNIT III LIMIT STATE DESIGN OF SLABS AND STAIRCASE 9

Analysis and design of cantilever, one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions- Types of Staircases – Design of dog-legged Staircase –Introduction to Flat Slab

UNIT IV LIMIT STATE DESIGN OF COLUMNS 9

Types of columns – Design of short Rectangular - Design of circular columns - Design of axial, uniaxial and biaxial bending of column – Design of Slender column.

UNIT V LIMIT STATE DESIGN OF FOOTING 9

Design of wall footing – Design of axially and eccentrically loaded rectangular pad – Design of combined rectangular footing for two columns only – Design procedure for RC wall and shear wall – Design of Retaining Wall.

TOTAL:45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Varghese P C	Limit State Design of Reinforced Concrete	Prentice Hall India Learning Private Limited, New Delhi, Second Edition	2002
2	Krishna Raju N	Design of Reinforced Concrete Structures	CBS Publishers and Distributors, New Delhi, Fourth Edition	2016

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Dayaratnam.P	Limit State Design of Reinforced Concrete Structures	Oxford, IBH Publishing Company Pvt. Ltd.,	2008
2	Unnikrishna Pillai S and Devdas Menon	Reinforced Concrete Design	Tata McGraw Hill Publishing Company Ltd, New Delhi, Fifth Edition	2005

WEBSITES:

1	www.nptel.ac.in/courses/105105104/pdf/m2l3.pdf

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	1	-	-	1	-	2	3	3	-
CO2	3	2	1	-	-	1	-	-	1	-	2	3	3	-
CO3	3	2	1	-	-	1	-	-	1	-	2	3	3	-
CO4	3	2	1	-	-	1	-	-	1	-	2	3	3	-
CO5	3	2	1	-	-	1	-	-	1	-	2	3	3	-
Avg.	**3**	**2**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**2**	**3**	**3**	-

25BECE441	MECHANICS OF SOLIDS (Theory & Laboratory)	SEMESTER IV 5H-4C
Instruction Hours/Week: L:3 T:0 P:2	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To get basic ideas of the bending and shear stresses in the beams
- To impart basic knowledge slope and deflection of beams
- To provide basic knowledge on the analysis of various types of trusses

COURSE OUTCOME:

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

CO1	Explain stress and strain in beams and columns, and forces in trusses	K2
CO2	Apply the concepts of compound stress and strain in two-dimensional system	K3
CO3	Illustrate the bending stress, shear stress, and bending moment of beams	K2
CO4	Construct slope and deflection of the beams and buckling of the columns	K3
CO5	Identify the behavior and applications of solid and hollow circular shafts under torsional loads	K3

(i). THEORY

UNIT I SIMPLE STRESSES AND STRAIN 9

Concept of stress and strain- stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law-stress – strain diagram for mild steel –Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section–composite bars– Temperature stresses. Strain Energy– Resilience- Gradual, sudden, impact and shock loadings – simple applications.

UNIT II COMPOUND STRESSES AND STRAINS 9

Two-dimensional system, stress at a point on a plane- principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications-Two-dimensional stress- strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain.

UNIT III SHEAR FORCE AND BENDING MOMENT DIAGRAMS 9

Shear force (SF) and Bending moment (BM) diagrams. SF and BM diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contraflexure -application of moments.

UNIT IV FLEXURAL STRESSES-THEORY OF SIMPLE BENDING 9

Derivation of bending equation: Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections, I,T, Angle and Channel sections – Design of simple beam sections. Shear Stresses- Derivation of moment equation– Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections. Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method.

UNIT V TORSION 9

Derivation of torsion equation and its assumptions-Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs. Thin Cylinders and Spheres.

TOTAL :45

(ii). LABORATORY:

LIST OF EXPERIMENTS:

1. Determination of tensile strength of HYSD bar
2. Determination of deflection of steel beam
3. Determination of impact strength – Izod test
4. Determination of impact strength – Charpy test
5. Determination of rigidity modulus by using torsion test
6. Determination of hardness by Brinell test
7. Determination of hardness by Rockwell test

TOTAL: 30

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ramamurtham S and Narayanan R	Strength of Materials	Dhanpat Rai Publishing Company Pvt Ltd	2020
2	Rajput R K	Strength of Materials (Mechanics of Solids)	Chand and Company Ltd.	2020

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Bansal R K	Strength of Materials	Laxmi Publications, 6th Edition, New Delhi	2020
2	Singh D K	Strength of Materials (Mechanics of Solids)	Ane Books Pvt. Ltd., 4th, New Delhi	2021

WEBSITES:

1	www.nitsri.ac.in/Department/Mechanical%20Engineering/Mechanics_of_Solids.pdf
2	www.freestudy.co.uk/statics/beams/beam%20tut3.pdf

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	-	1	1	-	-	2	1	-
CO2	3	2	1	-	-	1	-	1	1	-	-	2	1	-
CO3	2	1	-	-	-	1	-	1	1	-	-	2	1	-
CO4	3	2	1	-	-	1	-	1	1	-	-	2	1	-
CO5	3	2	1	-	-	1	-	1	1	-	-	2	1	-
Avg.	**2.6**	**1.6**	**1**	**-**	**-**	**1**	**-**	**1**	**1**	**-**	**-**	**2**	**1**	**-**

25BECE442	SOIL MECHANICS (Theory & Laboratory)	SEMESTER IV 5H-4C
Instruction Hours/Week: L:3 T:0 P:2	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVE:

The goal of this course is for the students:

- Infer the classification, Properties and Phase systems of soils.
- Apply the distribution of stresses acting on soils by Boussinesq, Westergaard, Newmark's principle.
- Experiment with Shear strength of soil by Direct shear test, Triaxial test and Unconfined compression test.

COURSE OUTCOME:

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

CO1	Interpret the soil engineering properties and its classification.	K2
CO2	Organize the effective stress concepts and permeability characteristics of soils.	K3
CO3	Apply the Boussinesq, Westergaard, Newmark's principles to analyse the distribution of stresses in subsoil under the energy of external loads.	K3
CO4	Explain the mechanism of compaction and consolidation for the settlements analysis of soils.	K2
CO5	Identify the strength parameters of soils by using the Mohr –Coulomb failure theory and various experimental programs.	K3

(i). THEORY:

UNIT I SOIL CLASSIFICATION 9

Formation of soil - Soil description – Significance of soil mechanics - Phase relationships – Determination of Index properties of soils - Soil Classification- BIS Classification system - Unified and Textural classification systems - Field Identification of soils.

UNIT II EFFECTIVE STRESS AND PERMEABILITY 9

Soil water - Capillary tension and Soil suction – Effective Stress - Permeability - Darcy's Law- Permeability measurement in the laboratory and field - Factors influencing permeability of soils- Seepage – Quick sand condition- Flow nets – Liquefaction – Cyclic Mobility.

UNIT III STRESS DISTRIBUTION 9

Stress distribution – Stresses due to self-weight - Concentrated force: Boussinesq equations and problems – Pressure distribution diagrams - Equivalent point load - Newmark's influence chart - Westergaard's Analysis - Pressure bulb – Contact Pressure.

UNIT IV COMPRESSIBILITY 9

Soil compaction- laboratory and field compaction methods - Factors influencing compaction behavior of soils – Effect of compaction on soil properties - Consolidation - Terzaghi's one dimensional consolidation theory – Determination of co-efficient of consolidation - e-log p relationship - Components of settlement.

UNIT V SHEAR STRENGTH AND STABILITY OF SLOPES 9

Shear strength of cohesive and cohesion less soils - Mohr-Coulomb failure theory - Measurement of shear strength - Direct shear test - Unconfined compression test - Triaxial compression test - Vane shear tests - Pore pressure parameters - Stability of slopes – Slope failures - Culmann's method – Swedish slip circle method - Friction circle method.

TOTAL: 45

(ii). LABORATORY:

LIST OF EXPERIMENTS:

1. Grain size distribution – Sieve analysis
2. Atterberg's Limits
3. Field density Test (Sand replacement method and Core cutter method)
4. Standard proctor compaction test.
5. Permeability determination (constant head and falling head methods)
6. Direct shear test in cohesion less soil
7. Unconfined compression test in cohesive soil

TOTAL: 30

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Gopal Ranjan and Rao A.S.R	Basic and Applied soil mechanics	New Age International Publishers	2016
2	Punmia, B.C	Soil Mechanics and Foundations	Laxmi Publications Pvt. Ltd.,	2019

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Braja M. Das	Advanced Soil Mechanics	CRC Publishers Taylor & Francis Group	2020
2	Arora .K.R	Soil Mechanics and Foundation Engineering	Standard Publication Distributors	2021

WEBSITES:

1	W1: NPTEL :: https://onlinecourses.nptel.ac.in/noc22_ce74/preview

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	3	-	2	1	-	2	3	2	-
CO2	3	2	1	-	-	3	-	2	1	-	2	3	2	-
CO3	3	2	1	-	-	3	-	2	1	-	2	3	2	-
CO4	2	1	-	-	-	3	-	2	1	-	2	3	2	-
CO5	3	2	1	-	-	3	-	2	1	-	2	3	2	-
Avg.	**2.6**	**1.6**	**1**	**-**	**-**	**3**	**-**	**2**	1	**-**	**2**	**3**	**2**	**-**

25BECE443	WATER SUPPLY AND WASTEWATER ENGINEERING (Theory & Laboratory)	SEMESTER IV 5H-4C
Instruction Hours/Week: L:3 T:0 P:2	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To introduce students to various components and
- To learn the design of water supply scheme, water treatment methods, water storage distribution system, sewage treatment and disposal
- To get basic idea of deign of intake structures and sewerage system.

COURSE OUTCOME:

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

CO1	Infer the various components of water supply scheme and design of intake structure and conveyance system for water transmission	K2
CO2	Explain on the characteristics and composition of sewage, ability to estimate sewage	K2
CO3	Apply the process of conventional treatment and in biological treatment process.	K3
CO4	Identify water distribution system and water supply in buildings and understand the self-purification of streams and sludge and septage disposal methods.	K3
CO5	Make use of various advanced treatment system and knowledge about the recent advances in water and wastewater treatment process and reuse of sewage.	K3

(i). THEORY:

UNIT I WATER SUPPLY 9

Estimation of surface and subsurface water resources - Predicting demand for water- Impurities of water and their significance - Physical, chemical and bacteriological analysis - Waterborne diseases - Standards for potable water. Intake of water: Pumping and gravity schemes.

UNIT II WATER TREATMENT 9

Objectives - Unit operations and processes - Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation – Clarifloccuator - Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - softening, removal of iron and manganese - Defluoridation - Softening - Desalination process - Residue Management - Construction, Operation and Maintenance aspect – IS Standards.

UNIT III WATER STORAGE AND DISTRIBUTION 9

Storage and balancing reservoirs - types, location and capacity. Distribution system: layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations - House service connections.

UNIT IV PLANNING AND DESIGN OF SEWERAGE SYSTEM 9

Characteristics and composition of sewage - Population equivalent - Sanitary sewage flow estimation - Sewer materials - Hydraulics of flow in sanitary sewers - Sewer design - Storm drainage-Storm runoff estimation - Sewer appurtenances - Corrosion in sewers - Prevention and control – Sewage pumping-drainage in buildings - Plumbing systems for drainage

UNIT V SEWAGE TREATMENT AND DISPOSAL 9

Objectives - Selection of Treatment Methods - Principles, Functions, - Activated Sludge Process and Extended aeration systems - Trickling filters - Sequencing Batch Reactor (SBR) - UASB - Waste

Stabilization Ponds - Other treatment methods - Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment - Construction, Operation and Maintenance aspects. - Discharge standards-sludge treatment -Disposal of sludge – IS Standards.

TOTAL: 45

(ii). LABORATORY:

LIST OF EXPERIMENTS:

1. Determination of pH Value and Turbidity
2. Determination of Chlorides and Residual Chlorine
3. Determination of Total Hardness
4. Determination of Alkalinity and Acidity
5. Determination of Sulphates
6. Determination of Total solids, Suspended Solids and Dissolved Solids
7. Determination of Optimum Coagulant Dosage

TOTAL: 30

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Garg, S.K	Environmental Engineering, Vol.I	Khanna Publishers, New Delhi,	2020
2	Dr.G.Venkatesan	Water Supply and Wastewater Engineering	Lakshmi publications	2021

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Punmia B.C, Ashok Jain and Arun Jain	Water Supply Engineering	Laxmi Publications (P) Ltd., New Delhi	2020
2	CPHEEO	Manual on Water Supply and Treatment	Ministry of Urban Development, Government of India, New Delhi,	2020

WEBSITES:

1	www.nptel.ac.in/courses/105105110/pdf/m1l01.pdf
2	www.accessengineeringlibrary.com/browse/water-treatment-plant-design-fifth-edition

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	1	1	-	2	2	2	1
CO2	2	1	-	-	-	2	-	1	1	-	2	2	2	1
CO3	3	2	1	-	-	2	-	1	1	-	2	2	2	1
CO4	3	2	1	-	-	2	-	1	1	-	2	2	2	1
CO5	3	2	1	-	-	2	-	1	1	-	2	2	2	1
Avg.	2.6	1.6	1	-	-	2	-	1	1	-	2	2	2	1

25BECE4E**	**PROFESSIONAL ELECTIVE I**	**SEMESTER IV 3H-3C**
Instruction Hours/Week: L:3 T:0 P:0	**Marks: Internal:40 External:60 Total:100**	
		End Semester Exam: 3 Hours

25BECE411	SKILL DEVELOPMENT-II	SEMESTER IV 2H-1C
Instruction Hours/Week: L:0 T:0 P:2	Marks: Internal:100 External:- Total:100	
	End Semester Exam: 3Hours	

Students will undergo 30 hours of skill development training, with internal examiners evaluating skills one hundred percentage for the End Semester Examination, based on report submission and internal examination marks.

25BECE451	DESIGN THINKING	SEMESTER IV 2H-1C
Instruction Hours/Week: L:2 T:0 P:0	Marks: Internal:100 External:- Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To Illustrate design thinking concepts and principles
- Utilize design thinking methods in every stage of the problem
- Identify the different phases of design thinking.

COURSE OUTCOME:

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

CO1	Explain the design thinking process, tools and theories.	K2
CO2	Identify the types of users and the requirements of customers.	K3
CO3	Extend the concepts of Prototyping and its testing.	K4
CO4	Analyze design thinking strategies in product and service design.	K4
CO5	Customize existing products by utilizing design thinking strategies	K4

UNIT I INTRODUCTION 6

Understanding Design thinking and tools - Human-Centric Design Process - Design Thinking Process- DT Activity with case studies.

UNIT II EMPATHISE WITH USERS 6

Five Whys - Needs of user - Types of user research -Customer Journey Mapping - Observational Research.

UNIT III PROTOTYPING 6

Ideas to presentable concepts - Scenario-based Prototyping – Testing prototypes - Usability and ergonomic testing - Rapid prototyping.

UNIT IV PRODUCT AND SERVICE DESIGN 6

Product Design - Interaction Design- Service Design - Communication Design - Transportation Design.

UNIT V DESIGN AND INNOVATION 6

DT For strategic innovations - Extreme Competition - Experience design - Standardization - Humanization - Creative Culture.

TOTAL HOURS: 30

TEXT BOOKS:

1. Bala Ramadurai, "Karmic Design Thinking", 2020.
2. Christian Mueller-Roterberg, “Handbook of Design thinking”, Amazon Digital Services LLC - KDP Print US, 2018.
3. Tim Brown, “Change by Design”, Harper Business Publisher, 2019

4. Hasso Plattner, Christoph Meinel and Larry Leifer, "Design Thinking: Understand – Improve Apply", Springer, 2011
5. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	1	1	-	1	-	-	-	-	-
CO2	3	2	1	-	-	1	1	-	1	-	-	-	-	-
CO3	3	2	2	1	-	1	1	-	1	-	-	-	-	-
CO4	3	3	2	1	-	1	1	-	1	-	-	-	-	-
CO5	3	3	2	1	-	1	1	-	1	-	-	-	-	-
Avg.	**2.8**	**2.2**	**1.6**	**1**	**-**	**1**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**

25BEMC452G	ESSENCE OF TRADITIONAL INDIAN KNOWLEDGE AND HERITAGE	SEMESTER IV 1H-0C
Instruction Hours/Week: L:1 T:0 P:0	Marks: Internal:100 External:- Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To impart a holistic understanding about Indian Culture and Thoughts from a Historical perspective.
- To introduce the students to important concepts from the diverse intellectual traditions of India
- To encourage critical appreciation of the Indian thoughts and cultural manifestations.

COURSE OUTCOME:

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

CO1	Infer the need of cultural diversity and unity	K2
CO2	Outline the traditional knowledge systems of India	K2

UNIT I INTRODUCTION TO INDIAN THOUGHT AND CULTURE

Plurality of Indian culture - Cultural Diversity and Cultural Unity -Different manifestations of Indian Culture: Indus valley culture -Vedic culture and Dravidian culture.-The Medieval Bhakti Culture.

UNIT II TRADITIONAL KNOWLEDGE SYSTEMS OF INDIA

Introduction to the Traditional Indian Education system of Gurukul - Parampara - Understanding Indian Philosophy: Vedic thought and the nine schools of philosophy - Indigenous Knowledge and Women in India

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Chatterjee, Satishchandra and Dhirendramohan Datta	Introduction to Indian Philosophy	Rupa Publications, New Delhi.	2007
2	Husain S. Abid	The National Culture of India. National Book Trust	National Book Trust, New Delhi.	2003

25BECE501	STRUCTURAL ANALYSIS	SEMESTER V 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To get basic ideas of the bending and shear stresses in the beams
- To impart basic knowledge slope and deflection of beams
- To provide basic knowledge on the analysis of various types of trusses

COURSE OUTCOME:

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

CO1	Apply virtual work method to analyse the indeterminate structures.	K3
CO2	Analyze of determinate truss and understand elastic theorems and energy principles.	K4
CO3	Utilize strain energy method in beam, truss and frame to determine deflection.	K3
CO4	Explain moving lines and influence lines.	K2
CO5	Interpret statically determinate and indeterminate suspension bridges and arches.	K2

UNIT I VIRTUAL WORK METHOD 9

Introduction of virtual work method – Principles – Analysis of cantilever beam subjected to concentrated load – analysis of cantilever beam subjected to UDL – Analysis of simply supported beam subjected to concentrated load – Analysis of simply supported beam subjected to UDL – Procedure for finding the deflection of truss using virtual work method – Procedure for finding the deflection of propped cantilever beam using virtual work method – Procedure for finding the deflection of frame using virtual work method.

UNIT II MOMENT DISTRIBUTION METHOD&TRUSS ANALYSIS 9

Analysis of determinate truss-Methods of joints and sections (Numerical problems) Elastic theorems and energy principles - strain energy due to axial load, bending moment, shear and torsion - strain energy method, Castigliano's method for deflection (Derivations only).

UNIT III STRAIN ENERGY METHODS 9

Analysis of beams, frames and trusses with internal and external redundancy – (Simple problems with maximum two redundant) Concepts of effect of pre strain, lack of fit, temperature changes and support settlement (No numerical problems).

UNIT IV MOVING LOADS AND INFLUENCE LINES 9

Introduction to moving loads - concept of influence lines - influence lines for reaction,shear force and bending moment in simply supported beams and over hanging beams - analysisfor different types of moving loads - single concentrated load - several concentrated loads, uniformly distributed load on shorter and longer than the span.

UNIT V ARCHES 9

Arches - Types of arches – Analysis of three hinged, two hinged and fixed arches - Parabolic and circular arches – Settlement and temperature effects.

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Vaidyanathan R and Perumal P	Structural Analysis Volume - I and II	3rd Edition, Laxmi Publications Private Limited, New Delhi	2020
2	Ramamrutham S	Theory of Structures	9th Edition, Dhapat Rai Publishing Pvt Ltd, New Delhi	2020

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Bhavikatti S S	Structural Analysis Volume - I and II	5th Edition, Vikas publishing house private limited, New Delhi	2020
2	Shah H J and Junnarkar S B	Mechanics of Structures Volume II	24th Edition, Charotar publishing house Pvt. Ltd., Gujarat	2021

WEBSITES:

1	https://www.researchgate.net/publication/292539849_REVIEW_OF_BASICS_IN_STRUCTURAL_ANALYSIS
2	https://www.colorado.edu/ceae/sites/default/files/attached-files/Review-Fe-Exam-Structures-Saouma.pdf

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	1	-	-	1	-	-	2	1	-
CO2	3	2	1	-	-	1	-	-	1	-	-	2	1	-
CO3	3	2	1	-	-	1	-	-	1	-	-	2	1	-
CO4	2	1	-	-	-	1	-	-	1	-	-	2	1	-
CO5	2	1	-	-	-	1	-	-	1	-	-	2	1	-
Avg.	**2.6**	**1.6**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**2**	**1**	**-**

25BECE502	FOUNDATION ENGINEERING	SEMESTER V 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	**Marks:** Internal:**40** External:**60** Total:**100**	
	End Semester Exam: 3Hours	

COURSE OBJECTIVE:

The goal of this course is for the students to:

- To describe the selection of foundation based on different soil conditions and explorations of soils for analyse and design the foundations.
- To assess the characteristics of problematic soils and remedial measures for the construction of foundation on such soils.
- To have deep knowledge on types of foundation.

COURSE OUTCOME:

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

CO1	Interpret the selection of foundation and sub-soil exploration	K2
CO2	Explain the bearing capacity of shallow foundation as per IS code.	K2
CO3	Develop design procedures for shallow foundation as per IS code.	K3
CO4	Infer the characteristics of foundations on different soil conditions	K2
CO5	Identify the theories and mechanisms for designing different retaining walls	K3

UNIT I SELECTION OF FOUNDATION AND SUB-SOIL EXPLORATION 9

Types of foundation - Factors affecting the selection of foundations - Types of foundation based on soil condition-Soil exploration- Boring and drilling methods of exploration -Soil sampling techniques -Field penetration tests -Bore log- Excavation methods -Introduction to geophysical methods.

UNIT II SETTLEMENT AND BEARING CAPACITY 9

Design criteria -Modes of shear failures - Bearing capacity theories - IS Code and Presumptive methods of bearing capacity – Settlement of foundation -Allowable bearing pressure – Bearing capacity from in-situ tests - Factors affecting bearing capacity - Bearing capacity of raft/mat foundation as per code of practice

UNIT III SHALLOW FOUNDATION 9

Design procedure of Spread footings: square footings - rectangular footings; Design procedure of Rectangular Combined footing- Design procedure of Mat Foundations: Differential settlement of mats - Structural design procedure of mat foundations – Settlement of foundation.

UNIT IV FOUNDATIONS ON PROBLEMATIC SOIL 9

Significant characteristics of expansive soil - Footing on expansive soil - Problems and preventive measures - Piles – Friction - Under-reamed pile foundation, design and field installation - Significant characteristics of silt and loess, problems -Remedial measures.

UNIT V RETAINING WALLS 9

Types of retaining walls - Rankine's theories of earth pressure - Mechanism of active and passive earth pressure - Design of retaining walls under various soil conditions**.**

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Arora, K.R	Soil Mechanics and Foundation Engineering	Standard Publishers and Distributors, New Delhi.	2020
2	Venkatramaiah, C	Geotechnical Engineering	New Age International Publishers, New Delhi, Fifth Edition.	2020

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Punmia B C	Soil Mechanics and Foundations	Laxmi Publications Pvt. Ltd, New Delhi, 16th Edition.	2020
2	Das B M	Principles of Foundation Engineering	C L Engineering, Punjab, 8th Edition.	2020

WEBSITES:

1	www.cedengineering.com/categories/geotechnical-engineering
2	www.fema.gov/media-library-data/1393888050307-13afc722f0aaf8d213b1a7010a29b491/P-752_Unit5.pdf

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	-	1	1	-	1	2	1	-
CO2	2	1	-	-	-	1	-	1	1	-	1	2	1	-
CO3	3	2	1	-	-	1	-	1	1	-	1	2	1	-
CO4	2	1	-	-	-	1	-	1	1	-	1	2	1	-
CO5	3	2	1	-	-	1	-	1	1	-	1	2	1	-
Avg.	2.4	1.4	1	-	-	1	-	1	1	-	1	2	1	-

25BECE503	HIGHWAY PLANNING, DESIGN AND OPERATION	SEMESTER V 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVE:

The goal of this course is for the students:

- To describe the highway geometry, cross section elements and pavement layer behaviour
- To impart knowledge on highway design process using CIVIL 3D software
- To estimate the rainfall and runoff data and design of highway drainage
- To explain the Principles and Design of Flexible and Rigid Pavements according to IRC specifications
- To skill up for executing pavement construction with quality control and assurance along with Plants and Machinery selection

COURSE OUTCOME:

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

CO1	Develop an understanding of the highway geometry, cross section elements and pavement layer behavior	K2
CO2	Demonstrate the highway design process using CIVIL 3D software	K3
CO3	Analyse rainfall and run off for the highway drainage design	K4
CO4	Conduct different tests on road construction materials to evaluate their characteristics	K5
CO5	Carry out the design of flexible and rigid pavements	K3

UNIT I HIGHWAY GEOMETRIC DESIGN AND CROSS SECTION ELEMENTS

Highway Geometric Design: Overview of highway - Classification of roads, Highway alignment and Survey, Highway Development in India, Geometric Standards of Highway Design – Sight distance, horizontal and vertical alignment; Geometric design using CIVIL 3D.

Highway Cross Section Elements: Median, Kerb and kerb shyness, Carriageway, Shoulders, Camber, Embankment Slope, RE walls and Retaining wall, Crash barriers, Drains, Footpath and guardrails, Boundary wall and Fencing, Utilities corridor, Avenue plantations, Right of Way, Project Facilities; Pavement Layers – Components and Functions.

UNIT II PAVEMENT MATERIALS AND DRAINAGE DESIGN ELEMENTS

Pavement material: Soil classification and desirable properties of Soil, Stone aggregates, Bituminous binders, Bituminous paving mix, Cement, Concrete.

Drainage Design: Highway Drainage - Components – types – materials – use, Catchment Analysis & Discharge Calculations – Rainfall data - Return period – Runoff estimation: SCS curve number method - rational formula - Synthetic unit hydrograph - Hydraulic Drain Design

UNIT III PRINCIPLES AND DESIGN OF PAVEMENTS

Flexible Pavement: Introduction, composition, factors governing design, design of flexible pavements as per IRC; Bituminous mix design (Marshall method), IITPAVE Software; Case study - Design Problem

Rigid pavement: Introduction, composition, factors governing design, DLC and PQC mix design; design of concrete pavements as per IRC; Joints; Case study – Design Problem

UNIT IV PLANTS AND MACHINERY, PLANNING FOR PAVEMENT CONSTRUCTION

Plants and Machinery: Introduction; Asphalt Hot Mix Plant, Concrete Batching Plant, Wet Mix Macadam Plant, Earthmoving and Excavation Equipment, Paving Equipment, Slipform Paver, Paver Milling and Road Marking Equipment; Factors affecting output of Plant & Equipment; Initiatives to improve Quality

Construction Planning: Concept of Highways, Planning; Schedules in Planning; Monitoring; Software in Planning

UNIT V CONSTRUCTION PRACTICES OF FLEXIBLE AND RIGID PAVEMENT

Subgrade and Base Layer: Construction Practices and Quality Control; Granular Sub-base Construction Activities; Cement Treated Sub-Base Construction Activities

Flexible Layers: Wet Mix Macadam; Construction Practices of Wet Mix Macadam; Hot Mix Asphalt; Construction Practices of Hot Mix Asphalt Layer, Quality Control of Flexible Layers Rigid Layers: Dry Lean Concrete; Construction Practices of Dry Lean Concrete; Pavement Quality Concrete; Construction Practices of Pavement Quality Concrete, Quality Control of Rigid Layers

Pavement Evaluation: Introduction, Pavement Condition Survey, Pavement Evaluation Functional and Structural, Distresses - Flexible and Rigid Pavement, Overlay Design of Flexible Pavement – KGPBACK Software

TOTAL: 30+15

REFERENCE BOOKS:

1.	IRC:37-2018 - Guidelines for the Design of Flexible Pavements. (Fourth Revision)
2.	IRC:58-2015 - Guidelines for the Design of Plain Jointed Rigid Pavements for Highway.
3.	Specifications for Road and Bridge Works; MoRTH 5th Revision
4.	Other relevant IRC and IS Codes of Practices
5.	Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised10th Edition, Nem Chand & Bros, 2017
6.	Partha Chakraborty, ' Principles of Transportation Engineering, PHI Learning,
E-RESOURCES:	
1.	L&T EduTech LMS Platform

SOFTWARE		
S.No	**Software Taught**	**Versions available (Student/Paid/Free)**
1.	IITPAVE	Free
2.	KGPBACK	Free
3.	CIVIL 3D	Student

PROJECT		
S.No	**Project objectives***	**Project outcomes***
1.	Develop the geometric layout of the highway project according to established standards	Propose the essential design standards forsafe and cost-effective highways.
2.	Assess the characteristics of pavement materials for construction	Evaluate the characteristics of pavement materials and find its suitability for construction
3.	Design of Flexible and Rigid pavement	Derive the pavement thickness as per IRC guidelines

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	3	-	-	2	1	2	-	1	2	2
CO2	3	2	1	-	-	3	-	-	2	1	2	-	1	2	2
CO3	3	3	2	1	-	3	-	-	2	1	2	-	1	2	2
CO4	3	3	3	2	1	3	-	-	2	1	2	-	1	2	2
CO5	3	2	1	-	-	3	-	-	2	1	2	-	1	2	2
Avg.	2.8	2.2	1.8	1.5	1	3	-	-	2	1	2	-	1	2	2

25BECE504	HYDROLOGY AND WATER RESOURCES ENGINEERING	SEMESTER V 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To assess the interaction among various processes in the hydrologic cycle.
- To illustrate of measurement of rainfall in different areas.
- To make use of advanced optimization techniques to cover the socio-technical aspects in the field of water resources.

COURSE OUTCOME:

Upon completion of this course the students will be able to

CO1	Solve the probable maximum precipitation.	K3
CO2	Summarize the different abstractions from precipitation.	K2
CO3	Apply the volume of runoff through unit hydrograph and base flow separation method.	K3
CO4	Interpret the usage of surface and subsurface water.	K2
CO5	Identify the discharges from canals and their distribution.	K3

UNIT I: INTRODUCTION **9**

Hydrologic cycle, water-budget equation, history of hydrology, world water balance, applications in engineering, sources of data. Precipitation- Forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth- area-duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India.

UNIT II: ABSTRACTIONS FROM PRECIPITATION **9**

Evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapo transpiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.

UNIT III: RUNOFF **9**

Runoff volume, SCS-CN method of estimating runoff volume, flow- duration curve, flow- mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph surface water resources of India, environmental flows. Ground water and well hydrology- Forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.

UNIT IV: WATER WITHDRAWALS AND USES **9**

Water for energy production, water for agriculture, water for hydroelectric generation; flood control. Analysis of surface water supply, Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water,

infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation.

UNIT V: DISTRIBUTION SYSTEMS **9**

Canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels-rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi-modular and modular outlets. Water logging: causes, effects and remedial measures. Lining of canals, types of lining. Drainage of irrigated lands: necessity, methods.

TOTAL: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	K. Subramanya	Engineering Hydrology	Mc-Graw Hill	2019
2	K. Subramanya	Water Resources Engineering	Tata Mc- Graw Hill	2017

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	K.N.Muthreja	Applied Hydrology	TataMc-GrawHill	2018
2	L.W.Mays	Water Resources Engineering	Wiley	2019

WEBSITES:

1	https://nptel.iitm.ac.in
2	https://www.groundwatermanagement.org

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	2	-	-	1	-	3	2	2	-
CO2	2	1	-	-	-	2	-	-	1	-	3	2	2	-
CO3	3	2	1	-	-	2	-	-	1	-	3	2	2	-
CO4	2	1	-	-	-	2	-	-	1	-	3	2	2	-
CO5	3	2	1	-	-	2	-	-	1	-	3	2	2	-
Avg.	**2.6**	**1.6**	**1**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**3**	**2**	**2**	**-**

25BECE5E**	**PROFESSIONAL ELECTIVE II**	**SEMESTER V 3H-3C**
Instruction Hours/Week: L:3 T:0 P:0	**Marks: Internal:40 External:60 Total:100**	
		End Semester Exam: 3 Hours

25BECE541	HYDRAULIC ENGINEERING (Theory & Laboratory)	SEMESTER V 5H-4C
Instruction Hours/Week: L:3 T:0 P:2	**Marks:** Internal**:40** External**:60** Total**:100**	
	End Semester Exam: 3Hours	

COURSE OBJECTIVE:

The goal of this course is for the students:

- To introduce various hydraulic engineering problems like open channel flows and hydraulic machines.
- To relate the theory and practice of problems in hydraulic engineering.
- To apply fundamental concepts and techniques of hydraulics and hydrology in the analysis, design, and operation of water resources systems.

COURSE OUTCOME:

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

CO1	Explain the flow in channel with its flow.	K2
CO2	Infer the characteristics of uniform flow with various empirical formula.	K2
CO3	Explain non-uniform flow channel transition with dynamic equations.	K2
CO4	Solve various problems of flow through pipes in parallel and series.	K3
CO5	Select pumps and turbines based on the channel flow.	K3

(i). THEORY:

UNIT I INTRODUCTION TO CHANNEL FLOW 9

Channel Flow: Open channel flow- Closed Channel flow- Comparison of closed and open channel; Geometrical Parameters of channel – Classification of open channel and its flow - Laminar and Turbulent Flow – Stoke's Law – Measurement of viscosity- Turbulence, scale and intensity – Causes if turbulence – Empirical theories of turbulence.

UNIT II UNIFORM FLOW 9

Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient -Most economical section of channel. Computation of Uniform flow, Normal depth.

UNIT III NON-UNIFORM FLOW 9

Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Measurement of Discharge and Velocity – Venturi Flume, Standing Wave Flume, Parshall Flume, Broad Crested Weir. Measurement of Velocity- Current meter, Floats, Hot-wire anemometer. Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile.

UNIT IV FLOW THROUGH PIPES 9

Loss of head through pipes-Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles. Analysis of pipe networks: Hardy Cross method, water hammer in pipes and control measures, branching of pipes, three reservoir problem.

UNIT V HYDRAULIC MACHINES 9

Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitations in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Indicator diagrams and its variations - Air vessels - Savings in work. Turbines - Classification - Impulse turbine – Pelton wheel - Reaction turbines - Francis turbine - Kaplan turbine - Draft tube - Cavitation - Performance of turbine - Specific speed - Runaway speed.

TOTAL HOURS: 45

(ii). LABORATORY:

LIST OF XPERIMENTS:

1. Determination of coefficient of discharge through orifice and mouthpiece
2. Determination of coefficient of discharge through V notch and trapezoidal notch
3. Determination of coefficient of discharge through orifice meter and Venturimeter
4. Verification of Bernoulli's theorem
5. Characteristic curves of Pelton wheel (Demonstration only)
6. Characteristics curves of reciprocating pump
7. Characteristics curves of centrifugal pump

TOTAL: 30

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	P.M. Modi and S.M. Seth	Hydraulics and Fluid mechanics	Standard Book House	2017
2	K. Subramanya	Theory and Applications of Fluid Mechanics	Tata McGrawHill	2011

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	K. Subramanya	Open channel Flow	Tata McGrawHill	2005
2	Ven Te Chow	Open Channel Hydraulics	Tata McGrawHill	2008

WEBSITES:

1	NPTEL: Civil Engineering - NOC: Hydraulic Engineering

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	1	1	-	2	2	2	1
CO2	2	1	-	-	-	2	-	1	1	-	2	2	2	1
CO3	2	1	-	-	-	2	-	1	1	-	2	2	2	1
CO4	3	2	1	-	-	2	-	1	1	-	2	2	2	1
CO5	3	2	1	-	-	2	-	1	1	-	2	2	2	1
Avg.	2.4	1.4	1	-	-	2	-	1	1	-	2	2	2	1

25BECE511	BUILDING DRAWING AND DETAILING LABORATORY	SEMESTER V 4H-2C
Instruction Hours/Week: L:0 T:0 P:4	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To communicate a design idea/concept graphically/visually.
- To interpret the building detailing drawings for finding the required quantities of materials.
- To produce plan, section and elevation diagram using a of AutoCAD 2D software.

COURSE OUTCOME:

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

CO1	Identify an effective section of flow in different cross sections.	K3
CO2	Solve problems in uniform, gradually and rapidly varied flows in steady state conditions.	K3
CO3	Summarize the principles, working and applications of gradually varied flow	K2
CO4	Experiment with head loss of fluid flow through pipes.	K3
CO5	Select the pumps for the given different hydraulic applications.	K2

LIST OF EXPERIMENTS:

1. Introduction to basic building drawings and layouts
2. Introduction to building by laws as per NBC
3. Plan, section and elevation of residential building
4. Plan, section and elevation of institutional buiding
5. Plan, section and elevation of community hall
6. Reinforcement detailing of singly reinforced beam
7. Reinforcement detailing of doubly reinforced beam
8. Reinforcement detailing of simply supported one-way slab
9. Reinforcement detailing of simply supported two-way slab
10. Reinforcement detailing of column with footing
11. Reinforcement detailing of dog-legged staircase

TOTAL HOURS: 60

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	1	1	-	2	2	-	1	2	1
CO2	3	2	1	-	-	1	1	-	2	2	-	1	2	1
CO3	2	1	.	-	-	1	1	-	2	2	-	1	2	1
CO4	3	2	1	-	-	1	1	-	2	2	-	1	2	1
CO5	2	1	-	-	-	1	1	-	2	2	-	1	2	1
Avg.	**2.6**	**1.6**	**1**	-	**-**	**1**	**1**	**-**	**2**	**2**	**-**	**1**	**2**	**1**

25BECE512	COMMUNITY ENGAGEMENT AND SOCIAL RESPONSIBILITY	SEMESTER V 2H-2C
Instruction Hours/Week: L:2 T:0 P:0	Marks: Internal:100 External: - Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
- To develop some ideas of the legal and practical aspects of their profession
- To impart the importance of Intellectual Property Rights and Patents

COURSE OUTCOME:

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

CO1	Interpret the professional practice and community engagement.	K2
CO2	Explain insight in Components and Principles of community development.	K2
CO3	Compare Rural and public administration	K2
CO4	Outline good ideas of the legal and practical aspects of their profession	K2
CO5	Infer ideas of the legal and practical aspects of their profession	K2

UNIT I INTRODUCTION 6

Concept-Ethics and Spectrum of Community Engagement-Local Community-Rural culture and Practice of community engagement

UNIT II COMMUNITY DEVELOPMENT 6

Stages-Components and Principles of community development- Utility of public resources-Contributions of self-help groups

UNIT -III RURAL ADMINISTRATION 6

Rural Development Programs and Rural institutions Local Administration and Community Involvement

UNIT -IV COMMUNITY ENGAGEMENT 6

Social contribution of community networking, Various government schemes. Programmes of community engagement and their evaluation.

UNIT -V COMMUNITY ENGAGED ETHICS 6

Community Engaged Research and Ethics in Community Engaged Research Rural Distress, Rural Poverty, Impact of COVID-19 on Migrant Laborers, Mitigation of Disaster

TOTAL HOURS: 30

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Donna Jo McCloskey, RN	Principles of Community Engagement	2nd Edition, NIH Publication No. 11-7782, Printed June 2011	2011
2	Israel BA, Coombe CM,	Community-based participatory research	Nov;100(11):2094-102. doi:	2010

WEBSITES:

1	https://www.mpgkpdf.com/2021/09/community-development-plan-in- hindi.html
2	https://www.businessmanagementideas.com/hi/entrepreneurship-2/entrepreneurship-development-in-india/19998,

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	1	1	-	2	-	-	-
CO2	2	1	-	-	-	2	-	1	1	-	2	-	-	-
CO3	2	1	-	-	-	2	-	1	1	-	2	-	-	-
CO4	2	1	-	-	-	2	-	1	1	-	2	-	-	-
CO5	2	1	-	-	-	2	-	1	1	-	2	-	-	-
Avg.	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**1**	**1**	**-**	**2**	**-**	**-**	**-**

25BECE591	INTERNSHIP-II	SEMESTER V 2H-1C
Instruction Hours/Week: L:0 T:0 P:2	Marks: Internal:100 External:- Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students to:

- To train the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks.
- To develop skills in facing and solving field problems.

COURSE OUTCOMES:

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

CO1	Compile the intricacies of textbook knowledge in fieldwork.	K5
CO2	Develop and estimate new techniques using textbook and field concepts	K5

STRATEGY

The students individually undertake training in reputed civil engineering companies for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

TOTAL: 30

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	2	2	1	1	2	3	2	2	1
CO2	3	3	3	2	1	2	2	1	1	2	3	2	2	1
Avg.	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**1**	**1**	**2**	**3**	**2**	**2**	**1**

25BECE601	**DESIGN OF STEEL STRUCTURES**	**SEMESTER VI 3H-3C**
Instruction Hours/Week: L:3 T:0 P:0		**Marks:** Internal**:40** External**:60** Total**:100**
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To perform appropriate structural analyses based on the loads designed for the structure.
- To learn the loads on truss and the design of purlins.
- To design structural components using timber and plate girders.
- To impart the basic concepts about the Design of columns under axial loads using specifications

COURSE OUTCOME:

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

CO1	Identify the various connections for steel structural members and their design criteria.	K3
CO2	Make use of limit state design criteria for designing the tension members.	K3
CO3	Apply the limit state allowable criteria for designing the compression member.	K3
CO4	Analyze the load carrying capacity of roof truss for various structural elements by using standards	K4
CO5	Develop the design of timber components subjected to live load on a member.	K3

UNIT I: INTRODUCTION TO STEEL AND STEEL STRUCTURES 9

Properties of steel, structural steel sections. Introduction to design: Design loads and load combinations, limit state design concepts. Bolted Connections- bracket connections and moment resisting connections – welded connection (Design of weld strength of a member only)

UNIT II: TENSION MEMBERS 9

Types of sections – net area- design of tension members- concept of shear lag-use of lug angle-connections in tension members

UNIT III: COMPRESSION MEMBERS 9

Design of struts- solid and built- up columns for axial loads-- design of lacingsand battens-column bases- slab base – gusseted base

UNIT IV: DESIGN OF ROOF TRUSSES 9

Types-design loads and load combinations assessment of wind loads- design of purlins. Moment resistant/Eccentric connections (in plane and out of plane).

UNIT V: DESIGN OF TIMBER STRUCTURES 9

Types of timber - classification - allowable stresses-design of beams-flexure, shear, bearing and deflection considerations-Design of columns. Design of composite beam sections with timber and steel.

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Subramanian N	Design of Steel Structures- Limit State	Oxford university Press, United Kingdom, First Edition.	2021
2	Duggul S K	Limit State Design of Steel Structures	Tata McGraw-Hill Education Pvt Ltd, New Delhi, Second Edition.	2020

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Bhavikatti S S	Design of Steel Structures by Limit State method as per IS: 800-2007	I K International Pvt Ltd, New Delhi, Fifth Edition.	2020
2	Ramamrutham S	Design of Steel Structures	Dhanpat Rai Publishing Company Pvt Ltd, Sixth Edition.	2020

WEBSITES:

1	www.inti.gob.ar/cirsoc/pdf/acero/s154content.pdf
2	www.elearning.vtu.ac.in/13/enotes/dss/tension%20members%20final%20--%20raviraj.s.pdf

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	2	-	-	1	1	1	2	3	3
CO2	3	2	1	-	-	2	-	-	1	1	1	2	3	3
CO3	3	2	1	-	-	2	-	-	1	1	1	2	3	3
CO4	3	3	2	1	-	2	-	-	1	1	1	2	3	3
CO5	3	2	1	-	-	2	-	-	1	1	1	2	3	3
Avg.	3	2.2	1.2	1	-	2	-	-	1	1	1	2	3	3

25BECE602	**ESTIMATION, COSTING AND VALUATION ENGINEERING**	**SEMESTER VI 3H-3C**
Instruction Hours/Week: L:3 T:0 P:0	**Marks:** Internal**:40** External**:60** Total**:100**	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand competitive bidding works and to submit a competitive bid proposal
- To impart the technical specifications for various works to be performed for a project and impact the cost of a structure.
- To gain knowledge on different methods of contract and their proposals.

COURSE OUTCOME:

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

CO1	Estimate the material quantities, prepare a bill of quantities.	K4
CO2	Build value estimate	K3
CO3	Identify the specification of the tender document.	K3
CO4	Illustrate the role arbitration of the legal bodies.	K2
CO5	Interpret knowledge in computation materials requirement.	K2

UNIT I ESTIMATE OF BUILDINGS 9

Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof – Various types of arches – Calculation of brick work and RCC works in arches – Estimate of joineries for panelled and glazed doors, windows, ventilators, handrails etc**.**

UNIT II ESTIMATE OF OTHER STRUCTURES 9

Estimating of septic tank, soak pit – sanitary and water supply installations – water supply pipe line – sewer line – tube well – open well – estimate of bituminous and cement concrete roads – estimate of retaining walls – culverts – estimating of irrigation works – aqueduct, syphon, fall**.**

UNIT III SPECIFICATION AND TENDERS 9

Data – Schedule of rates – Analysis of rates – Specifications – sources – Preparation of detailed and general specifications – Tenders – TTT Act – e-tender – Preparation of Tender Notice and Document – Contracts – Types of contracts – Drafting of contract documents – Arbitration and legal requirements**.**

UNIT IV VALUATION 9

Necessity – Basics of value engineering – Capitalised value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease

UNIT V REPORT PREPARATION 9

Principles for report preparation – report on estimate of residential building – Culvert – Roads – Water supply and sanitary installations – Tube wells – Open wells.

TOTAL: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Dutta, B.N	Estimating and Costing in Civil Engineering	UBS Publishers & Distributors Pvt. Ltd	2003
2	Kohli, D.D and Kohli, R.C	A Text Book of Estimating and Costing (Civil)	S.Chand & Company Ltd	2004

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Tamil Nadu Government	Tamil Nadu Transparencies in Tender Ac	-	1998
2	Standard Bid Evaluation Form	Procurement of Goods or Works	The World Bank	1996

WEBSITES:

1	https://onlinecourses.swayam2.ac.in/nou20_cs11/preview
2	https://archive.nptel.ac.in/courses/112/107/112107209/

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO 3
CO1	3	3	2	1	-	2	-	1	1	-	1	2	1	-
CO2	3	2	1	-	-	2	-	1	1	-	1	2	1	-
CO3	3	2	1	-	-	2	-	1	1	-	1	2	1	-
CO4	2	1	-	-	-	2	-	1	1	-	1	2	1	-
CO5	2	1	-	-	-	2	-	1	1	-	1	2	1	-
Avg.	2.6	1.8	1.3	1	-	2	-	1	1	-	1	2	1	-

25BECE603	**PROFESSIONAL PRACTICE, LAW AND ETHICS**	**SEMESTER VI 3H-3C**
Instruction Hours/Week: L:3 T:0 P:0	**Marks:** Internal**:40** External**:60** Total**:100**	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
- To develop some ideas of the legal and practical aspects of their profession
- To give an understanding of Intellectual Property Rights, Patents.

COURSE OUTCOME:

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

CO1	Illustrate constitutes professional practice, stakeholders 'roles	K2
CO2	Explain insight in contracts and contracts management, resolution mechanisms, laws governing engagement of labour.	K2
CO3	Compare Intellectual Property Rights, Patents	K2
CO4	Outline good ideas of the legal and practical aspects of their profession	K2
CO5	Infer ideas of the legal and practical aspects of their profession	K2

UNIT-I PROFESSIONAL PRACTICE & PROFESSIONAL ETHICS 9

Professional Practices- Respective roles of various stakeholders: Government Standardization Bodies; professional bodies -Institution of Engineers, Indian Roads Congress. Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures.

UNIT-II GENERAL PRINCIPLES OF CONTRACTS MANAGEMENT 9

Indian Contract Act, 1872 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contracts and their features; Valid & Voidable Contracts; Prime and sub-contracts; Joint Ventures & Consortium;Contract award & Notice to Proceed; Variations & Changes in Contracts; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non- performance; Contract documentation; Contract Notices; Wrong practices in contract in; Reverse auction; Case Studies; Build-Own-Operate & variations; Public- Private Partnerships; International Commercial Terms.

UNIT-III ARBITRATION, CONCILIATION AND ADR 9

Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity,reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign

awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok A dalats

UNIT IV ENGAGEMENT OF LABOUR & CONSTRUCTION- RELATED LAWS 9

Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub- contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers Act (1996) and Rules (1998); RERA Act 2017, NBC 2017

UNIT V LAW RELATING TO INTELLECTUAL PROPERTY 9

Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 -Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies.

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Avtar Singh	Law of Contract.	Eastern Book Co	2002
2	S K Kataria &Sons	Fundamental concepts in Law of Contract	3rd Edition. Professional Offset),	2006

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	T. Ramappa	Intellectual Property Rights Law in India	Asia Law House Bare text.	2010
2	T. Ramappa	Right to Information Act.. 2010	Asia Law House Bare text	2010

WEBSITES:

1	https://www.scribd.com/document/557778730/Professional-Ethics-NPTEL-Syllabus
2	https://www.goseeko.com/studymaterial/aryabhatta-knowledge-university-bihar/engineering/civil-engineering/fourth-year/sem-1/professional-practice-law-and-ethics

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	3	-	1	-	2	1	1	-
CO2	2	1	-	-	-	2	3	-	1	-	2	1	1	-
CO3	2	1	-	-	-	2	3	-	1	-	2	1	1	-
CO4	2	1	-	-	-	2	3	-	1	-	2	1	1	-
CO5	2	1	-	-	-	2	3	-	1	-	2	1	1	-
Avg.	2	1	-	-	-	2	3	-	1	-	2	1	1	-

25BECE6E**	**PROFESSIONAL ELECTIVE-III**	**SEMESTER VI 3H-3C**
Instruction Hours/Week: L:3 T:0 P:0	**Marks: Internal:40 External:60 Total:100**	
		End Semester Exam: 3 Hours

25BECE6E**	**PROFESSIONAL ELECTIVE-IV**	**SEMESTER VI 3H-3C**
Instruction Hours/Week: L:3 T:0 P:0	**Marks: Internal:40 External:60 Total:100**	
		End Semester Exam: 3 Hours

25BECE6E**	**PROFESSIONAL ELECTIVE-V**	**SEMESTER VI 3H-3C**
Instruction Hours/Week: L:3 T:0 P:0	**Marks: Internal:40 External:60 Total:100**	
		End Semester Exam: 3 Hours

25BEHS601G	**UNIVERSAL HUMAN VALUES**	**SEMESTER VI 2H-2C**
Instruction Hours/Week: L:2 T:0 P:0		**Marks:** Internal**:100** External**:-** Total**:100**
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To help students to understand the need, basic guidelines, content and process of value education.
- To help students distinguish between values and skills
- To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
- To help students understand the meaning of happiness within their selves.
- To help students understand the meaning of happiness and prosperity for a human being

COURSE OUTCOME:

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

CO1	Illustrate the significance of value inputs in a classroom, distinguish between values and skills.	K2
CO2	Interpret the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society	K2
CO3	Illustrate the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships.	K2

UNIT-I COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION 10

Understanding the need, basic guidelines, content and process for Value Education, Self Exploration– what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT-II UNDERSTANDING HARMONY IN THE HUMAN BEING HARMONY IN MYSELF 10

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

UNIT-III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY HARMONY IN HUMAN-HUMAN RELATIONSHIP 10

Understanding harmony in the Family- the basic unit of human interaction , Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay- tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the

meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family.

TOTAL HOURS:30

TEXT BOOKS:

1. R R Gaur, R Asthana, G P Bagaria,A Foundation Course in Human Values and Professional Ethics 2nd Revised Edition, Excel Books, New Delhi 2019
2. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
3. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
4. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
6. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
7. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
8. A N Tripathy, 2003, Human Values, New Age International Publishers.

WEBSITE:

1. http://uhv.ac.in
2. http://www.uptu.ac.in
3. http://www.storyofstuff.com

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	3	2	-	-	2	-	-	-
CO2	2	1	-	-	-	-	3	2	-	-	2	-	-	-
CO3	2	1	-	-	-	-	3	2	-	-	2	-	-	-
Avg.	2	1	-	-	-	-	3	2	-	-	2	-	-	-

25BECE611	MINI PROJECT - I	SEMESTER VI 2H-1C
Instruction Hours/Week: L:0 T:0 P:2	Marks: Internal:100 External:- Total:100	
	End Semester Exam: 3Hours	

The students will be directed to do a mini project in their domain field for 3 months. Their project work will be evaluated one hundred percentage by internal examiner for End Semester Examination. End Semester Examination evaluation will be based on the report submitted by the student after the completion of their project report.

25BECE612	SURVEY CAMP	SEMESTER VI 2H-1C
Instruction Hours/Week: L:0 T:0 P:2	Marks: Internal:100 External:- Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- Provide hands-on training in surveying techniques such as mapping and contouring to enhance students' practical skills
- Gain the knowledge for teamwork and problem-solving abilities through small group exercises
- Understand surveying principles in real-time field work.

COURSE OUTCOME:

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

CO1	Determine the longitudinal and cross section of a real-time field work.	K3
CO2	Examine the various techniques of surveying in field work.	K2
CO3	Analyse the errors and adjustments associated with field measurements.	K3
CO4	Discover experiments employed for establishment of horizontal and vertical measurements for roadways and construction of buildings	K2
CO5	Compare challenging practical problems and find solution by applying proper methodology.	K3

LIST OF EXPERIMENTS:

Two weeks Survey Camp will be conducted during summer vacation in the following activities:

1. Traverse - using Total station
2. Contouring
   (i). Radial tachometric contouring - Radial Line at Every 45 Degree and Length not less than 60 meter on each Radial Line 65
   (ii). Block Level/ by squares of size at least 100 meter x 100 meter atleast 20 meter interval
3. L.S & C.S - Road and canal alignment for a Length of not less than 1 kilo meter atleast L.S at Every 30m and C.S at every 90 m
4. Offset of Buildings and Plotting the Location
5. Sun observation to determine azimuth (guidelines to be given to the students)
6. Curve setting by deflection angle

TOTAL HOURS: 30

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	1	1	1	1	1	1	1	3	2
CO2	3	3	3	2	1	1	1	1	1	1	1	1	3	2
CO3	3	3	2	1	-	1	1	1	1	1	1	1	3	2
CO4	3	3	2	1	-	1	1	1	1	1	1	1	3	2
CO5	3	3	2	1	-	1	1	1	1	1	1	1	3	2
Avg.	**3**	**3**	**2.4**	**1.4**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**	2

25BECE7E**	**PROFESSIONAL ELECTIVE-VI**	**SEMESTER VII 3H-3C**
Instruction Hours/Week: L:3 T:0 P:0	**Marks: Internal:40 External:60 Total:100**	
	End Semester Exam: 3 Hours	

25BECE7E**	**PROFESSIONAL ELECTIVE-VII**	**SEMESTER VII 3H-3C**
Instruction Hours/Week: L:3 T:0 P:0	**Marks: Internal:40 External:60 Total:100**	
		End Semester Exam: 3 Hours

25BECE791	MINI PROJECT – II/ DESIGN PROJECT	SEMESTER VII 8H-4C
Instruction Hours/Week: L:0 T:0 P:8	Marks: Internal:80 External: 120 Total:200	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students to:

- To train the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks.
- To develop skills in facing and solving field problems.

COURSE OUTCOMES:

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

CO1	Compile the intricacies of textbook knowledge in fieldwork.	K5
CO2	Develop and estimate new techniques using textbook and field concepts	K5

STRATEGY

The students individually undertake training in reputed civil engineering companies for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

TOTAL: 30

CO-PO MAPPING

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	2	-	1	1	2	3	2	2	1
CO2	3	3	3	2	1	2	-	1	1	2	3	2	2	1
Avg.	**3**	**3**	**3**	**2**	**1**	**2**	-	**1**	**1**	**2**	**3**	**2**	**2**	**1**

25BECE891	PROJECT WORK	SEMESTER VIII 16H-8C
Instruction Hours/Week: L:0 T:0 P:16	Marks: Internal:120 External: 180 Total:300	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students to:

- To train the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks.
- To develop skills in facing and solving field problems.

COURSE OUTCOMES:

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

CO1	Compile the intricacies of textbook knowledge in fieldwork.	K5
CO2	Develop and estimate new techniques using textbook and field concepts	K5

STRATEGY

The students individually undertake training in reputed civil engineering companies for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

TOTAL: 30

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	2	-	1	1	2	3	2	2	1
CO2	3	3	3	2	1	2	-	1	1	2	3	2	2	1
Avg.	**3**	**3**	**3**	**2**	**1**	**2**	-	**1**	**1**	**2**	**3**	**2**	**2**	**1**

PROFFESIONAL ELECTIVES

25BECE4E01	ELECTIVE I: AIRPORTS AND SEAPORTS ENGINEERING	SEMESTER IV 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand the concept of master planning of a modern airport
- To plan and design of key airside facilities, terminal building and landside works
- To provide inputs on the overview of port infrastructures and the design considerations and functional requirements of typical structures.

COURSE OUTCOME:

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

CO1	Illustrate the master plan and development of modern commercial airports as per laid down codes and regulations	K2
CO2	Understand various infrastructure elements on landside, Terminal building, Navigational to support the operations of airports	K2
CO3	Design the runways, taxiways, aprons, ducts; preconstruction works of airports	K3
CO4	Explain the procedures of construction, maintenance and rehabilitation of airport pavements	K2
CO5	Interpret the design considerations, operations and components of ports	K2

UNIT I INTRODUCTION AND TYPICAL MASTER PLANNING PROCESS OF A COMMERCIAL AIRPORT BIM

Introduction-key features of a modern airport, Important Codes and aviation regulation organizations, Infrastructure in the Country, Need for Growth Requirements- Passenger Demand Capacity, New Airport envisaged for the Next 10 years.

Phases: Airport Master Plan Process, ICAO: Outline of Master Planning process, Configuration of Runways, Topographical Survey of various airside elements/facilities, Layout plans, Functions of Terminal building, Data, Size, position and number of Arrival and Departure gates, MEP and HVAC Systems.

UNIT II PLANNING OF LANDSIDE WORKS AND AIRSIDE WORKS

Air Traffic Control Tower, Departure/Arrival Forecourt and approach roads, Drainage Planning, Multi-Level/Surface car parking/Waiting areas, arboriculture, Water harvesting cum storage/distribution, Fuel storage and supply, Renewable Energy, Data for Orientation and Design of Runway, Design of Taxiways, Aprons and drainage system.

UNIT III NAVIGATIONAL AIDS AND PRE-CONSTRUCTION WORKS

Navigational and Meteorological Aids, Ducts and Runway/Approach Lighting Systems, Runway Marking, Earthmoving Plants, Dumpers and Compaction Equipment, Tower Cranes and Hoists, Procurement and phase-wise deployment of key resources and setting up of Site Infrastructure

UNIT IV CONSTRUCTION, DISTRESS EVALUATION OF AIRPORT PAVEMENTS

Construction: rigid pavement, Execution & Estimation of Other Layers of Flexible and Rigid Pavements, Airport Layout and Grading Plan, Types of Layers and Gradients etc., Typical Failures of Flexible and Rigid Pavements, Maintenance, Strengthening and Rehabilitation of pavements.

UNIT V OVERVIEW OF PORTS AND HARBORS

Introduction and Evolution of Ports and Harbours, Overview of Marine structures, Operation and components of Ports, Navigation Aids, Site Investigation and Survey, Design considerations and Functional requirements of typical structures.

TOTAL: 30+15

WEBSITE:

	E-resources
1	L&T EduTech LMS

Project		
S.No	**Project objectives***	**Project outcomes***
1.	The construction of an airport with a runway suitable for both passenger and cargo flights whose characteristics meet ICAO recommendations.	Identify the runway orientation by analyzing the wind data.
		Calculate the runway length.

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	1	2	1	2	-	2	1	1
CO2	2	1	-	-	-	2	1	2	1	2	-	2	1	1
CO3	3	2	1	-	-	2	1	2	1	2	-	2	1	1
CO4	2	1	-	-	-	2	1	2	1	2	-	2	1	1
CO5	2	1	-	-	-	2	1	2	1	2	-	2	1	1
Avg.	2.2	1.2	1	-	-	2	1	2	1	2	-	2	1	1

25BECE4E02	ELECTIVE I: ENVIRONMENTAL SOIL POLLUTION	SEMESTER IV 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3 Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To impart foundational knowledge on the physical and chemical properties of soils.
- To develop a thorough understanding of inorganic and organic geochemical processes.
- To equip students with the ability to analyze contaminant fate and transport mechanisms in soil.

COURSE OUTCOME:

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

CO1	Interpret the process of soil formation, its composition, and the structural arrangement of soil particles.	K2
CO2	Explain the sources and types of metal contamination in soils and their geochemical distribution	K2
CO3	Identify microbial transformations and biological degradation of contaminants in soils.	K3
CO4	Summarize the significance of ground improvement techniques in environmental and waste containment applications.	K2
CO5	Outline advanced chemical remediation strategies including oxidation-reduction and bio-augmentation techniques.	K2

UNIT I PHYSICS AND CHEMISTRY OF SOIL 9

Soil formation - Composition -Soil fabric -Mass-volume relationship - Index properties and soil classification -Hydraulic and consolidation characteristics - Chemical properties - Surface charge and point of zero charge - Anion and Cation exchange capacity of clays - Specific surface area -Bonding in clays- Soil pollution- Factors governing soil-pollutant interaction.

UNIT II INORGANIC AND ORGANIC GEOCHEMISTRY 9

Inorganic geochemistry - Metal contamination - Distribution of metals in soils - Geochemical processes - Chemical analysis of metal in soil - Organic geochemistry - Organic contamination – Distribution and Process controlling of NAPLs in soils - Chemical analysis of NAPLs in soils.

UNIT III CONTAMINANT FATE AND TRANSPORTING SOIL 9

Transport processes -Advection -Diffusion -Dispersion -Chemical mass transfer processes - Sorption and desorption -Precipitation and dissolution -Oxidation and reduction - Acid base reaction - Complexation -Ion exchange -Volatilization -Hydrolysis -Biological process microbial transformation of heavy metals.

UNIT IV GROUND IMPROVEMENT TECHNIQUES IN WASTE MANAGEMENT 9

Role of Ground Improvement-Drainage and Ground Water Lowering-Electro osmotic Methods Diaphragm walls-Thermal and Freezing methods – In situ Densification - Deep Compaction - Dynamic Compaction -Blasting - Sand piles and pre-loading -Stone Columns and lime piles- Earth reinforcement - Rock bolts Cables and guniting – Geo textiles as reinforcement Filtration - Drainage and Erosion control.

UNIT V SOIL REMEDIATION TECHNOLOGIES 9

Contaminated site characterization - Containment - Soil vapour extraction - Soil washing - Solidification and Stabilization - Electro-kinetic remediation - Thermal desorption -Vitrification - Bioremediation - Phytoremediation - Soil fracturing –Bio stimulation – Bio augmentation - Chemical oxidation and reduction.

TOTAL: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Calvin Rose	An Introduction to the Environmental Physics of Soil, Water and Water Sheds	Cambridge University Press	2004
2	Paul Nathanail C. and Paul Bardos R	Reclamation of Contaminated Land	John Wiley & Sons Limited	2004

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Hari D. Sharma and Krishna R. Reddy	Geo-Environmental Engineering: Site Remediation, Water Contaminant and Emerging Water Management Technologies	John Wiley & Sons Limited	2004
2	William J. Deutsch	Groundwater Geochemistry: Fundamentals and Applications to Contamination	Lewis Publishers	2010

WEBSITES:

1	https://www.iberdrola.com/sustainability/soil-pollution-causes-effects-solutions
2	https://www.unep.org/resources/report/global-assessment-soil-pollution

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	-	-	-	1	1	-	-
CO2	2	1	-	-	-	2	-	-	-	-	1	1	-	-
CO3	3	2	1	-	-	2	-	-	-	-	1	1	-	-
CO4	2	1	-	-	-	2	-	-	-	-	1	1	-	-
CO5	2	1	-	-	-	2	-	-	-	-	1	1	-	-
Avg.	**2.2**	**1.2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	1	1	**-**	**-**

25BECE4E03	ELECTIVE I: EARTH REINFORCEMENT	SEMESTER IV 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand of the concept of master planning of a modern airport
- To plan and design of key airside facilities, terminal building and landside works
- To provide inputs on the overview of port infrastructures and the design considerations and functional requirements of typical structures.

COURSE OUTCOME:

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

CO1	Infer the basics, components, and benefits of reinforced earth construction.	K2
CO2	Outline various infrastructure elements on landside, Terminal building, Navigational to support the operations of airports	K2
CO3	Summarize the methods, advantages, and design aspects of soil nailing techniques in comparison with reinforced soil.	K2
CO4	Explain the functions of geosynthetics in road and slope application	K2
CO5	Interpret the use of geosynthetics in filters, drains, and landfills, including design criteria and environmental guidelines.	K2

UNIT I BASICS OF REINFORCED EARTH CONSTRUCTION 9

Historical Background - Components, Mechanism of earth reinforcement - Advantages and Disadvantages reinforced earth Construction - Sandwich technique for clayey soil- Requirements, testing &evaluation of reinforcements.

UNIT II DESIGN OF REINFORCED EARTH RETAINING WALLS 9

Design of Reinforced earth retaining wall - Internal and external stability - Selection of materials - Typical problems - Modes of failure of foundation - Determination of force induced in reinforcement ties – Location of surface, tension failure and pull out resistance- Bearing capacity improvement in soft soils.

UNIT III SOIL NAILING TECHNIQUES 9

Introduction, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, -construction sequence components of system, design aspects.

UNIT IV GEOSYNTHETICS FOR ROADS AND SLOPES 9

Roads - Applications to Temporary and Permanent roads - Role of Geo synthetic in enhancing properties of road -Control of mud pumping - Enhancing properties of subgrade - Design requirements Slopes - Causes for slope failure - Improvement of slope stability with Geo synthetic - Drainage requirements - Construction technique - Simple Numerical Stability Checking Problems on Reinforced Slopes.

UNIT V GEOSYNTHETICS - FILTER, DRAIN AND LAND FILLS 9

Filter and Drain - Conventional granular filter design criteria, Design criteria of Geo synthetic and filter – Soil retention – Geo synthetic permeability, anti clogging, survivability and durability - Landfills - Typical design of Landfills - Landfill liner and cover - EPA Guidelines - Barrier walls for existing landfills and abandoned dumps.

TOTAL: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Koerner. R.M	Design with Geo synthetics	Prince Hall Publications	2017
2	Koerner. R.M &Wesh, J. P	Construction and Geotechnical Engineering using synthetic fabrics	Wiley Inter Science, New York	2005

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Swami Saran	Reinforced Soil and its Engineering Applications (3rd Edition)	I.K. International Publishing House	2017
2	Jie Han	Principles and Practice of Ground Improvement (1st Edition)	Wiley Publishers	2015

WEBSITES:

1	https://onlinecourses.nptel.ac.in/noc24_ce09/preview
2	https://www.geopier.com/resources

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	-	-	-	1	1	1	-
CO2	2	1	-	-	-	2	-	-	-	-	1	1	1	-
CO3	2	1	-	-	-	2	-	-	-	-	1	1	1	-
CO4	2	1	-	-	-	2	-	-	-	-	1	1	1	-
CO5	2	1	-	-	-	2	-	-	-	-	1	1	1	-
Avg.	2	1	-	-	-	**2**	-	-	-	-	1	1	1	-

25BECE4E04	ELECTIVE I: AIR AND NOISE POLLUTION AND ITS CONTROL	SEMESTER IV 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To provide a comprehensive understanding of the structure and composition of the atmosphere.
- To develop competency in controlling gaseous emissions.
- To gain knowledge on vehicular emissions, noise pollution, indoor air quality, and landfill pollution control.

COURSE OUTCOME:

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

CO1	Interpret ambient air quality and emission standards as well as air pollution indices.	K2
CO2	Identify various sampling methods and techniques for monitoring air pollutants.	K3
CO3	Explain gas-particle interaction mechanisms in pollution control systems.	K2
CO4	Outline the design and working principles of absorption, adsorption, and biofiltration systems	K2
CO5	Explain emission control technologies for vehicles and standards for noise levels.	K2

UNIT I INTRODUCTION 9

Structure and composition of Atmosphere – Sources and classification of air pollutants Effects of air pollutants on human health, vegetation & animals, Materials & Structures – Effects of air Pollutants on the atmosphere, Soil & Water bodies – Long- term effects on the planet – Global Climate Change, Ozone Holes – Ambient Air Quality and Emission Standards – Air Pollution Indices – Emission Inventories.

UNIT II AIR POLLUTION MONITORING AND MODELLING 9

Ambient and Stack Sampling and Analysis of Particulate and Gaseous Pollutants – Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Transport & Dispersion of Air Pollutants – Modeling Techniques – Air Pollution Climatology.

UNIT III CONTROL OF PARTICULATE CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Gas Particle Interaction, – Working principle, Design and performance equations of Gravity Separators, cyclones, Fabric filters, Particulate Scrubbers, Electrostatic Precipitators – Operational Considerations - Process Control and Monitoring – Costing of APC equipment – Case studies for stationary and mobile sources.

UNIT IV CONTROL OF GASEOUS CONTAMINANTS 9

Factors affecting Selection of Control Equipment – Working principle, Design and performance equations of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Biofilters – Process control and Monitoring - Operational Considerations - Costing of APC Equipment – Case studies for stationary and mobile sources.

UNIT V AUTOMOBILE AND NOISE POLLUTION 9

Vehicular Pollution: Automobile emission- Types of emissions- Exhaust emissions, evaporative emissions, crank-case emissions- Prevention and control of vehicular pollution. Noise Pollution:

Sources and Effects of Noise Pollution – Measurement – Standards –Control and Preventive measures. Sources types and control of indoor air pollutants, sick building syndrome types – Radon Pollution and its control- Typical design of Landfills - Landfill liner and cover - EPA Guidelines - Barrier walls for existing landfills and abandoned dumps.

TOTAL: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Khitoliya R K	Environmental Pollution	S. Chand Publishing	2012
2	Kuo-Tsai Liou, Chia-Hung Chen	Air Pollution Control and Sustainable Development	MDPI	2024

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	EduGorilla	Air and Noise Pollution Control	EduGorilla Publication	2024
2	Mukesh Khare, Prateek Sharma, Sri Harsha Kota, Sumanth Chinthala	Air Pollution: Science, Engineering and Management Fundamentals	CRC Press	2023

WEBSITES:

1	https://onlinecourses.nptel.ac.in/noc23_ce14/preview
2	https://training.rheglobal.com/courses/95/introduction-to-environmental-noise-online

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	-	-	-	1	1	-	-
CO2	3	2	1	-	-	2	-	-	-	-	1	1	-	-
CO3	2	1	-	-	-	2	-	-	-	-	1	1	-	-
CO4	2	1	-	-	-	2	-	-	-	-	1	1	-	-
CO5	2	1	-	-	-	2	-	-	-	-	1	1	-	-
Avg.	**2.2**	**1.2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	1	1	**-**	**-**

25BECE5E01	ELECTIVE II: DESIGN AND EXECUTION OF PILE FOUNDATION	SEMESTER V 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVE:

The goal of this course is for the students:

- To Introduce the concept of Piling works and design requirements for a pile
- To elaborate the construction procedures which are involved in different pile foundations
- To explain the different load test which need to be conducted on the piles.
- To understand the Environmental, Health and Safety standards which need to be in place for the handling of the pile works
- To elaborate on the bill of quantities of various Pile foundations

COURSE OUTCOME:

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

CO1	Comprehend Basic design concepts, of pile foundations	K2
CO2	Compute capacity of piles and select suitable type of pile foundation based on soil conditions	K4
CO3	Apply different construction procedures of pile foundation.	K3
CO4	Design and execute different load testing on piles	K3
CO5	Compute bill of quantities for pile foundations	K4

UNIT I INTRODUCTION TO PILES, DESIGN AND CONSTRUCTION OF BORED CAST INSITU PILES AND DRIVEN CAST INSITU PILES

Overview of Pile foundations, Selection Criteria, Common Design considerations, General Terminologies and Indian standard codes. Materials and Equipment, Construction procedures, workmanship, Vertical and Lateral Capacity calculations, Load tests, Case Studies of Bored cast insitu piles and Driven cast insitu piles.

UNIT II INTRODUCTION, DESIGN AND CONSTRUCTION OF PRECAST DRIVEN AND UNDER REAMED PILES

Materials and Equipment, Construction procedures, workmanship, Vertical and Lateral Capacity calculations, Load tests, Case Studies of precast driven piles, precast driven piles in pre-bored holes and under reamed piles

UNIT III GROUPING AND SETTLEMENT OF PILES AND TESTING

Introduction to Grouping and Settlement of piles, Pile Group efficiency and Spacing, Capacity of Pile group, Settlement of Pile group, Case studies Introduction & Types of testing on piles and General requirements for testing, Pile Integrity tests - introduction & Equipment Types of Pile Integrity test, Data Recording & Interpretation of results, Introduction to quality assurance of piles, General requirement.

UNIT IV QUALITY CONTROL AND SPECIAL TYPES OF PILES

Quality Control of BCIS, DCIS piles, Quality records and checklists. Materials, Equipment, manufacturing procedure, Design and installation, suitability and application and failure modes of spun piles and helical piles

UNIT V SOFTWARE AND BILL OF QUANTITIES, CONSTRUCTION CHALLENGES

Introduction to Bill of quantities for Bored cast insitu, Driven Cast insitu, Precast driven and Precast driven piles in pre-bored holes and undreamed piles. Challenges in bored and driven piles, Introduction to types of piling software, Software demonstrations (e.g., PLAXIS) and step-by-step design techniques for deep foundations. Modelling in Plaxis 3D.

TOTAL: 30+15

REFERENCE BOOKS:

1.	IS 2911- Indian standard code driven cast insitu, bored cast insitu, Driven precast piles
2.	IS 14593-Indian standard code for bored cast insitu piles founded on rocks - Guidelines
E-RESOURCES	
1.	E-learning content on L&T EduTech Platform

SOFTWARE		
S.No	**Software Taught**	**Versions available(Student/Paid/Free)**
1.	Plaxis 3D	Student Version

PROJECT		
S.No	**Project objectives***	**Project outcomes***
	The learner will be asked to	**The learner will be able to**
1	Estimate the capacity of pile foundation from the given input data on the soil profile and other related parameters	Estimate lateral, uplift and vertical capacity of piles and determine the suitability of the pile for a particular soil
2	Estimate Bill of quantities for a given pile foundation	Estimate the bill of quantities for different pile foundations

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	3	1	2	1	2	-	1	2	2
CO2	3	3	2	1	-	3	1	2	1	2	-	1	2	2
CO3	3	2	1	-	-	3	1	2	1	2	-	1	2	2
CO4	3	2	1	-	-	3	1	2	1	2	-	1	2	2
CO5	3	3	2	1	-	3	1	2	1	2	-	1	2	2
Avg.	2.8	2.2	1.5	1	-	3	1	2	1	2	-	1	2	2

25BECE5E02	ELECTIVE II: ENVIRONMENTAL GEOTECHNOLOGY	SEMESTER IV 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand the fundamentals and scope of geo environmental engineering.
- To learn the principles of design and evaluation of waste containment systems.
- To acquire knowledge of advanced soil characterization techniques and modern site evaluation tools.

COURSE OUTCOME:

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

CO1	Explain the multiphase behavior of soil and its role in environmental applications.	K2
CO2	Infer the forces acting between soil particles and their effect on contaminant transport	K2
CO3	Identify the environmental criteria for site selection using EIA	K3
CO4	Outline the functions of leachate and gas collection systems	K2
CO5	Interpret the role of geotechnical centrifuge modeling in environmental studies	K2

UNIT I FUNDAMENTALS OF GEO ENVIRONMENTAL ENGINEERING 9

Scope of geo environmental engineering - Multiphase behavior of soil -Role of soil in geo environmental applications - Environmental Interactions-Sources and type of ground contamination - Impact of ground contamination on geo environment - case histories.

UNIT II SOIL-WATER-CONTAMINANT INTERACTION 9

Soil mineralogy characterization - Soil-water interaction - Forces of interaction between soil particles - Concepts of unsaturated soil -Importance of unsaturated soil in geo environmental problems - Measurement of soil suction - Water retention curves -Ground waterflow – Sources of ground water contaminants - Contaminants transport.

UNIT III WASTE CONTAINMENT SYSTEM 9

Evolution of waste containment facilities and disposal - Site selection based on environmental impact assessment - Different role of soil in waste containment -Different components of waste containment system and its stability issues - Property evaluation for checking soil suitability - Design of waste containment facilities.

UNIT IV LINES AND COVERS FOR WASTE DISPOSAL 9

Rigid and flexible liners - Leachate and gas collection system- Engineered land fills (including basal liner and cover liner systems) - components – design criteria. Hydrological design for ground water pollution control. Soil contamination and remediation technology.

UNIT V ADVANCED SOIL CHARACTERIZATION 9

Contaminant analysis - Water content and permeability measurements -Electrical and thermal property evaluation -Use of GPR for site evaluation - Introduction to geotechnical centrifuge modeling.

TOTAL: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Robert W. Sarsby	Environmental Geotechnics	ICE Publishing	2013
2	Robert W. Sarsby	Environmental Geotechnics in Practice: Introduction and Case Studies	ICE Publishing	2019

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Lakshmi N. Reddi, Hilary I. Inyang	Geo environmental Engineering: Principles and Applications	CRC Press	2000
2	D.E. Daniel	Geotechnical Practice for Waste Disposal	Chapman & Hall	1993

WEBSITES:

1	https://archive.nptel.ac.in/courses/105/101/105101196/
2	https://alison.com/course/introduction-to-environmental-geomechanics

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	-	-	-	1	1	-	-
CO2	2	1	-	-	-	2	-	-	-	-	1	1	-	-
CO3	3	2	1	-	-	2	-	-	-	-	1	1	-	-
CO4	2	1	-	-	-	2	-	-	-	-	1	1	-	-
CO5	2	1	-	-	-	2	-	-	-	-	1	1	-	-
Avg.	**2.2**	**1.2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	1	1	**-**	**-**

25BECE5E03	ELECTIVE II: TRANSPORT OF WATER AND WASTE WATER	SEMESTER IV 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3 Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand the fundamentals of fluid properties and flow measurement in hydraulic systems.
- To plan, design, and operate of water transmission and distribution systems
- To explore the application of software tools in the design and analysis of water and sewer systems.

COURSE OUTCOME:

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

CO1	Explain the principles of continuity, energy, and momentum in fluid flow.	K2
CO2	Outline the need and components for water transport and distribution systems.	K2
CO3	Interpret design principles of sanitary sewers and pumping stations.	K2
CO4	Summarize stormwater runoff using rational method and hydrologic principles.	K2
CO5	Illustrate optimized water distribution and sewerage designs using software applications	K2

UNIT I GENERAL HYDRAULICS AND FLOW MEASUREMENT 9

Fluid properties; fluid flow – continuity principle, energy principle and momentum principle; frictional head loss in free and pressure flow, minor heads losses, Carrying Capacity–Flow measurement.

UNIT II WATER TRANSMISSION AND DISTRIBUTION 9

Need for Transport of water and wastewater-Planning of Water System –Selection of pipe materials, Water transmission main design- gravity and pumping main; Selection of Pumps-characteristics-economics; Specials, Jointing, laying and maintenance, water hammer analysis; water distribution pipe networks Design, analysis and optimization – appurtenances – corrosion prevention – minimization of water losses – leak detection Storage reservoirs.

UNIT III WASTEWATER COLLECTION AND CONVEYANCE 9

Planning factors – Design of sanitary sewer; partial flow in sewers, economics of sewer design; Wastewater pumps and pumping stations- sewer appurtenances; material, construction, inspection and maintenance of sewers; Design of sewer outfalls-mixing conditions; conveyance of corrosive wastewaters.

UNIT IV STORM WATER DRAINAGE 9

Necessity- - combined and separate system; Estimation of storm water run-off Formulation of rainfall intensity duration and frequency relationships- Rational methods.

UNIT V CASE STUDIES AND SOFTWARE APPLICATIONS 9

Use of computer software in water transmission, water distribution and sewer design –EPANET 2.0, LOOP version 4.0, SEWER, BRANCH, Canal ++ and GIS based software's.

TOTAL: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Mohammad Karamouz, Ali Moridi, Sara Nazif	Water and Wastewater Engineering: Hydraulics, Hydrology and Management	Wiley	2021
2	Mackenzie L. Davis	Water and Wastewater Engineering: Design Principles and Practice	McGraw-Hill Education	2010

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	George Tchobanoglous, H. David Stensel, Ryujiro Tsuchihashi	Wastewater Engineering: Treatment and Resource Recovery	McGraw-Hill Education	2013
2	Nazih K. Shammas, Lawrence K. Wang	Fair, Geyer, and Okun's Water and Wastewater Engineering: Water Supply and Wastewater Removal	Wiley	2010

WEBSITES:

1	https://ocw.mit.edu/courses/1-85-water-and-wastewater-treatment-engineering-spring-2006/pages/lecture-notes/
2	https://www.expertnotes.in/courses/transport-of-water-and-wastewater-by-er-parveen-kumar/

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	-	-	-	-	1	1	-	-
CO2	2	1	-	-	-	1	-	-	-	-	1	1	-	-
CO3	2	1	-	-	-	1	-	-	-	-	1	1	-	-
CO4	2	1	-	-	-	1	-	-	-	-	1	1	-	-
CO5	2	1	-	-	-	1	-	-	-	-	1	1	-	-
Avg.	2	1	-	-	-	1	-	-	-	-	1	1	-	-

25BECE5E04	ELECTIVE II: BUILDING CONSTRUCTION PRACTICE	SEMESTER V 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3 Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To introduce various building materials and their properties, applications, and suitability in construction
- To impart knowledge on foundation types, soil investigation methods, and masonry construction techniques.
- To provide insights into superstructure construction methods of complex structural systems.

COURSE OUTCOME:

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

CO1	Identify the types, properties, and applications of various natural and manufactured building materials	K3
CO2	Explain the functions, types, and quality aspects of foundations and brick/stone masonry	K2
CO3	Illustrate the sequence of construction activities from site clearance to final finishes	K2
CO4	Compare different types of piles, caissons, cofferdams, and well foundations	K2
CO5	Interpret superstructure methods including launching, special formwork, and in-situ pre-stressing	K2

UNIT I BUILDING MATERIALS 9

Stone as building material; Requirement of good building stones, dressing of stones, Deterioration and Preservation of stone work. Bricks, Cement Concrete blocks, Stabilized Mud Blocks, Mortar: types and requirements. Timber as construction material, Fine aggregate: Natural and manufactured, Coarse aggregate: Natural and manufactured.

UNIT II FOUNDATION AND MASONRY 9

Preliminary investigation of soil, safe bearing capacity of soil, Function and requirements of good foundation, types of foundation. Masonry: Definition and terms used in masonry. Brick masonry, characteristics and requirements of good brick masonry. Requirements of good stone masonry, Classification, characteristics of different stone masonry, Joints in stone masonry. Types of walls.

UNIT III CONSTRUCTION PRACTICES 9

Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork – masonry – stone masonry – Bond in masonry – concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements –Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick — weather and water proof – roof finishes – acoustic and fire protection.

UNIT IV SUB STRUCTURE CONSTRUCTION 9

Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunneling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation.

UNIT V SUPER STRUCTURE CONSTRUCTION 9

Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks.

TOTAL: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Mohammad Karamouz, Ali Moridi, Sara Nazif	Water and Wastewater Engineering: Hydraulics, Hydrology and Management	Wiley	2021
2	Mackenzie L. Davis	Water and Wastewater Engineering: Design Principles and Practice	McGraw-Hill Education	2010

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	George Tchobanoglous, H. David Stensel, Ryujiro Tsuchihashi	Wastewater Engineering: Treatment and Resource Recovery	McGraw-Hill Education	2013
2	Nazih K. Shammas, Lawrence K. Wang	Fair, Geyer, and Okun's Water and Wastewater Engineering: Water Supply and Wastewater Removal	Wiley	2010

WEBSITES:

1	https://ocw.mit.edu/courses/1-85-water-and-wastewater-treatment-engineering-spring-2006/pages/lecture-notes/
2	https://www.expertnotes.in/courses/transport-of-water-and-wastewater-by-er-parveen-kumar/

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	2	-	-	-	-	1	1	-	-
CO2	2	1	-	-	-	2	-	-	-	-	1	1	-	-
CO3	2	1	-	-	-	2	-	-	-	-	1	1	-	-
CO4	2	1	-	-	-	2	-	-	-	-	1	1	-	-
CO5	2	1	-	-	-	2	-	-	-	-	1	1	-	-
Avg.	**2.2**	**1.2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	1	1	**-**	**-**

25BECE6E01	ELECTIVE III: METROS RAIL TRANSPORTATION SYSTEM AND CONSTRUCTION	SEMESTER VI 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To elaborate on the salient features and types of Transit oriented development and its significance
- To explain the planning, design and execution of elevated and underground Metro viaducts, tunnels including monitoring systems and stations
- To explain the design Earth retaining structures used in Metro systems
- To explain the different pre-excavation and tunnel support systems

COURSE OUTCOME:

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

CO1	Create the basic layout of elevated and underground metro stations as per laid down codes and regulations	K6
CO2	Interpret design recommendations and Codes of Practice for Elevated and Underground Metros and select suitable construction practices	K2
CO3	Design the earth retaining systems for the excavations of underground stations	K3
CO4	Select suitable pre-excavation and tunnel support systems for different ground conditions	K4
CO5	Comprehend the tunnel instrumentation and monitoring systems	K2

UNIT I INTRODUCTION TO MASS RAPID TRANSIT SYSTEM (MRTS, PLANNING OF METROS AND SITE INVESTIGATION)

Overview of Metro- Transit Oriented Development, Feasibility Study for MRTS Project, Sustainable and Smart Technologies-Recent Advancements & Future Technologies (High Speed Rail Technology, 'Maglev & Ground Effect Trains etc.). Basic Interfacing Principles – Alignment, Urban level planning, constraints and restrictions, Sub surface investigations, Sampling techniques, Laboratory testing of Rocks and soils.

UNIT II ELEVATED METRO STATIONS AND VIADUCTS

Introduction to Contracts, Overview of FIDIC standards, Introduction to Quality Systems, Pre-casting Yard Development, Types of Precast Super Structure, Precast Mould development, Formwork System Overview, introduction to Precast Erection, Superstructure launching Methods, Obligatory Spans, substructure and foundation Construction Methodology, Challenges in Foundation Construction.

Alignment / Span configuration of elevated structures, Soil condition and type of foundations, Substructure system, choosing type of Pier based on alignment profile, Rail / Over Head Equipment mast, Station overall layout, Pier arm - spine wing / cantilever and Platform- precast/cast-in-situ system. Erection methods and case studies

Overview of Elevated station, Analysis and Design, Spine beam method, Design of station components, Loads and introduction to IRC/IRS Codes, 'Analysis and Design of superstructure, Substructure and foundation

UNIT III PRE-EXCAVATION SUPPORT SYSTEMS, TUNNEL SUPPORT SYSTEMS AND EARTH RETAINING SYSTEMS

Need for pre-excavation supports, fore poling, face supports, grouting, Rock bolts, Rock anchors, Shotcrete, Rib reinforced shotcrete, Lattice girder and steel arches, Selection of tunnel supports, Applicability of temporary and Permanent retaining systems, Sheet piles, soldier piles, secant piles and contiguous piles and Diaphragm walls, Establishing design situation, design life and geotechnical categorisation, Determination of ground water pressure and surcharges.

UNIT IV UNDERGROUND METRO STATIONS AND TUNNELS

Underground Stations and its configurations, Shoring Systems, supporting systems, Construction Methodology (Bottom-Up method/ Top-Down method), Tunnelling methods- NATM, NMT, Drill and Blast, cut and cover Earth retaining structures, Secant pile wall design, Guide walls, Introduction to Loads, Load combinations, Fire resistant criteria and Floatation check, SOD restrictions & Element sizing for UG Stations, Design of all the components of UG station.

UNIT V TUNNEL INSTRUMENTATION AND MONITORING SYSTEMS AND MEP IN METROS

Purpose of instrumentation and monitoring, Geotechnical monitoring systems for underground structures, Load, stress and water pressure monitoring, Deformation monitoring, trigger limits and instrumentation monitoring plans, MEP systems- HVAC, Tunnel ventilation, Fire protection and fire alarm systems.

TOTAL: 30+15

BOOKS:

REFERENCE BOOKS:	
1	Indian Standard code- IS 456, Guidance on embedded retaining wall design CIRIA- C760
2	David Chapman, Nicole Metje, Alfred Stark ” Introduction to Tunnel Construction “2017 , CRC Press
3	M. Ramachandran ,” Metro Rail Projects in India- A Study in Project Planning “2011, Oxford University Press
E-RESOURCES	
1	L&T EduTech LMS

SOFTWARE		
S.No	**Software Taught**	**Versions available(Student/Paid/Free)**
1	STAAD.Pro	Student version
2	Wallap	Paid version

PROJECT		
S.No	**Project objectives***	**Project outcomes***
	The learner will be asked to	**The learner will be able to**

1	Create a basic layout of elevated and underground metro station using the given data.	Interpret the given data and understand the requirements of the elevated and underground metro station and create with a basic layout
2	Create a flowchart for design and analysis of diaphragm walls using the available data. Write the input data required for analysis in software by calculating the parameters wherever necessary using the given data.	Create a flowchart depicting the step-by-step procedure of design and analysis of diaphragm wall using software including the input parameters using the given data for a

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	1	2	1	2	-	1	2	2
CO2	2	1	-	-	-	3	1	2	1	2	-	1	2	2
CO3	3	2	1	-	-	3	1	2	1	2	-	1	2	2
CO4	3	3	2	1	-	3	1	2	1	2	-	1	2	2
CO5	2	1	-	-	-	3	1	2	1	2	-	1	2	2
Avg.	2.6	2	2	2	2	3	1	2	1	2	-	1	2	2

25BECE6E02	ELECTIVE III: CONSTRUCTION PROJECT PLANNING AND SYSTEMS	SEMESTERVI 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand project planning, scheduling, and resource management.
- To impart knowledge on project monitoring methods, delays, and corrective actions.
- To learn the quality control, safety, and environmental practices in construction.

COURSE OUTCOME:

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

CO1	Explain project planning stages, stakeholder roles, and use of WBS and productivity analysis	K2
CO2	Construct CPM and PERT networks with float values and critical paths	K3
CO3	Interpret the significance of contract management and site organization in construction	K2
CO4	Outline the supervision, progress, updates, overruns, corrections, Lean Construction, and BIM.	K2
CO5	Summarize quality control, inspection methods, accident causes, safety programs, and environmental measures in construction.	K2

UNIT I PROJECT PLANNING SYSTEMS 9

Definition of Projects; Stages of project planning: pre-tender planning, pre- construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data.

UNIT II PLANNING TECHNIQUES 9

Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three-time estimates, analysis, slack computations, calculation of probability of completion. Allocation of Resources- materials, equipment, staff, labour and finance; resource levelling and optimal schedules; Project organisation, documentation and reporting systems.

UNIT III CONTRACTS MANAGEMENT 9

Importance of Contracts Management; Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling.

UNIT IV PROJECT MONITORING 9

Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management.

UNIT V QUALITY CONTROL 9

Concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

TOTAL: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Jha, Kumar Neeraj	Construction Project management, Theory & Practice	Pearson Education India	2015
2	Varghese P.C.	Building Construction	Prentice Hall India	2007

REFERENCE BOOKS:

1. National Building Code, Bureau of Indian Standards, New Delhi,2017.

2. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill,2011

3. Nunnally, S.W. Construction Methods and Management, Prentice Hall,2006

4. Punmia B.C., Khandelwal, K. K., Project Planning with PERT and CPM, Laxmi Publications, 2016

WEBSITES:

1	https://www.nibs.org/
2	https://www.cmaanet.org/

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	-	-	-	1	2	1	1
CO2	3	2	1	-	-	2	-	-	-	-	1	2	1	1
CO3	2	1	-	-	-	2	-	-	-	-	1	2	1	1
CO4	2	1	-	-	-	2	-	-	-	-	1	2	1	1
CO5	2	1	-	-	-	2	-	-	-	-	1	2	1	1
Avg.	**2.2**	**1.2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	1	**2**	1	1

25BECE6E03	ELECTIVE III: SUSTAINABLE CONSTRUCTION METHODS	SEMESTERVI 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand various conventional and modular construction methods.
- To explore innovative and sustainable materials and technologies in construction.
- To impart knowledge on LEED standards in green construction practices through case studies.

COURSE OUTCOME:

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

CO1	Compare different foundations and construction methods used in conventional building systems.	K2
CO2	Infer the principles of modular and precast construction techniques.	K2
CO3	Outline advanced sustainable materials and technologies used in modern construction.	K2
CO4	Explain the concepts of sustainable development and environmental ethics in construction	K2
CO5	Interpret the LEED rating system by its application through successful green building case studies.	K2

UNIT I TYPES OF FOUNDATIONS AND CONSTRUCTION METHODS 9

Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with block work walls).

UNIT II MODULAR CONSTRUCTION METHODS 9

Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.

UNIT III CUTTING EDGE OF SUSTAINABLE CONSTRUCTION 9

Identification of cutting-edge sustainable construction materials, technologies, and project management strategies for use in the construction industry and evaluation of their potential to reduce the negative environmental impacts of construction activity.

UNIT IV SUSTAINABILITY IN BUILT ENVIRONMENT 9

The fundamental concepts of sustainable development in the built environment; the environmental - resources issues and industrial - construction metabolism with examples. Environmental ethics and environmental justice; ecological - environmental economics including Life Cycle Costing; building assessment (frameworks) and ecolabels. Energy systems, energy, entropy, energy conservation and renewable energy; Life Cycle Assessment, embodied energy, energy, and materials.

UNIT V LEED CONSTRUCTION MANAGEMENT 9

Examination of the current LEED for New Construction rating system, and case studyanalysis of highly successful recent "green construction projects" through student team assignments and presentations. Preparation for the LEED Green Associate professional licensing exam.

TOTAL: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Charles J. Kibert	Sustainable Construction: Green Building Design and Delivery	John Wiley & Sons	2022
2	Charles J. Kibert	Working Toward Sustainability: Ethical Decision Making in a Technological World	John Wiley & Sons	2011

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Charles Nehme	Sustainable Building Practices: From Green Materials to Energy Efficiency	Independently Published	2024
2	Charles Nehme	Building Green: A Comprehensive Guide to Sustainable Construction	Independently Published	2023

WEBSITES:

1	https://www.coursera.org/learn/sustainable-construction-management
2	https://onlinecourses.nptel.ac.in/noc19_ce40/preview

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	2	-	-	1	-	3	2	2	-
CO2	2	1	-	-	-	2	-	-	1	-	3	2	2	-
CO3	3	2	1	-	-	2	-	-	1	-	3	2	2	-
CO4	2	1	-	-	-	2	-	-	1	-	3	2	2	-
CO5	3	2	1	-	-	2	-	-	1	-	3	2	2	-
Avg.	**2.6**	**1.6**	**1**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**3**	**2**	**2**	**-**

25BECE6E04	ELECTIVE III: ADVANCED STRUCTURAL ANALYSIS	SEMESTERVI 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand statically and kinematically indeterminate structures using classical methods.
- To reinforce the fundamental concepts of structural analysis, including equilibrium, compatibility, and energy methods.
- To get knowledge on matrix concepts and their application in structural analysis.

COURSE OUTCOME:

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

CO1	Make use of principles of equilibrium, compatibility, and virtual work to solve determinate structures	K3
CO2	Implement force and displacement methods for analyzing indeterminate structures	K3
CO3	Solve structural problems using matrix operations and eigenvalue analysis	K3
CO4	Calculate stiffness and flexibility matrices to analyze axial and truss systems	K3
CO5	Demonstrate the effect of axial forces on stability and carry out second-order analysis of beam-columns.	K3

UNIT I REVIEW OF BASIC CONCEPTS IN STRUCTURAL ANALYSIS 9

Review topics on Structural Analysis and Linear Algebra. structure; loads; (equilibrium, compatibility, force-displacement relations); levels of analysis; analysis of statically determinate structures; applications of principle of virtual work and displacement- based and force-based energy principles; deriving stiffness and flexibility coefficients.

UNIT II REVIEW OF ANALYSIS OF INDETERMINATE STRUCTURES 9

Force methods: Statically indeterminate structures (method of consistent deformations; theorem of least work). Displacement Methods: Kinematically indeterminate structures (slope- deflection method; moment distribution method).

UNIT III MATRIX CONCEPTS AND MATRIX ANALYSIS OF STRUCTURES 9

Matrix; vector; basic matrix operations; rank; solution of linear simultaneous equations; Eigen values and Eigen vectors. Introduction; coordinate systems; displacement and force transformation matrices; Contra- gradient principle; element and structure stiffness matrices; Element and structure flexibility matrices; equivalent joint loads; stiffness and flexibility approaches.

UNIT IV MATRIX ANALYSIS OF STRUCTURES WITH AXIAL ELEMENTS 9

Introduction: Axial stiffness and flexibility; stiffness matrices for an axial element, plane truss element and space truss element; One-dimensional axial structures: Analysis by conventional stiffness method (two DOF per element) and reduced element stiffness method (single DOF);Analysis by flexibility method; Plane trusses: Analysis by conventional stiffness method (four DOF per element) and reduced element stiffness method (single DOF);Analysis by flexibility method; Space trusses: Analysis by conventional stiffness method (six DOF per element) and reduced element stiffness method (single DOF).

UNIT V ANALYSIS OF ELASTIC INSTABILITY & SECOND-ORDER EFFECTS 9

Effects of axial force on flexural stiffness: Review of buckling of ideal columns; flexural behaviour and stiffness measures for beam-columns - braced and un braced, under axial compression; Solution by slope deflection method: Slope deflection equations for prismatic beam columns using stability functions; modifications for pinned and guided-fixed- end conditions; fixed end moments in beam-columns; Solution by matrix method: Stiffness matrix for prismatic beam column element; estimation of critical elastic buckling loads; second-order analysis.

TOTAL: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Punmia.B.C.	Theory of Structures	Laxmi Publications	2014
2	Vaidyanathan, R. and Perumal, P.	Comprehensive structural Analysis – Vol.I &II	Laxmi Publications	2010

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Devdas Menon	Advanced Structural Analysis	Naros Publishing House	2009
2	Amin Ghali, Adam M Neville and Tom G Brown	Structural Analysis: A Unified Classical and Matrix Approach	Chapman & Hall	2007

WEBSITES:

1	https://www.researchgate.net/publication/292539849_review_of_basics_in_structural_analysis
2	https://www.colorado.edu/ceae/sites/default/files/attached-files/Review-Fe-Exam-Structures-Saouma.pdf

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	2	-	-	-	-	1	2	2	-
CO2	3	2	1	-	-	2	-	-	-	-	1	2	2	-
CO3	3	2	1	-	-	2	-	-	-	-	1	2	2	-
CO4	3	2	1	-	-	2	-	-	-	-	1	2	2	-
CO5	3	2	1	-	-	2	-	-	-	-	1	2	2	-
Avg.	**3**	**2**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**-**

25BECE6E05	ELECTIVE IV: CONSTRUCTION TECHNIQUES AND MANAGEMENT	SEMESTERVI 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand foundation and masonry construction practices.
- To introduce the materials used for the floors and roof in construction site.
- To summarize networking concepts of CPM and PERT.

COURSE OUTCOME:

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

CO1	Outline the features of foundation and masonry in construction.	K2
CO2	Compare the various methods and materials used in construction of floors and roof.	K2
CO3	Interpret the different types of shoring and Temporary shed	K2
CO4	Explain a basic ability to plan the various resources in the construction projects with respect to time.	K2
CO5	Utilize the CPM & PERT network analysis method in construction management	K3

UNIT I FOUNDATION 9

Introduction of substructure – Types of foundations – shallow foundation – Wall footing – Isolated footing – Combined footing – Strap footing – Mat foundation – Deep foundation – Pile foundation – Well foundation.

UNIT II MASONRY 9

Introduction of superstructure – Masonry – Types of masonry – Brick masonry – Materials used for brick masonry – Type of bond in brick masonry – Stone Masonry – Materials used for stone masonry – Type of stone masonry.

UNIT III FLOORS AND ROOFS 9

Flooring – Factors affecting the choice of flooring material – Classification of flooring – Roofs – Requirements of roof – Classification roofs.

UNIT IV TEMPORARY WORKS AND CONSTRUCTION EQUIPMENTS 9

Shoring – Types of shoring – Scaffolding – Underpinning – Needs for underpinning – Methods of underpinning – Temporary shed – Materials used for construction of temporary shed – Equipments used for construction of a residential building.

UNIT V CONSTRUCTION MANAGEMENT 9

Construction Planning – Resource Planning – Planning for materials, machines, men and organization – Network planning methods – CPM and PERT, Calculate the duration of construction of a residential building.

TOTAL HOURS:45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Varghese, P.C	Building Construction	Prentice Hall India	2018
2	Kumar Neeraj Jha, Dilip A Patel, Amarjit Singh	Construction Safety Management	Laxmi Publications Pvt. Ltd.,	2022

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Jha, Kumar Neeraj	Construction Project management	CRC Publishers Taylor & Francis Group	2020
2	Punmia, B.C., Khandelwal, K.K.,	Project Planning with PERT and CPM	Laxmi Publications	2016

WEBSITES:

1	https://nptel.ac.in/courses/construction_management_and_safety

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	-	-	-	-	2	1	1	-
CO2	2	1	-	-	-	1	-	-	-	-	2	1	1	-
CO4	2	1	-	-	-	1	-	-	-	-	2	1	1	-
CO5	2	1	-	-	-	1	-	-	-	-	2	1	1	-
CO3	3	2	1	-	-	1	1	-	-	-	2	1	1	-
Avg.	**2.2**	**1.2**	**1**	-	**-**	**1**	**1**	**-**	-	**-**	**2**	**1**	**1**	**-**

25BECE6E06	ELECTIVE IV: SOLID WASTE MANAGEMENT	SEMESTER VI 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	**Marks:** Internal:**40** External:**60** Total:**100**	
	End Semester Exam: 3Hours	

COURSE OBJECTIVE:

The goal of this course is for the students:

- To understand the impact of Sources and types of solid wastes.
- To gain the knowledge of source reduction, waste storage and recycling.
- To know the collection and transfer of wastes.

COURSE OUTCOME:

CO1	Outline the characteristics and the regulatory requirements regarding municipal solid waste management.	K2
CO2	Explain the reduction, reuse and recycling of solid waste.	K2
CO3	Summarize the systems for storage, collection, transport, processing and disposal of municipal solid waste.	K2
CO4	Apply knowledge on the issues on solid waste management from an integrated and holistic perspective, as well as in the local and international context	K3
CO5	Interpret the operation of sanitary landfill	K2

UNIT I SOURCES AND CHARACTERISTICS 9

Sources and types of municipal solid wastes- Public health and environmental impacts of improper disposal of solid wastes- sampling and characterization of wastes - factors affecting waste generation rate and characteristics - Elements of integrated solid waste management –- Role of public and NGOs- Public Private participation – Elements of Municipal Solid Waste Management Plan.

UNIT II SOURCE REDUCTION, WASTE STORAGE AND RECYCLING 9

Waste Management Hierarchy - Reduction, Reuse and Recycling - source reduction of waste – On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – case studies under Indian conditions – Recycling of Plastics and Construction/Demolition wastes.

UNIT III COLLECTION AND TRANSFER OF WASTES 9

Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection routes – Analysis of waste collection systems; Transfer stations –location, operation and maintenance; options under Indian conditions – Field problems- solving.

UNIT IV PROCESSING OF WASTES 9

Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and bio methanation; Thermal processing options – case studies under Indian conditions.

UNIT V WASTE DISPOSAL 9

Land disposal of solid waste- Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor – Dumpsite Rehabilitation**.**

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	William A. Worrell, P. Aarne Vesilind	Solid Waste Engineering	Cengage Learning	2018
2	John Pitchel	Waste Management Practices-Municipal, Hazardous and industrial	CRC Press	2014

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	CPHEEO	Manual on Municipal Solid waste management	CRC Publishers Taylor & Francis Group	2014
2	S. Bhatia	Solid And Hazardous Waste Management	Handbook of Solid waste management, McGraw Hill	2023

WEBSITES:

1	https://nptel.ac.in/courses/solid_waste_management

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	1	-	-	-	2	1	1	-
CO2	2	1	-	-	-	2	1	-	-	-	2	1	1	-
CO3	2	1	-	-	-	2	1	-	-	-	2	1	1	-
CO4	3	2	1	-	-	2	1	-	-	-	2	1	1	-
CO5	2	1	-	-	-	2	1	-	-	-	2	1	1	-
Avg.	2.2	1.2	1	-	-	2	1	-	-	-	2	**1**	1	-

25BECE6E07	ELECTIVE IV: DESIGN OF CONCRETE STRUCTURES-I	SEMESTER VI 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	**Marks:** Internal**:40** External**:60** Total**:100**	
	End Semester Exam: 3Hours	

COURSE OBJECTIVE:

The goal of this course is for the students:

- To impart knowledge on the behavior of RC members under shear, bond, and torsion.
- To develop the design of reinforced concrete elements according to IS codal provisions.
- To apply serviceability criteria including deflection and cracking limits in the design of reinforced concrete structures.

COURSE OUTCOME:

CO1	Interpret the plain and reinforced concrete elements using design philosophies and IS code provisions.	K2
CO2	Analyze shear strength, bond, and development length as per IS code guidelines	K4
CO3	Design singly and doubly reinforced beams, including T-beams and torsional reinforcement.	K4
CO4	Apply IS code procedures to design and detail one-way and cantilever slabs	K3
CO5	Solve two-way slabs and check for deflection and cracking using IS code provisions	K3

UNIT I INTRODUCTION- PLAIN AND REINFORCED CONCRETE 9

Properties of concrete and reinforcing steel-Objectives of design-Different design philosophies-Working Stress and Limit State method of design-Introduction to BIS code- Types of limit states characteristic and design values-partial safety factors-types of loads and their factors. Limit State of Collapse in Bending - assumptions-stress-strain relationship of steel and concrete- analysis of singly reinforced rectangular beams balanced-under reinforced-over reinforced sections-moment of resistance codal provisions.

UNIT II LIMIT STATE OF COLLAPSE IN SHEAR AND BOND 9

Shear stresses in beams types of reinforcement-shear strength of RC beam-IS code recommendations for shear design-design of shear reinforcement examples Bond and development length - anchorage for reinforcement bars - code recommendations regarding curtailment of reinforcement.

UNIT III DESIGN OF SINGLY REINFORCED BEAMS 9

Basic rules for design- design example of simply supported beam- design of cantilever beam detailing Analysis and design of doubly reinforced beams – detailing, T-beams- terminology- analysis of T beams- examples - Design for torsion-IS code approach- examples.

UNIT IV DESIGN OF SLABS 9

Introduction- one-way and two-way action of slabs - load distribution in a slab- IS recommendations for design of slabs- design of one-way slab- cantilever slab- numerical problems – concepts of detailing of continuous slab –code coefficients.

UNIT V TWO- WAY SLABS 9

Simply supported and restrained slabs – design using IS Code coefficients Reinforcement detailing Limit State of Serviceability- limit state of deflection- short term and long-term deflection-IS code recommendations- limit state of cracking- estimation of crack width- simple numerical examples**.**

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Pillai S.U & Menon D	Reinforced Concrete Design	Tata McGraw	2010
2	Punmia, B. C, Jain A.K and, Jain A.K	RCC Designs	Laxmi Publications Ltd	2015

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Varghese P.C.	Limit State Design of Reinforced Concrete	Prentice Hall of India Pvt Ltd	2008
2	Krishna Raju N	Design of Reinforced Concrete Structures	CBS Publishers and Distributors, New Delhi, Fourth Edition	2016

WEBSITES:

1	www.nptel.ac.in/courses/105105104/pdf/m2l3.pdf

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	-	-	-	-	2	1	1	-
CO2	3	3	2	1	-	1	-	-	-	-	2	1	1	-
CO3	3	3	2	1	-	1	-	-	-	-	2	1	1	-
CO4	3	2	1	-	-	1	-	-	-	-	2	1	1	-
CO5	3	2	1	-	-	1	-	-	-	-	2	1	1	-
Avg.	2.8	2.2	1.2	1	-	**1**	-	-	-	-	2	**1**	1	-

25BECE6E08	ELECTIVE IV: CONTRACTS MANAGEMENT	SEMESTER VI 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	**Marks:** Internal**:40** External**:60** Total**:100**	
	End Semester Exam: 3Hours	

COURSE OBJECTIVE:

The goal of this course is for the students:

- To introduce the fundamentals of contract management, including its importance, types, and key stakeholders.
- To provide an understanding of contract administration across different contract scenarios.
- To familiarize students with bidding processes, tender evaluation, risk management.

COURSE OUTCOME:

CO1	Infer the importance, types, and processes of contract management.	K2
CO2	Explain contract parameters like delays, penalties, and dispute resolution.	K2
CO3	Summarize contract administration and legal aspects in various contract types	K2
CO4	Interpret the bid process and tender evaluation components	K2
CO5	Outline the risk, change, and performance management in contract closure	K2

UNIT I CONTRACT MANAGEMENT 9

Introduction, Importance of Contracts, Overview of Contract Management, Overview of Activities in Contract Management; Planning and People- Resource Management; Types of Contracts, Parties to a Contract; Contract Formation, Formulation of Contract, Contract Start- Up,Managing Relationships; Common contract clauses.

UNIT II CONTRACT PARAMETERS 9

Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Notices under contracts; Conventional and Alternative Dispute Resolution methods.

UNIT III VARIOUS ACTS GOVERNING CONTRACTS 9

Contract Administration and Payments- Contract Administration, Payments; Contract Management in Various Situations- Contract Management in NCB Works, Contract Management in ICB Works Contracts, Contract of Supply of Goods- Design, Supply and Installation Contracts, Contract Management in Consultancy.

UNIT IV BID PROCESS AND BID EVALUATION 9

Bid process, important points in a tender document, and unbalanced contracts. Material covered includes: Request For Proposal and problems Different types of proposals Design Conditions and Standard Component List-Tender document - Unbalanced proposals. Exercises: Evaluating Unit Prices Premium Portion Of The Overtime Rate Handling Bid Questions.

UNIT V MANAGING RISKS AND CHANGE 9

Managing Risks, Managing Change; Contract Closure and Review- Ending a Contract, Post-Implementation Review; Legal Aspects in Contract Management- Contract Management Legal View, Dispute Resolution, Integrity in Contract Management; Managing Performance- Introduction, Monitoring and Measurement**.**

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	R. K. Rajput	Engineering Materials	S. Chand & Company Ltd.	2008
2	M. S. Shetty	Concrete Technology (Theory and Practice)	S. Chand & Company Ltd.	2014

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Varghese, P.C.	Building Construction	Prentice Hall India	2014
2	-	National Building Code	Bureau of Indian Standards	2017

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	1	-	-	-	2	1	1	-
CO2	2	1	-	-	-	2	1	-	-	-	2	1	1	-
CO3	2	1	-	-	-	2	1	-	-	-	2	1	1	-
CO4	2	1	-	-	-	2	1	-	-	-	2	1	1	-
CO5	2	1	-	-	-	2	1	-	-	-	2	1	1	-
Avg.	2	1	-	-	-	2	1	-	-	-	2	**1**	1	-

25BECE6E09	ELECTIVE V: GROUND IMPROVEMENT TECHNIQUES	SEMESTER VI 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	**Marks:** Internal**:40** External**:60** Total**:100**	
	End Semester Exam: 3Hours	

COURSE OBJECTIVE:

The goal of this course is for the students:

- To classify the ground improvement by various modifications.
- To infer the basic concept/design aspects of various ground improvement methods
- To assess the installation methods of stone columns, lime piles and soil nailing.
- To impart knowledge on the different application of geosynthetics and soil stabilisation in Ground improvement.

COURSE OUTCOME:

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

CO1	Interpret the role of ground improvement techniques in hydraulic modifications.	K2
CO2	Outline the mechanical modifications for the soil conditions and its effects.	K2
CO3	Explain the functions and methods of installation of stone column and lime piles	K2
CO4	Utilize principles and mechanism of earth reinforcements for improving filtration and drainage in the soil.	K2
CO5	Summarize soil stabilization with cement and lime by using grouting technology in chemical modification.	K2

UNIT I HYDRAULIC MODIFICATIONS 9

Scope and necessity of ground improvement in Geotechnical engineering basic concepts. Drainage – Ground Water lowering by well points, deep wells, vacuum, and electro-osmotic methods. Stabilization by thermal and freezing techniques - Applications.

UNIT II MECHANICAL MODIFICATIONS 9

Insitu compaction of granular and cohesive soils, Shallow and Deep compaction methods – Sand piles – Concept, design, factors influencing compaction. Blasting and dynamic consolidation design and relative merits of various methods – Soil liquefaction mitigation methods.

UNIT III PHYSICAL MODIFICATION 9

Preloading with sand drains, fabric drains, wick drains – theories of sand drain - Stone column with and without encased, limestone – functions – methods of installation – design, estimation of load carrying capacity and settlement. Root piles and soil nailing – methods of installation –Design and Applications.

UNIT IV MODIFICATION BY INCLUSIONS 9

Reinforcement – Principles and basic mechanism of reinforced earth, simple design: Synthetic and natural fiber-based Geotextiles and their applications. Filtration, drainage, separation, erosion control.

UNIT V CHEMICAL MODIFICATION 9

Grouting – Types of grouts – Suspension and solution grouts – Basic requirements of grout. Grouting equipment – injection methods – jet grouting – grout monitoring – Electro – Chemical stabilization – Stabilization with cement, lime - Stabilization of expansive clays.

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Purushothama Raj, P	Ground Improvement Techniques	Tata Mc-Graw-Hill Publishing company, New Delhi	2012
2	Moseley	Ground Improvement	USA and Canada – CRC Press Inc. Florida	2004

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Koemer, R.M	Design with Geosynthetics.	Prentice Hall, New Jersey	2002
2	Khedkar, M.S and Mandal, J	Soil Reinforcement with Geotextiles.	CIRIA- Special Publication, London	2009

WEBSITES:

1	https://archive.nptel.ac.in/courses/105/105/105105210/
2	https://freevideolectures.com/course/3435/ground-improvement-techniques

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	-	-	-	2	1	1	-
CO2	2	1	-	-	-	2	-	-	-	-	2	1	1	-
CO3	2	1	-	-	-	2	-	-	-	-	2	1	1	-
CO4	2	1	-	-	-	2	-	-	-	-	2	1	1	-
CO5	2	1	-	-	-	2	-	-	-	-	2	1	1	-
Avg.	2	1	-	-	-	2	-	-	-	-	2	**1**	1	-

25BECE6E10	ELECTIVE V: IRRIGATION ENGINEERING	SEMESTER VI 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3 Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To introduce students to various components and
- To learn the design of water supply scheme, water treatment methods, water storage distribution system, sewage treatment and disposal
- To get basic idea of deign of intake structures and sewerage system.

COURSE OUTCOME:

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

CO1	Explain the need of irrigation and estimation of evapotranspiration.	K2
CO2	Outline the irrigation methods and its efficiencies.	K2
CO3	Relate different types of impounding and diversion structures.	K2
CO4	Apply canal regulations in designing the prismatic canal and unlined canal.	K3
CO5	Interpret the modernization and optimization of water use in irrigation	K2

UNIT I CROP WATER REQUIREMENT 9

Need and classification of irrigation- historical development and merits and demerits of irrigation-types of crops-crop season-duty, delta and base period- consumptive use of crops- estimation of Evapotranspiration using experimental and theoretical methods.

UNIT II IRRIGATION METHODS 9

Tank irrigation - Well irrigation- Irrigation methods: Surface and Sub-Surface and Micro Irrigation - design of drip and sprinkler irrigation - ridge and furrow irrigation-Irrigation scheduling - Water distribution system- Irrigation efficiencies.

UNIT III DIVERSION AND IMPOUNDING STRUCTURES 9

Types of Impounding structures — Gravity dam — Forces on a dam -Design of Gravity dams; Earth dams, Arch dams- Diversion Head works — Weirs and Barrages.

UNIT IV CANAL IRRIGATION 9

Canal regulations — direct sluice — Canal drop — Cross drainage works-Canal outlets — Design of prismatic canal-canal alignments-Canal lining — Kennedy?s and Lacey? s Regime theory-Design of unlined canal.

UNIT V WATER MANAGEMENT IN IRRIGATION 9

Modernization techniques- Rehabilitation — Optimization of water use-Minimizing water losses- On form development works-Participatory irrigation management- Water resources associations- Changing paradigms in water management-Performance evaluation-Economic aspects of irrigation.

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Dr. B.C.Punmia & B.B.Pande	Irrigation & Water Power Engineering	Laxmi Publications, New Delhi,	2020
2	Modi, P.N	Water Supply Engineering, Vol.I	Standard Book House, New Delhi,	2020

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Dr. K.R.Arora	Irrigation, Water Power & Water Resources Engineering	Laxmi Publications (P) Ltd., New Delhi	2016
2	S.K.Garg	Irrigation Engineering and Hydraulic Structures	Khanna Publishers, New Delhi,	2018

WEBSITES:

1	www.nptel.ac.in/courses/105105110/pdf/m1l01.pdf

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	-	-	-	2	1	1	-
CO2	2	1	-	-	-	2	-	-	-	-	2	1	1	-
CO3	2	1	-	-	-	2	-	-	-	-	2	1	1	-
CO4	2	1	-	-	-	2	-	-	-	-	2	1	1	-
CO5	2	1	-	-	-	2	-	-	-	-	2	1	1	-
Avg.	2	1	-	-	-	2	-	-	-	-	2	1	1	-

25BECE6E11	ELECTIVE V: ADVANCED CONSTRUCTION TECHNIQUES	SEMESTER VI 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To identify the sub-structure and super structure construction.
- To gain knowledge on the erection and construction of special structures.
- To interpret on demolition, rehabilitation and strengthening techniques of structures.

COURSE OUTCOMES:

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

CO1	Interpret various methods and techniques in sub structure construction.	K2
CO2	Relate construction technique for tall buildings and large span buildings.	K2
CO3	Explain the construction techniques of special structures such as lattice tower, chimneys, etc.,	K2
CO4	Outline the strengthening procedures for beams, columns, slabs and walls.	K2
CO5	Summarize on demolition techniques and safety precautions of structures.	K2

UNIT I SUB STRUCTURE CONSTRUCTION 9

Box jacking- Pipe jacking- Under water construction of diaphragm walls and basement - Tunnelling techniques- Piling techniques- Driving well and caisson- sinking cofferdam- cable anchoring and grouting- Driving diaphragm walls, Sheet piles- Laying operations for built up offshore system- Shoring for deep cutting.

UNIT II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS 9

Vacuum dewatering of concrete flooring– Concrete paving technology– Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections– Erection techniques of tall structures, large span structures– launching techniques for heavy decks– in-situ prestressing in high rise structures.

UNIT III CONSTRUCTION OF SPECIAL STRUCTURES 9

Erection of lattice towers- Rigging of transmission line structures– Construction sequence in cooling towers, Silos, chimney, sky scrapers- Bow string bridges, Cable stayed bridges - Launching and pushing of box decks– Construction of jetties and break water structures - Construction sequence and methods in domes.

UNIT IV REHABILITATION AND STRENGTHENING TECHNIQUES 9

Seismic retrofitting- Strengthening of beams- Strengthening of columns- Strengthening of slab - Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation– Micro piling and underpinning for strengthening floor and shallow profile.

UNIT V DEMOLITION 9

Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Sankar S.K. & Saraswati S.	Construction Technology	Oxford University Press, New Delhi	2008
2	Jerry Irvine	Advanced Construction Techniques	CA Rocketr	2010

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Patrick Powers. J	Construction Dewatering: New Methods and Applications	John Wiley & Sons	2006
2	Peter. H. Emmons	Concrete repair and maintenance illustrated	Galgotia Publications	2008

WEBSITES:

1	https://nptel.ac.in/courses/advanced_concrete_techniques

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	-	-	-	2	1	1	-
CO2	2	1	-	-	-	2	-	-	-	-	2	1	1	-
CO3	2	1	-	-	-	2	-	-	-	-	2	1	1	-
CO4	2	1	-	-	-	2	-	-	-	-	2	1	1	-
CO5	2	1	-	-	-	2	-	-	-	-	2	1	1	-
Avg.	2	1	-	-	-	2	-	-	-	-	2	1	1	-

25BECE6E12	ELECTIVE V: DESIGN OF CONCRETE STRUCTURES-II	SEMESTER VI 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	**Marks:** Internal:**40** External:**60** Total:**100**	
	End Semester Exam: 3Hours	

COURSE OBJECTIVE:

The goal of this course is for the students:

- To introduce the behavior and design methods of reinforced concrete columns under axial and eccentric loads.
- To provide an understanding of the structural behavior and design aspects of retaining walls.
- To familiarize students with the IS code-based design of water tanks, circular slabs, and domes.

COURSE OUTCOME:

CO1	Explain the design of short and slender columns using SP16 and IS code	K2
CO2	Interpret the design of isolated and combined footings as per IS code.	K2
CO3	Summarize the design and behavior of cantilever and counterfort retaining walls.	K2
CO4	Outline the IS code-based design of rectangular and circular water tanks	K2
CO5	Describe the design and detailing of circular slabs and domes	K2

UNIT I ANALYSIS AND DESIGN OF SHORT COLUMNS 9

Eccentric loading Columns subjected to compression and uniaxial bending- design using SP16 charts for limit state Columns subjected to combined axial load and biaxial bending moments-code procedure for design- design using SP16 charts for limit state Slender columns- behavior of slender columns-braced and un-braced columns-design procedure- design using SP16 charts for limit state.

UNIT II FOUNDATIONS 9

Classification-IS code provisions for design of isolated footings- design principles of rectangular footings- Design of rectangular footings-uniform thickness and sloped- eccentrically loaded rectangular footing of uniform thickness-detailing. Combined footings (design principles only)- analysis of combined footings rectangular and trapezoidal.

UNIT III RETAINING WALLS 9

Types- Cantilever retaining wall- earth pressure and forces acting-stability- proportioning-structural behavior of components -design example of cantilever retaining wall without surcharge-detailing Counterfort retaining wall- design principles of components and detailing (design not required).

UNIT IV INTRODUCTION TO DESIGN OF WATER TANKS 9

Design philosophy and requirements-joints- IS code recommendations Design of rectangular water tanks using IS code coefficients (IS 3370). Design of circular water tanks using- IS code coefficients (IS 3370).

UNIT V CIRCULAR SLABS 9

Stresses- reinforcements- simply supported, fixed and partially fixed subjected to uniformly distributed loads Design and detailing of spherical and conical domes**.**

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Pillai S.U & Menon D	Reinforced Concrete Design	Tata McGraw	2010
2	Punmia, B. C, Jain A.K and, Jain A.K	RCC Designs	Laxmi Publications Ltd	2015

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Varghese P.C.	Limit State Design of Reinforced Concrete	Prentice Hall of India Pvt Ltd	2008
2	Krishna Raju N	Design of Reinforced Concrete Structures	CBS Publishers and Distributors, New Delhi, Fourth Edition	2016

WEBSITES:

1	www.nptel.ac.in/courses/105105104/pdf/m2l3.pdf

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	-	-	-	2	1	2	-
CO2	2	1	-	-	-	2	-	-	-	-	2	1	2	-
CO3	2	1	-	-	-	2	-	-	-	-	2	1	2	-
CO4	2	1	-	-	-	2	-	-	-	-	2	1	2	-
CO5	2	1	-	-	-	2	-	-	-	-	2	1	2	-
Avg.	2	1	-	-	-	2	-	-	-	-	2	1	2	-

25BECE7E01	ELECTIVE VI: BRIDGE ENGINEERING DESIGN PRACTICES	SEMESTER VII 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External: -60 Total:100	
	End Semester Exam: 3Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To determine the optimal solution of Bridge structure depending on various constraints and input parameters
- To analysis and design of all components of bridges and cross drainage work with detailing
- To illustrate various Erection methods (Segmental, Balanced cantilever and Cable stayed bridges etc.) with case studies in detail

COURSE OUTCOME:

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

CO1	Obtain solution of Bridge structure depending on various constraints and input parameters	K3
CO2	Analyse and Design of RCC composite Girder	K4
CO3	Design of Substructure and Auxiliary components	K5
CO4	Design of different types of foundations for bridges	K5
CO5	Concept of different types of execution methods of Bridges and Inspection, Monitoring & Maintenance of Bridges	K3

UNIT I INTRODUCTION AND CONCEPTUAL DESIGN OF BRIDGES

Introduction to bridges – Types of bridges based on Material, Structural form, Usage, span and support, alignment and decks – Auxiliary components of bridges.

Conceptual design based on planning, design and execution – Functional – Aesthetics – Inventory – different types of surveys – Investigations – Geometrical aspects as per IRC co de.

UNIT II ANALYSIS AND DESIGN OF CONCRETE & PRE-STRESSED CONCRETE

Loads due to Permanent loads – Prestressing loads – Live loads for Highway, Railway and Metro – Seismic – Thermal – Water Currents – Wind Forces – Accidental Loads – Creep & Shrinkage

Structural analysis methods – Hand computed methods – Grillage Analysis – Transverse Analysis – FEM Methods Introduction to IRC Codal provisions – Ultimate and Serviceability Limit State Design – Prestressing systems – Cable profiling – End block design

UNIT III ANALYSIS AND DESIGN OF COMPOSITE SUPER STRUCTURE

Idealization and Grillage Analysis – Load Applications – ULS and SLS design Composite plate girder bridge – Modelling – Design according to IRC– Introduction to Truss and Bow String Truss Bridges.

UNIT IV DESIGN OF SUBSTRUCTURE AND FOUNDATION

Types of Substructures – Cantilever Pier – Portal Pier – Pier Cap – Bearings – Pedestals & Seismic restrainers

Types of Foundation – Geotechnical capacities – Open foundation - Pile foundation – Well foundation.

UNIT V ERECTION METHODS AND INSPECTION, MONITORING & MAINTENANCE OF BRIDGES

Introduction to concept of Execution of Bridges – PSC I girder (Pre-& Post – Tensioned) – Truss Bridge – Balanced Cantilever Bridge – Segmental Bridge – Cable Stayed Bridge Installation of Sensors for Service Stage – Periodic inspection methods – Periodic Maintenance- Replacement of bearings, expansion joints etc.

TOTAL: 30+15

BOOKS:

REFERENCE BOOKS:	
1	Relevant Indian Road Congress (IRC) codes and Ministry of Road Transport & Highway (MORT) Specifications
E-RESOURCES	
1	L&T EduTech LMS

SOFTWARE		
S.No	**Software Required**	**Versions available(Student/Paid/Free)**
1	STAAD.Pro	
2	AutoCAD	

PROJECT		
S.No	**Project objectives***	**Project outcomes***
	The learner will be asked to	**The learner will be able to**
1	Analysis and Design of different componentsof Beam and Slab bridge for various vehicular loading according to IRC codes.	Student will be able to design the superstructure
2	Design of Pier Cap and Pier for highway bridge	Student will be able to design the Sub structure
3	Design of different types of foundations	Student will be able to design the suitable foundation for specific types of bridges.

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	3	1	2	1	2	-	1	2	2
CO2	3	3	2	1	-	3	1	2	1	2	-	1	2	2
CO3	3	3	3	2	1	3	1	2	1	2	-	1	2	2
CO4	3	3	3	2	1	3	1	2	1	2	-	1	2	2
CO5	3	2	1	-	-	3	1	2	1	2	-	1	2	2
Avg.	3	2.6	2	1.6	1	3	1	2	1	2	-	1	2	2

25BECE7E02	ELECTIVE VI: BIOLOGICAL PROCESSES FOR CONTAMINANT REMOVAL	SEMESTER VII 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand microbiological principles and kinetics in biological wastewater treatment.
- To know the design and operation of aerobic treatment systems.
- To gain knowledge of anaerobic processes and biogas production.

COURSE OUTCOMES:

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

CO1	Explain the fundamentals of microbiology and identify the kinetic and stoichiometric coefficients relevant to biological treatment processes	K2
CO2	Compare fixed and suspension culture systems used in aerobic biological treatment.	K2
CO3	Outline the stages, mechanisms, and energetics of anaerobic digestion and biogas production	K2
CO4	Interpret the role of C:N:P ratio in the stability of the activated sludge process.	K2
CO5	Summarize the key control parameters in biological treatment processes.	K2

UNIT I INTRODUCTION 9

Microbiology fundamentals and kinetic and stoichiometric coefficients - Bacterial growth and biological oxidation - Kinetics and stoichiometric of biological growth.

UNIT II AEROBIC BIOLOGICAL TREATMENT 9

Fixed Cultures- Suspension cultures - Suspension cultures - Characteristics of the activated sludge process - Control parameters - Overproduction of sludge and oxygen consumption - Scums -Fixed cultures - percolators and bio discs - Nutrient (N and P) removal.

UNIT III ANAEROBIC BIOLOGICAL TREATMENT 9

Biogas production, collection and use - Mechanism and phases of the anaerobic process Gas production, collection and use - Energetics and stoichiometric of the process - Anaerobic contact process and slurry filter - anaerobic digestion of slurry.

UNIT IV ENERGETICS AND STOICHIOMETRIC 9

Activated sludge process - Balanced diet - C:N:P ratio - Presence of toxic substances -Operational difficulties – swelling - rising sludge.

UNIT V CONTROL PARAMETERS 9

Load – pH – VFAs – Acidity - Alkalinity - Gas quantity – Quality.

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Sunil Kumar & Muhammad Zaffar Hashmi	Biological Approaches to Controlling Pollutants	Elsevier	2021
2	Maulin P. Shah	Modern Approaches in Waste Bioremediation: Environmental Microbiology	Springer	2023

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Márcia Dezotti, Geraldo Lippel, João Paulo Bassin	Advanced Biological Processes for Wastewater Treatment: Emerging, Consolidated Technologies and Introduction to Molecular Techniques	Springer	2017
2	Dr. Banwari Lal	Wealth from Waste: Trends and Technologies	The Energy and Resources Institute (TERI)	2011

WEBSITES:

1	https://www.sciencedirect.com/science/article/pii/S0734975020300677
2	https://pmc.ncbi.nlm.nih.gov/articles/PMC3947798/

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO2	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO3	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO4	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO5	2	1	-	-	-	2	-	-	-	-	-	1	-	-
Avg.	2	1	-	-	-	2	-	-	-	-	-	1	-	-

25BECE7E03	ELECTIVE VI: INSTRUMENTATION AND SENSOR TECHNOLOGIES FOR CIVIL ENGINEERING APPLICATIONS	SEMESTER VII 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand the principles of measurement, sensing, and instrumentation.
- To know the working of transducers for measuring physical quantities.
- To learn sensor data using statistical and signal processing methods.

COURSE OUTCOMES:

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

CO1	Outline the basic principles of measurement systems, sensor types, and their applications in instrumentation.	K2
CO2	Explain the methodology for sensor installation and the planning of monitoring programs.	K2
CO3	Interpret the working principles and classifications of common transducers used for measuring physical quantities.	K2
CO4	Summarize statistical tools and data interpretation techniques used in sensor signal analysis.	K2
CO5	Infer the application of sensors and instruments in real-world scenarios and the significance of the results obtained	K2

UNIT I FUNDAMENTALS OF MEASUREMENT, SENSING AND INSTRUMENTATION 9

Definition of measurement and instrumentation, physical variables, common types of sensors; Describe the function of these sensors; Use appropriate terminology to discuss sensor applications; and qualitatively interpret signals from a known sensor type, types of instrumentation, Sensor Specifics, Permanent installations, Temporary installations.

UNIT II SENSOR INSTALLATION AND OPERATION 9

Predict the response of sensors to various inputs, construct a conceptual instrumentation and monitoring program, describe the order and methodology for sensor installation. Differentiate between types of sensors and their modes of operation and measurement. Approach to Planning Monitoring Programs, Define target, Sensor selection, Sensor siting, Sensor Installation & Configuration, Advanced topic, Sensor design, Measurement uncertainty.

UNIT III TRANSDUCERS 9

Definition and classification - common transducers for measurement of displacement velocity, flow, liquid level, force, pressure, strain and temperature - basic principles and working of LVDT, electromagnetic and ultrasonic flow meters, piezoelectric force transducer, load cell, strain gauge-bridge configuration for four strain gauges, RTD, Thermistors, thermocouple, Need for instrumentation system, data acquisition system.

UNIT IV DATA ANALYSIS AND INTERPRETATION 9

Fundamental statistical concepts- Data reduction and interpretation- Time domain signal processing- Discrete signals, Signals and noise, a few examples of statistical information to calculate are: Average

value (mean), On average, how much each measurement deviates from the mean (standard deviation), Midpoint between the lowest and highest value of the set (median), Most frequently occurring value (mode), Span of values over which your data set occurs (range)..

UNIT V TUTORIALS FROM THE ABOVE MODULES 9

Demonstrating clearly the understanding and use for the sensors and instruments used for the problems posed and inferences drawn from the measurement and observations made along with evaluation report.

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Alan S Morris	Measurement and Instrumentation Principles	Butterworth Heinemann	2001
2	David A. Bell	Electronic Instrumentation and Measurements	Oxford Press	2007

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	S. Tumanski	Principle of Electrical Measurement	Taylor &Francis	2006
2	Ilya Gertsbakh	Measurement Theory for Engineers	Springer	2010

WEBSITES:

1	https://shop.elsevier.com/books/sensor-technologies-for-civil-infrastructures/lynch/978-0-08-102706-6

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO2	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO3	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO4	2	1	-	-	-	2	-	-	-	-	-	1	-	-
CO5	2	1	-	-	-	2	-	-	-	-	-	1	-	-
Avg.	2	1	-	-	-	2	-	-	-	-	-	1	-	-

25BECE7E04	ELECTIVE VI: RURAL WATER SUPPLY AND ONSITE SANITATION SYSTEMS	SEMESTER VII 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand the challenges and management techniques of rural water supply systems.
- To learn low-cost water treatment methods suitable for rural areas.
- To gain knowledge of rural sanitation planning, wastewater treatment, and disposal methods.

COURSE OUTCOMES:

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

CO1	Explain the issues, techniques, and management of rural water supply	K2
CO2	Infer low-cost water treatment methods and their application for removing specific contaminants.	K2
CO3	Outline the planning, treatment, and disposal methods for rural sanitation and wastewater management.	K2
CO4	Interpret occupational hygiene and sanitation requirements in industrial, public, and institutional settings	K2
CO5	Summarize solid waste management practices and their impact on rural health	K2

UNIT I RURAL WATER SUPPLY 9

Issues of rural water supply –Various techniques for rural water supply- merits-National rural drinking water program- rural water quality monitoring and surveillance-operation and maintenance of rural water supplies.

UNIT II LOW-COST WATER TREATMENT 9

Introduction – Epidemiological aspects of water quality methods for low cost water treatment - Specific contaminant removal systems.

UNIT III RURAL SANITATION 9

Introduction to rural sanitation- Community and sanitary latrines - Planning of wastewater collection system in rural areas- Treatment and Disposal of wastewater – Compact and simple wastewater treatment units and systems in rural areas- stabilization ponds - septic tanks - Imhoff tank- soak pits- low cost excreta disposal systems- Effluent disposal.

UNIT IV INDUSTRIAL HYGIENE AND SANITATION 9

Occupational Hazards- Schools- Public Buildings Hospitals- Eating Establishments-Swimming pools – Cleanliness and maintenance and comfort- Industrial plant sanitation.

UNIT V SOLID WASTE MANAGEMENT 9

Disposal of Solid Wastes- Composting- land filling incineration- Biogas plants –Rural health - Other specific issues and problems encountered in rural sanitation.

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Richard Carter	Rural Community Water Supply: Sustainable Services for All	Practical Action Publishing	2021
2	Metcalf & Eddy	Wastewater Engg. Treatment and Reuse	Tata McGraw Hill	2000

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Steve Metcalf	Water and Sanitation for the 21st Century: Health and Microbiological Aspects of Excreta and Wastewater Management	IWA Publishing	2018
2	Igor Shiklomanov (Ed.)	Decentralised Water and Wastewater Systems	IWA Publishing	2020

WEBSITES:

1	https://www.rural-water-supply.net/en/resources
2	https://www.youtube.com/playlist?list=PLEDvAVCQm_e3bc15hdLN_wt3rPmy-JyLc

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	-	-	-	-	1	1	-
CO2	2	1	-	-	-	2	-	-	-	-	-	1	1	-
CO3	2	1	-	-	-	2	-	-	-	-	-	1	1	-
CO4	2	1	-	-	-	2	-	-	-	-	-	1	1	-
CO5	2	1	-	-	-	2	-	-	-	-	-	1	1	-
Avg.	2	1	-	-	-	2	-	-	-	-	-	1	1	-

25BECE7E05	ELECTIVE VII: PREFABRICATED STRUCTURES	SEMESTER VII 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3 Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To get introduced to prefabrication and its types.
- To know the different types of prefabrication systems.
- To learn different structural connections.

COURSE OUTCOMES:

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

CO1	Explain the principles, material and standardization in prefabricated structures	K2
CO2	Interpret the components and behaviour of panels.	K2
CO3	Develop efficient designs of joint flexibility and deformation	K3
CO4	Construct dimension and detailing design of expansion joints.	K3
CO5	Analyze the abnormal loads and progressive collapse in prefabricated structures	K4

UNIT I INTRODUCTION 9

Need for prefabrication – Principles – Materials – Modular coordination – Standardization – Systems – Production – Transportation – Erection.

UNIT II PREFABRICATED COMPONENTS 9

Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls.

UNIT III DESIGN PRINCIPLES 9

Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

UNIT IV JOINT IN STRUCTURAL MEMBERS 9

Joints for different structural connections – Dimensions and detailing – Design of expansion joints.

UNIT V DESIGN FOR ABNORMAL LOADS 9

Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Praveen Nagarjan	Prestessed concrete design	Pearson Education, New Delhi	2013
2	IS 159166-2010	Building Design and Erection using Prefabricated Concrete - code of practice	New Delhi	2010

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Garold (Gary) Oberlender and Robert Peurifoy	Formwork for Concrete Structures	McGraw Hill	2010
2	Punmia B.C and Jain A.K	"Reinforced concrete structures (Vol.2)	Laxmi Publications	2015

WEBSITES:

1	https://nptel.ac.in/courses/prefabricated_structures

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	1	-	-	-	1	2	2	-
CO2	2	1	-	-	-	2	1	-	-	-	1	2	2	-
CO3	3	2	1	-	-	2	1	-	-	-	1	2	2	-
CO4	3	2	1	-	-	2	1	-	-	-	1	2	2	-
CO5	3	3	2	1	-	2	1	-	-	-	1	2	2	-
Avg.	2.6	1.8	0.8	1	-	2	1	-	-	-	1	2	2	-

25BECE7E06	ELECTIVE VII: ENVIRONMENTAL IMPACT ASSESSMENT	SEMESTER VII 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3 Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To expose the students to the need, methodology, documentation and usefulness of environmental impact assessment.
- To understand the remediation techniques and development of predictive models.
- To develop the EIA models and life cycle assessment.

COURSE OUTCOME:

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

CO1	Explain the impacts and risks that will be caused by projects or industries and the methods to overcome these impacts.	K2
CO2	Infer the methodologies used for measuring the environmental impacts	K2
CO3	Explain the principles, problems and strategies in environmental management	K2
CO4	Interpret the system approach in regional environmental management system	K2
CO5	Summarize the current and future role of LCA in product stewardship	K2

UNIT I ENVIRONMENTAL IMPACT ASSESSMENT (EIA) 9

Introduction, definitions and concepts, rationale and historical development of EIA, EIA for civil engineers. road components of EIA: Initial environmental examination, environmental impact statement, environmental appraisal, environmental impact factors and areas of consideration. Pertinent institutional information, unique pollution problems, existing visual quality, public participation techniques.

UNIT II METHODOLOGIES 9

Measurement of environmental impact, organization, scope and methodologies of EIA pertinent environmental factors. Six generic steps, descriptive checklists, simple interaction matrix, stepped matrix, uniqueness ratio, habitat evaluation system. Public involvement techniques, comprehensive environmental impact study, various project types, archaeological properties, leachate testing, evaluation species, proposing agency, EIA Models. Status of EIA in India: EIA Regulations in India.

UNIT III ENVIRONMENTAL MANAGEMENT 9

Principles, problems and strategies; Review of political, ecological and remedial actions. Future strategies; multidisciplinary environmental strategies, the human, planning, decision- making and management dimensions. Environmental audit: Definitions and concepts, partial audit, compliance audit, methodologies and regulations.

UNIT IV EMS AND STANDARDIZATION 9

Introduction to ISO and ISO 14000.EMAS regulations, wider application of system-based approach. Local infrastructure development and environmental management: A system approach, Regional environmental management system, Conversion plan development and implementation strategies, Environmental management systems in local government.

UNIT V LCA 9

Life cycle assessment; Triple bottom line approach; Industrial Ecology. Ecological foot printing, Design for Environment, Future role of LCA, Product stewardship, design, durability and justifiability, measurement techniques and reporting. Carbon trading Energy foot printing, Food foot printing and Carbon foot printing. GHG emissions, global warming, climate change and Carbon credits.

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	L. W. Canter	Environmental Impact Assessment	McGraw-Hill	2012
2	P. Judith and G. Eduljee	Environmental Impact Assessment for Waste Treatment and Disposal Facilities	John Wiley & Sons	2004

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	C. H. Eccleston	Environment Impact Statements	John Wiley & Sons	2008
2	Welford R	Corporate Environmental Management	Universities Press	2009

WEBSITES:

1	https://archive.nptel.ac.in/courses/105/105/105105210/

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	1	-	-	-	2	2	1	-
CO2	2	1	-	-	-	2	1	-	-	-	2	2	1	-
CO3	2	1	-	-	-	2	1	-	-	-	2	2	1	-
CO4	2	1	-	-	-	2	1	-	-	-	2	2	1	-
CO5	2	1	-	-	-	2	1	-	-	-	2	2	1	-
Avg.	2	1	-	-	-	2	1	-	-	-	2	2	1	-

25BECE7E07	ELECTIVE VII: REPAIR AND REHABILITATION OF STRUCTURES	SEMESTER VII 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
		End Semester Exam: 3 Hours

COURSE OBJECTIVES:

The goal of this course is for the students:

- To identify the quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures.
- To assessing damage to structures and various repair techniques
- To Analyse the damage to structures using various tests

COURSE OUTCOMES:

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

CO1	Interpret various maintenance and repair strategies.	K2
CO2	Explain the strength, durability and thermal properties of concrete	K2
CO3	Relate various special concrete such as polymer concrete, FRC, etc.,	K2
CO4	Outline the techniques for techniques for repair and protection methods	K2
CO5	Summarize on repair, rehabilitation and retrofitting of structures.	K2

UNIT I MAINTENANCE AND REPAIR STRATEGIES 9

Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.

UNIT II STRENGTH AND DURABILITY OF CONCRETE 9

Quality assurance for concrete – Strength, Durability and Thermal properties, of concrete – Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion – Effects of cover thickness.

UNIT III SPECIAL CONCRETES 9

Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self-compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

UNIT IV TECHNIQUES FOR REPAIR AND PROTECTION METHODS 9

Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.

UNIT V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES 9

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake – Demolition Techniques – Engineered demolition methods – Case studies.

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Denison Campbell, Allen and Harold Roper	Concrete Structures, Materials, Maintenance and Repair	Longman Scientific and Technical UK	2018
2	Allen R.T. & Edwards S.C	Repair of Concrete Structures	Blakie and Sons	2010

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ravishankar.K., Krishnamoorthy.T.S	Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures	Allied Publishers	2004
2	Peter. H. Emmons	Concrete repair and maintenance illustrated	Galgotia Publications	2008

WEBSITES:

1	https://nptel.ac.in/courses/repair_and_rehabilitation_techniques

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	-	-	-	-	2	2	1	-
CO2	2	1	-	-	-	2	-	-	-	-	2	2	1	-
CO3	2	1	-	-	-	2	-	-	-	-	2	2	1	-
CO4	2	1	-	-	-	2	-	-	-	-	2	2	1	-
CO5	2	1	-	-	-	2	-	-	-	-	2	2	1	-
Avg.	2	1	-	-	-	2	-	-	-	-	2	2	1	-

25BECE7E08	ELECTIVE VII: PRE-STRESSED CONCRETE STRUCTURES	SEMESTER VII 3H-3C
Instruction Hours/Week: L:3 T:0 P:0	Marks: Internal:40 External:60 Total:100	
	End Semester Exam: 3 Hours	

COURSE OBJECTIVES:

The goal of this course is for the students:

- To understand the basic principles, materials, and systems used in prestressed concrete.
- To learn the design of prestressed concrete members using limit state criteria for flexure, shear, and torsion.
- To study the behavior and design of composite and continuous prestressed structures.

COURSE OUTCOMES:

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

CO1	Explain the fundamental concepts, materials, prestressing systems, and analyze stresses	K2
CO2	Apply limit state design principles to design prestressed concrete sections	K3
CO3	Design shear and torsional reinforcement in prestressed concrete members	K4
CO4	Analyze anchorage zone stresses and design reinforcement in post-tensioned members	K4
CO5	Utilize basic principles of indeterminate structures to design composite beams	K3

UNIT I INTRODUCTION 9

Basic concept and principles of pre-stressed concrete, materials, prestressing systems – Analysis of prestress and bending stresses loss of pre-stress Stresses at transfer and service loads.

UNIT II LIMIT STATE DESIGN CRITERIA 9

Inadequacy of elastic and ultimate load method, criteria for limit states, strength and serviceability. Design of sections for flexure codal provisions- ultimate strength in flexure.

UNIT III SHEAR AND TORSIONAL RESISTANCE 9

Design of shear reinforcement, design of reinforcement for torsion, shear and bending. Deflections of prestressed concrete members: Importance, factors, short term and long-term deflection. Codal provisions.

UNIT IV ANCHORAGE ZONE STRESSES IN POST TENSIONED MEMBERS 9

Stress distribution in end block, anchorage zone reinforcement. Prestressed concrete poles and sleepers: Design of sections for compression and bending Partial pre-stressing- Definitions, principles and design approaches and applications.

UNIT V COMPOSITE BEAMS 9

Analysis and design – Ultimate strength – applications, Elementary idea of composite construction for tee beams in bridges. Statically Indeterminate structures: advantages of continuous member (Concepts and steps for analysis).

TOTAL HOURS: 45

TEXT BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	N. Krishna Raju	Prestressed Concrete	Tata McGraw-Hill Education	2012
2	N. Rajagopalan	Prestressed Concrete	Narosa Publishing House	2002

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	M. Nadim Hassoun and Akthem Al-Manaseer	Structural Concrete: Theory and Design	Wiley	2020
2	M.K. Hurst	Prestressed Concrete Design	CRC Press	2019

WEBSITES:

1	https://en.wikipedia.org/wiki/Prestressed_concrete
2	https://www.cement.org/cement-concrete/products/prestressed-concrete

CO-PO MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
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CO2	3	2	1	-	-	2	1	-	1	-	2	2	1	-
CO3	3	3	2	1	-	2	1	-	1	-	2	2	1	-
CO4	3	3	2	1	-	2	1	-	1	-	2	2	1	-
CO5	3	2	1	-	-	2	1	-	1	-	2	2	1	-
Avg.	2.8	2.2	1.2	1	-	2	1	-	1	-	2	2	1	-