



ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

**DEPARTMENT OF CIVIL AND STRUCTURAL
ENGINEERING**

B.E. CIVIL AND STRUCTURAL ENGINEERING

(Full Time)

**(Outcome Based
Education)**

HAND BOOK

2025 Onwards

FACULTY OF ENGINEERING & TECHNOLOGY

Institutional Vision & Mission

VISION

Providing world class quality education with strong ethical values to nurture and develop outstanding professionals fit for globally competitive environment.

MISSION

- Provide quality technical education with a sound footing on basic engineering principles, technical and managerial skills, and innovative research capabilities.
- Transform the students into outstanding professionals and technocrats with strong ethical values capable of creating, developing and managing global engineering enterprises.
- Develop a Global Knowledge Hub, striving continuously in pursuit of excellence in Education, Research, Entrepreneurship and Technological services to the Industry and Society.
- Inculcate the importance and methodology of life-long learning to move forward with updated knowledge to face the challenges of tomorrow.

With the objective and a dynamic vision to support contemporary Engineering, the Faculty of Engineering and Technology (FEAT) was established in the year 1945, as the Second Engineering College of the then composite Madras State. The FEAT proudly celebrated its Golden Jubilee in the year 1996 and Diamond Jubilee in the year 2005. The FEAT has eleven departments of study namely Chemical Engineering, Civil Engineering, Civil & Structural Engineering, Computer Science & Engineering, Electrical Engineering, Electronics and Communication Engineering, Electronics & Instrumentation Engineering, Information Technology, Mechanical Engineering, Manufacturing Engineering and Pharmacy.



ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY
B. E. (Four-Year) Degree Programme (FULL-TIME)
Choice Based Credit System (CBCS)
REGULATIONS 2025

1. Condition for Admission

Candidates for admission to the first year of the four year B.E. Degree programmes shall be required to have passed the final examination of the Higher Secondary Course (Plus 2) with Mathematics, Physics and Chemistry as courses of study and candidates who have passed the Higher Secondary Examination through vocational stream under Engineering, conducted by the Board of Secondary Education, Government of Tamil Nadu or an examination of any other authority accepted by the Syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time.

Candidates who have passed the Diploma programme in Engineering of the State Board of Technical Education, Tamil Nadu will be eligible for admission to the second year of the four year degree programme in B.E. under the lateral entry scheme provided they satisfy other conditions.

2. Branches of Study in B.E.

BRANCH I	-	Civil Engineering
BRANCH II	-	Civil and Structural Engineering
BRANCH III	-	Mechanical Engineering
BRANCH IV	-	Mechanical Engineering (Manufacturing)
BRANCH V	-	Electrical and Electronics Engineering
BRANCH VI	-	Electronics and Instrumentation Engineering
BRANCH VII	-	Chemical Engineering
BRANCH VIII	-	Computer Science and Engineering
BRANCH IX	-	Information Technology
BRANCH X	-	Electronics and Communication Engineering
BRANCH XI	-	Computer Science and Engineering (Artificial Intelligence and Machine Learning)
BRANCH XII	-	Computer Science and Engineering (Data Science)

3. Courses of Study and Scheme of Examinations

The courses of study with respective syllabi and the scheme of Examinations are given separately.

4. Choice Based Credit System (CBCS)

The curriculum includes Humanities, Social Sciences, Management, Basic Sciences, Engineering Sciences, Professional Core, Professional Electives and Open Electives in addition to Seminar & Industrial Training and Project. Each semester curriculum shall normally both theory and practical courses. The total credits for the entire degree Programme is **172 (130 for lateral entry students)**.

5. Eligibility for the Degree

A candidate shall be eligible for the degree of Bachelor of Engineering if the candidate has satisfactorily undergone the prescribed courses of study for a period of four academic years and has passed the prescribed examinations in all the four academic years. For the award of the degree, a student has to earn a minimum of 172 credits (130 for lateral entry students).

He / She should serve in any one of the following Co-curricular activities for at least one year.

- National Cadet Corps (NCC)
- National Service Scheme (NSS)
- National Sports Organization (NSO) and
- Youth Red Cross (YRC)

The students enrolled in any one of the co-curricular activities (NCC / NSS / NSO / YRC) will undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid. While the training activities will normally be during weekends, the camp will normally be during vacation period.

(or)

Enrol as a student member of a recognized professional society such as

- Student Chapters of Institution of Engineers (India)
- Student Chapters of other Professional bodies like ICI, ISA, IChE, IEEE, SAE, ASHRAE, CSI and IWS

5.1 B.E (Honours) Degree

A student shall be eligible to get Under Graduate degree with Honours, if he/she completes an additional 20 credits. Thus the total credits is 192. Out of 192 credits(150 credits for lateral entry students), 20 credits must be earned by studying honours electives offered by his/her branch of study in fifth, sixth and seventh semesters.

5.2 B.E Degree with Minor Engineering

A student shall be eligible to get Under Graduate degree with additional Minor Engineering, if he/she completes an additional 20 credits. Out of the 192 credits (150 credits for lateral entry students), 20 credits must be earned from the courses offered by any other Department in the Faculty of Engineering and Technology in fifth, sixth and seventh semesters.

6. Assignment of Credits for Courses

Each course is normally assigned one credit per hour of lecture/tutorial per week and half credit for one hour for laboratory or practical or drawing course per week.

7. Duration of the Programme

A student is normally expected to complete the B.E. programme in four years but in any case not more than seven years from the time of admission.

8. Registration for Courses

A newly admitted student will automatically be registered for all the courses prescribed for the first and second semesters without any option.

Every other student shall enrol for the courses intended to be credited in the succeeding semester in the current semester itself by completing the registration form indicating the list of courses. This registration will be done a week before the last working day of the current semester.

A student is required to earn 172 (130 for lateral entry students) credits in order to be eligible for obtaining the degree. However the student is entitled to enjoy an option to earn either more or less than the total number of credits prescribed in the curriculum of a particular semester on the following guidelines:

8.1 Slow Learners

The **slow learners** may be allowed to withdraw certain courses with the approval by the Head of the Department and those courses may be completed by them in the fifth year of study and still they are eligible to be awarded with First Class. A student can withdraw a maximum of 2 courses per semester from IV semester to VII semester and take up those courses in the fifth year of study. However, courses withdrawn during odd semesters (V and VII) must be registered in the odd semester of fifth year and courses withdrawn during even semesters (IV and VI) must be registered in the even semester of fifth year.

8.2 Advanced Learners

The advanced learners may be allowed to take up the two professional elective courses of eighth semester in fifth/sixth/seventh semesters through SWAYAM/NPTEL with the approval of the Head of the concerned Department. On successful completion of two courses they are permitted to pursue industrial training/internship/project work in the entire eighth semester period.

9. Project Work

The student typically registers for project at the end of seventh semester and completes it at the end of the eighth semester along with the courses prescribed for study in the eighth semester. However a student who has registered and successfully completed the courses of eighth semester by acquiring additional credits in the earlier semesters can attempt to spend his/her period of study in an industry and complete his/her project work, submit the project report and appear for viva-voce examination at the end of eighth semester.

10. Mandatory Induction Programme

A 3-week long induction programme for the UG students entering the institution, right at the start is proposed. Normal classes start only after the induction programme is over. The following are the activities under the induction programme in which the student would be fully engaged throughout the day for the entire duration of the programme.

- Physical Activity
- Creative Arts
- Imparting Universal Human Values
- Literary Activities
- Conduct of crash courses on soft skills
- Lectures by Eminent People
- Visits to Local Area
- Familiarization to Dept./Branch & Innovative practices

11. Electives

The elective courses fall under two basic categories: Professional Electives and Open Electives.

11.1 Professional Elective Courses

The Professional Elective courses are offered in the concerned branch of specialization and a student can choose the Professional Elective courses with the approval of the Head of the Department concerned.

11.2 Open Elective Courses

Apart from the various professional elective courses, a student must study **three** open elective courses. The student has to study three open elective courses offered by other Departments in the Faculty with the approval of the Head of the concerned Department and the Head of the Department offering the courses or Naan Mudhalvan courses or SWAYAM/NPTEL courses in fifth, sixth and seventh semesters. In case the student opts to study an open elective course offered by other Department in the Faculty, it shall be handled by the faculty of that Department offering the chosen open elective.

11.3 MOOC (SWAYAM) Courses

The student can be permitted to study Massive Open Online Courses (MOOCs) offered through the SWAYAM/NPTEL with the approval of the Head of the Department concerned and the Dean of the Faculty. The courses will be considered as equivalent to professional elective / open elective courses from third to eighth semesters and the credits earned through MOOC courses may be transferred and considered for awarding Degree to the student concerned.

A student who earns 3 or more credits from a 12 week MOOC course through SWAYAM/NPTEL portal (Syndicate Resolution No.:14 dated 10.05.2019) shall be exempted from studying the elective course and permitted to transfer the credits. Besides the student may be permitted to claim for the conversion to the next higher grade in accordance with the Syndicate Resolution No.: 31 dated 09.09.2020

11.4 Value Added Courses

A student can study one or more value added courses being offered by the other Departments of Study either within the Faculty or any other Faculty in the University in any semester of the B.E degree programme except First Year, with the restriction that only one Value added Course can be registered at a time.

11.5 Extra One Credit Courses

One credit courses shall be offered by a Department with the prior approval from the Dean of the Faculty.

For one credit courses, a relevant potential topic may be selected by a committee consisting of the Head of the Department concerned and the Board of Studies member from the Department and a senior faculty member from the Department concerned. An expert from industry familiar with the topic chosen may be accordingly invited to handle classes for the students. The details of the syllabus, time table and the name of the industrial expert may be sent by the above committee to the Dean for approval. The credits earned through the extra one credit courses shall be over and above the total credit requirement prescribed in the curriculum for the award of the degree. Students can take a maximum of two extra one credit courses (one each in VI and VII semesters). They shall be allowed to take extra one credit courses offered in other Departments with the permission of Head of the Department offering the courses. A separate mark sheet shall be issued for extra one credit courses.

11.6 Naan Mudhalvan (Skill Related) Courses

A student may opt to study the courses listed in the Naan Mudhalvan (Skill Related) portal against the

professional elective courses in third and fourth semesters and open elective courses in fifth, sixth and seventh semesters of study as part of acquiring skills in the specified field.

12. Assessment

12.1. Theory Courses

The break-up of Continuous Assessment for the theory courses relates to evaluating the performance under the five Course Outcomes uniformly with 5 Marks for each outcome spread over Two Mid-Semester tests and One Assignment, totalling to 25 Marks. Similarly the break-up mark for University End Semester exams involves evaluating the performance under the five Course Outcomes with 15 Marks for each Outcome, totalling to 75 Marks.

The break-up of continuous assessment and examination marks for theory courses is as follows:

First assessment (Mid-Semester Test-I Covering Units I & II)	: 8 marks
Second assessment (Mid-Semester Test-II Covering Units III, IV & V)	: 12 marks
Third Assessment (Assignment Covering Units I, II, III, IV & V)	: 5 marks
End Semester Examination	: 75 marks

12.2 Practical Courses

The break-up of Continuous Assessment for the practical courses involves evaluating the performance under the five Course Outcomes uniformly with 8 Marks for each outcome spread over Two tests and Record work, totalling to 40 Marks. Similarly the break-up mark for University End Semester exams relates to evaluating the performance under the five Course Outcomes with 12 Marks for each Outcome, totalling to 60 Marks

The break-up of continuous assessment and examination marks for Practical courses is as follows:

First Assessment (Test-I)	: 15 marks
Second Assessment (Test-II)	: 15 marks
Maintenance of Record book	: 10 marks
End Semester Examination	: 60 marks

12.3 Project Work

The continuous assessment marks for the project work will be 40 and to be assessed by a review committee consisting of the project guide and a minimum of two members nominated by the Head of the Department. One of the committee members will be nominated as the Chairman by the Head of the Department. The Head of the Department may be a member or the Chairman. At least two reviews should be conducted during the semester by the review committee. The student shall make presentation on the progress made before the committee. 60 marks are allotted for the project work and viva voce examination at the end of the semester.

12.4 Industrial Internship

After attending the internship during the semester vacation of IV and VI semester for a period of 4 weeks duration in each year, the student has to submit a report and appear for the viva-voce exam along with the V and VII semester end semester examinations.

13. Substitute Assessment

A student, who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the final examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Dean / Head of the Department within a week from the date of the missed assessment.

14. Mentoring & Statutory Support for Students

14.1 Student Counsellors (Mentors)

To help the students in planning their course of study and for general advice on the academic programme, the Dean / Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study. Such student counsellors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the Dean / Head of the Department.

14.2 POSH

Prevention of Sexual Harassment (POSH) Cell is established to ensure a safe and secure working / studying environment for Girls and Women in the University. More information about this cell can be accessed at the following link: https://annamalaiuniversity.ac.in/stud_posh.php

14.3 SC / ST Cell

A separate cell is functioning in the University to safeguard the rights and privileges of the students, belonging to SC/ST category. This cell also informs the students about the various scholarships and fellowships and encourages them to apply relevant ones. More information about this cell can be accessed at the following link: https://annamalaiuniversity.ac.in/stud_eoc_sccell.php

15. Class Committee

For all the branches of study during the first two semesters, a common class committee will be constituted by the Dean of the faculty. From among the various teachers teaching the same common course to different classes during each semester of the first year, the Dean shall appoint one of them as course coordinator.

The composition of the class committee during first and second semesters will be as follows:

- Course coordinators of all courses.
- All the Heads of the Sections, among whom one may be nominated as Chairman by the Dean.
- The Dean may opt to be a member or the Chairman.

For each of the higher semesters, separate class committees will be constituted by the respective Head of the Departments.

The composition of the class committees from third to eighth semester will be as follows:

- Teachers of the individual courses.
- A seminar coordinator (for seventh semester only) shall be appointed by the Head of the Department
- A project coordinator (for eighth semester only) shall be appointed by the Head of the Department from among the project supervisors.
- One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University end semester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory/40 marks for seminar/ industrial training, practical and project work will be finalized for every student and tabulated and submitted to the Head of the Department (to the Dean in the case of I & II Semester) for approval and transmission to the Controller of Examinations.

16. Attendance Requirements

The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

17. Temporary Break of Study

A student is permitted to go on break of study for a maximum period of one year either as two breaks of one semester each or a single break of one year.

If a student wishes to apply for break of study, the student shall apply to the Dean in advance, in any case, not later than the last date of the first assessment period. The application duly filled by the student shall be submitted through the Head of the Department. In the case of short term employment/ training/ internship, the application for break of study shall be approved and forwarded by the Head of the Department concerned to the Dean.

However, the student must complete the entire programme within the maximum period of seven years.

18. Procedure for Withdrawing from the Examinations

A student can withdraw from all the examinations of the semester only once during the entire programme on valid grounds accepted by the University. Such withdrawal from the examinations of a semester will be permitted only if the candidate applies for withdrawal at least 24 hours before the commencement of the last examination. The letter grade 'W' will appear in the mark sheet for such candidates.

19. Passing and Declaration of Examination Results

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the Controller of Examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the Grade Point Average (GPA), Cumulative Grade Point Average (CGPA) and prepare the mark sheets.

90 to 100 marks	:	Grade 'S'
80 to 89 marks	:	Grade 'A'
70 to 79 marks	:	Grade 'B'
60 to 69 marks	:	Grade 'C'
55 to 59 marks	:	Grade 'D'
50 to 54 marks	:	Grade 'E'
Less than 50 marks	:	Grade 'RA'
Withdrawn from the examination	:	Grade 'W'

A student who obtains less than 30 / 24 marks out of 75 / 60 in the theory / practical examinations respectively or is absent for the examination will be awarded grade RA.

A student who earns a grade of S, A, B, C, D or E for a course, is declared to have successfully completed that course. Such a course cannot be repeated by the student.

A student who is detained for lack of attendance must re-register for and repeat the courses in the respective semester.

A student who obtains letter grade RA in the mark sheet must reappear for the examination of the courses except for Honours courses.

A student who obtains letter grade W in the mark sheet must reappear for the examination of the courses.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA - 0

Courses with grade RA / W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-evaluation of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

OGPA/CGPA is similarly calculated considering all the courses taken from the time of admission.

20. Awarding Degree

After successful completion of the programme, the degree will be awarded based on OGPA/CGPA.

The conversion of OGPA/CGPA (from I semester to VIII Semester) to the corresponding Percentage of marks may be calculated as per the following formula:

$$\text{Percentage of marks} = (\text{OGPA (or) CGPA} - 0.25) \times 10$$

$$\text{Where OGPA (or) CGPA} = \frac{\sum C_i GP_i}{\sum C_i}$$

C_i - Credit hours of a course

GP_i - Grade Point of that course

20.1 Honours Degree

The student requires to earn a minimum of 192 credits within four years (150 credits within three years for lateral entry students) from the time of admission, pass all the courses in the first attempt from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students) and obtain a OGPA/CGPA of 8.25 or above to obtain the Honours Degree.

The Student is required to complete 6 elective courses, 2 each in the V, VI and VII semesters with a stipulation that 2 of the 6 courses need to be of 4 credits each, while the remaining 4 has to be of 3 credits each, thus totalling to 20 credits, the choice being approved by the Head of the Department concerned and the Dean of the Faculty.

However, if the student either does not clear the extra course(s) relating to become eligible for the Honours Degree or discontinues it in any of the semesters, then the student may revert to the category of the First Class with Distinction or First class, provided the student is eligible for that respective category. The student may claim for revised mark sheet, paying the stipulated fee in order that the unsuccessful appearance or discontinuity of the course(s) is not reflected in the new mark sheet.

20.2 First Class with Distinction

To obtain B.E Degree First Class with Distinction, a student must earn a minimum of 172 Credits within four years (130 credits within three years for lateral entry students) from the time of admission, by passing all the courses in the first attempt from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students) and obtain a CGPA of 8.25 or above.

20.3 First Class

To obtain B.E Degree First Class, a student must earn a minimum of 172 credits within **five** years (130 credits within **four** years for lateral entry students) from the time of admission and obtain a OGPA/CGPA of 6.75 or above for all the courses from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

20.4 Second Class

For Second Class, the student must earn a minimum of 172 credits within **seven** years (130 credits within **six** years for lateral entry students) from the time of admission.

20.5 B.E Degree with Minor Engineering

The student shall be given an option to earn a Minor Engineering Degree in another discipline of Engineering other than his/her branch of study provided the student clears all the subjects in the first year in the first attempt and secures a OGPA/CGPA of not less than 7.5

The Student is required to complete 6 elective courses, 2 each in the V, VI and VII semesters with a stipulation that 2 of the 6 courses need to be of 4 credits each, while the remaining 4 has to be of 3 credits each, thus totalling to 20 credits, the choice being approved by the Head of the Department concerned and the Dean of the Faculty.

The rules for awarding the B.E degree in First Class with Distinction or in First Class or in Second Class apply in the same manner for B.E Degree with Minor Engineering.

However the student who opts for Honours Degree is not entitled to pursue B.E Degree with Minor Engineering and vice-versa.

21. Ranking of Candidates

The candidates who are eligible to get the B.E. degree with Honours will be ranked together on the basis of OGPA/CGPA for all the courses of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The candidates who are eligible to get the B.E. degree in First Class with Distinction will be ranked next after those with Honours on the basis of OGPA/CGPA for all the courses of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The candidates passing with First Class will be ranked next after those with distinction on the basis of OGPA/CGPA for all the courses of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The ranking of candidates will be done separately for each branch of study.

22. Transitory Regulations

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

Wherever there had been change of syllabi, examinations based on the existing syllabi will be conducted for three consecutive times after implementation of the new syllabi in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent courses, as per the new syllabi, on the recommendations of the Head of the Department concerned.

DETAILS OF COURSE CODE

S. No	Code (3 rd and 4 th Digits)	Details	Code (5 th and 6 th Digits)	Details
1	ET	Common Course for the faculty	HS	Humanities Theory
2	CE	Civil Engg. Course	HP	Humanities Practical
3	CZ	Civil and Structural Engg. course	BS	Basic Science Theory
4	ME	Mechanical Engg. Course	BP	Basic Science Practical
5	MM	Mechanical Engg. (Manufacturing) Course	ES	Engineering Science Theory
6	EE	Electrical and Electronics Engg. Course	SP	Engineering Science Practical
7	EI	Electronics and Instrumentation Engg. course	PC	Professional Core Theory
8	CH	Chemical Engg. course	CP	Professional Core Practical
9	CS	Computer Science and Engg. course	PE	Professional Elective Theory
10	IT	Information Technology course	EP	Professional Elective Practical
11	EC	Electronics and Communication Engg. course	IT	Internship /Industrial Training
12	AI	Computer Science and Engineering (Artificial Intelligence and Machine Learning)	OE	Open Elective Theory
13	DS	Computer Science and Engineering (Data Science)	PV	Project and Viva-voce
14	YY	Code of the Program concerned (S. No 02 to S.No.13)	AC	Audit Course

The first two digits relate to the year from which the Regulations commence

7th digit represents the semester and 8th and 9th digits represent the serial number of courses.

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B.E (Four Year) Degree Program
Choice Based Credit System (CBCS)
REGULATIONS 2025

CURRICULUM FOR GROUP 'A' BRANCHES

(Computer Science and Engineering, Electrical and Electronics, Electronics and Communication, Electronics and Instrumentation, Information Technology, CSE- Data Science, CSE – AI and ML)

SEMESTER I									
Course Code	Category	Course	L	T	P/D	CA	FE	Total	Credits
25ETBS101	BS-I	Physics	3	-	-	25	75	100	3
25ETBS102	BS-II	Mathematics-I	3	1	-	25	75	100	4
25ETHS103	HS-I	Technical English	2	-	-	25	75	100	2
25ETHS104	HS-II	Heritage of Tamils தமிழர் மரபு	1	-	-	25	75	100	1
25ETES105	ES-I	Basic Electrical and Electronics Engineering	2	-	-	25	75	100	2
25ETES106	ES-II	Basic Mechanical Engineering.	3	-	-	25	75	100	3
25ETBP107	BSP-I	Physics lab	-	-	3	40	60	100	1.5
25ETSP108	ESP-I	Design Thinking	1	-	2	40	60	100	2
25ETSP109	ESP-II	Programming for Problem Solving Lab	-	-	3	40	60	100	1.5
25ETAC110	AC	NCC /NSS/YRC/Sports							-
Total Credits									20

SEMESTER II									
Course Code	Category	Course	L	T	P/D	CA	FE	Total	Credits
25ETBS201	BS-III	Chemistry	3	-	-	25	75	100	3
25ETBS202	BS-IV	Mathematics-II	3	1	-	25	75	100	4
25ETHS203	HS-III	Universal Human Values	2	-	-	25	75	100	2
25ETHS204	HS-IV	Tamils and Technology தமிழரும் தொழில்நுட்பமும்	1	-	-	25	75	100	1
25ETES205	ES-III	Basic Civil Engineering	3	-	-	25	75	100	3
25ETES206	ES-IV	Environmental Studies	2	-	-	25	75	100	2
25ETSP207	BSP-II	Chemistry Lab	-	-	3	40	60	100	1.5
25ETHP208	HSP-I	English Communication Lab	-	-	3	40	60	100	1.5
25ETSP209	ESP-III	Electrical Wiring and Earthing Practices Lab	-	-	2	40	60	100	1
25ETSP210	ESP-IV	Engineering Graphics & Design	1	-	4	40	60	100	3
Total Credits									22

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CURRICULUM FOR GROUP 'B' BRANCHES
 (Chemical, Civil, Civil and Structural, Mechanical, Mechanical (Manufacturing))

SEMESTER I									
Course Code	Category	Course	L	T	P/D	CA	FE	Total	Credits
25ETBS101	BS-I	Chemistry	3	-	-	25	75	100	3
25ETBS102	BS-II	Mathematics-I	3	1	-	25	75	100	4
25ETHS103	HS-I	Technical English	2	-	-	25	75	100	2
25ETHS104	HS-II	Heritage of Tamils தமிழர் மரபு	1	-	-	25	75	100	1
25ETES105	ES-I	Basic Electrical and Electronics Engineering	2	-	-	25	75	100	2
25ETES106	ES-II	Basic Mechanical Engg.	3	-	-	25	75	100	3
25ETSP107	BSP-I	Chemistry Lab	-	-	3	40	60	100	1.5
25ETSP108	ESP-I	Design Thinking	1	-	2	40	60	100	2
25ETSP109	ESP-II	Programming for Problem Solving Lab	-	-	3	40	60	100	1.5
25ETAC110	AC	NCC /NSS/YRC/Sports							-
Total Credits									20

SEMESTER II									
Course Code	Category	Course	L	T	P/D	CA	FE	Total	Credits
25ETBS201	BS-III	Physics	3	-	-	25	75	100	3
25ETBS202	BS-IV	Mathematics-II	3	1	-	25	75	100	4
25ETHS203	HS-III	Universal Human Values	2	-	-	25	75	100	2
25ETHS204	HS-IV	Tamils and Technology தமிழரும் தொழில்நுட்பமும்	1	-	-	25	75	100	1
25ETES205	ES-III	Basic Civil Engineering	3	-	-	25	75	100	3
25ETES206	ES-IV	Environmental Studies	2	-	-	25	75	100	2
25ETBP207	BSP-II	Physics lab	-	-	3	40	60	100	1.5
25ETHP208	HSP-I	English Communication Lab	-	-	3	40	60	100	1.5
25ETSP209	ESP-III	Electrical Wiring and Earthing Practices Lab	-	-	2	40	60	100	1
25ETSP210	ESP-IV	Engineering Graphics & Design	1	-	4	40	60	100	3
Total Credits									22

25ETBS101/ 25ETBS201	ENGINEERING PHYSICS	L	T	P/D	C
		3	0	0	3

(25ETBS101 for Group 'A' branches and 25ETBS201 for Group 'B' branches)

Course Objectives

At the end of the course the students would be exposed to fundamental knowledge in various engineering subjects and applications

- To understand the ray of light to undergo the phenomenon of interference and diffraction.
- To understand the principle and various application of Laser.
- To develop knowledge in crystal structure and its properties.
- To understand the energy quantization of subatomic particles like electron.
- Rationalize the law of conservation of energy in solar water heater and solar cells.

Unit - I. Mechanical properties of solids, Oscillations and Optics (9 Lectures)

Introduction –Elastic behaviors of solids – Hooke's law – Young's Modulus – Applications of Elastic behaviors of materials –Rectilinear motion – Oscillations or Vibrations–Simple Harmonic motion –Reflection and Refraction of light waves – Total internal reflection – Interference – Newton's Rings – Michelson Interferometer – Theory of Air wedge and Experiment – Diffraction – Diffraction Grating.

Unit -II. Lasers (8 Lectures)

Introduction – Basic Principles –Energy levels – Ionization and Excitation potentials – Absorption – Spontaneous emission – Stimulated emission – Einstein's Coefficients – Characteristics – Population inversion – Pumping – Methods of Pumping – Active medium – Active center – Types of lasers: Rubylaser – He-Ne laser – Basic applications of lasers in industry.

Unit - III. Crystal Physics (7 Lectures)

Introduction to solid Materials – Crystal structure – Geometry of lattice unit cell – Bravais's lattice – crystal systems –Crystal structures of Materials –(Coordination number, Atomic radius, packing factor and packing density) – Types of crystal Lattice (Simple Cubic, Body Centered Cubic, Face Centered Cubic and Hexagonal Closed Packed) Miller Indices and their calculations – Finding Miller indices of crystal planes.

Unit - IV. Quantum Mechanics (8 Lectures)

Heisenberg uncertainty Principle –Dual nature of Matter and radiation – Properties of Matter waves – De Broglie's Wave length –De Broglie wavelength of an electron – The Schrödinger wave Equation – Schrödinger's time dependent and independent wave equations– The Wave function and its physical significance – The particle in a box Problem (one dimensional box).

Unit - V. Energy Physics (8 Lectures)

Introduction to energy sources– Energy sources and their availability (Conventional and Non- conventional energy sources)solar energy – Methods of Harvesting solar energy – Solar heat collector – solar water heater and solar cells–Wind energy - Basic principle and components of Wind Energy Conversion System (WECS) – Application of wind energy – Biomass – Biogas Generation – Classification of Biogas plants –Properties and application of Biogas.

Text Books

1. Arumugam. M., “Engineering Physics”, Anuradha agencies, 2nd Edition, 1997.
2. John Twidell & Tony Weir, “ Renewable Energy Resources”, Taylor & Francis, 2005.
3. Avadhanulu. M.N. and Kshirsagar P.G., “A Text Book of Engineering Physics”, S. Chand & Company Ltd., 7th Enlarged Revised Ed., 2005.
4. Gaur R.K. and Gupta S.L., “Engineering Physics”, Dhanpat Rai Publishers, New Delhi, 2003.
5. Rai.G.D., “Solar Energy Utilization”, Volume-1 & 2 by Khanna Publishers, New Delhi.
6. Pajput. R.K. Non-Conventional energy sources and Utilization – S.Chand Publication – 2013.

Reference Books

1. Rajendran.V , “Engineering Physics”, Tata McGraw Hill publishers, 2009.
2. Rai G.D., “Non-conventional Energy sources”, Khauna Publications, 1993.
3. Mani. P. “Engineering Physics”, Dhanam Publication, Chennai, 2011.
4. Agarwal.M.P, “Solar Energy”, S.Chand & Co., I Edn, New Delhi, 1983.

Course outcomes:

1. To understand the ray of light to undergo the phenomenon of interference, diffraction and gain knowledge on the construction of different types of interferometers.
2. To understand the principle and various application of Laser.
3. To explain the fundamental terms in crystallography and its properties.
4. To evaluate the quantum mechanical concept of wave functions.
5. To Compare the different energy resources and their availability.

Mapping of Course Outcomes with Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11
CO1	2	2	2	-	3	2	-	-	-	-	1
CO2	3	2	-	-	2	1	1	-	-	-	-
CO3	3	1	1	-	-	1	-	-	-	-	-
CO4	2	1	2	2	1	1	-	-	-	-	-
CO5	3	2	-	-	1	2	1	-	-	1	1

25ETBS102	MATHEMATICS - I	L	T	P	C
		3	1	0	4

Course Objectives:

The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

- To familiarize definite integrals and its application in finding area and volume.
- To Introduce the fundamentals of functions of single variable.
- To make the student to learn infinite series and its nature.
- To Introduce the fundamentals of Multivariable Differential Calculus
- To Introduce the fundamentals of Multivariable Integral Calculus

Module 1: Basic Calculus

Curvature, Evolutes, and Involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Single-variable Calculus (Differentiation)

Rolle's Theorem, Mean value theorems and applications; Extreme values of functions; Indeterminate forms and L'Hospital's rule.

Module 3: Sequences and series

Convergence of sequence and series-tests for convergence: Comparison test (only for series with positive terms)-D'Alembert's ratio test-Cauchy's root test-Integral test-Leibnitz's test (Alternating series).

Module 4: Multivariable Calculus (Differentiation)

Limit, continuity and partial derivatives, total derivative; Euler's theorem; Jacobians; Taylor and Maclaurin series; Maxima, minima, and saddle points; Method of Lagrange multipliers.

Module 5: Multivariable Calculus (Integration)

Double integrals (Cartesian) - change of order of integration in double integrals - Change of variables (Cartesian to polar) - Applications: Area as a double integral. Triple integrals (Cartesian) - Applications: Volume as a triple integral,

Text Books:

1. Veerarajan T., *Engineering Mathematics for first year*, Tata McGraw-Hill, New Delhi, 2008.
2. B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 36th Edition, 2010

Reference Books

1. Reena Garg, . *Mathematics-II (Calculus, Ordinary Differential Equations and Complex Variable)*, Khanna Book Publishing Co, 2023
2. G.B. Thomas and R.L. Finney, *Calculus and Analytic geometry*, 9th Edition, Pearson publishers, Reprint, 2002.
3. Erwin kreyszig, *Advanced Engineering Mathematics*, 9th Edition, John Wiley & Sons, 2006.
4. Ramana B.V., *Higher Engineering Mathematics*, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. N.P. Bali and Manish Goyal, *A text book of Engineering Mathematics*, Laxmi Publications, Reprint, 2008.

Course Outcomes

At the end of this course, students will learn

1. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions Solve improper integrals using Beta and Gamma functions.
2. The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
3. The tool of power series for learning advanced Engineering Mathematics.
4. To deal with functions of several variables that are essential in most branches of engineering.
5. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-
CO3	3	3	3	2	-	-	-	-	-	-	-
CO4	3	3	3	2	-	-	-	-	-	-	-
CO5	3	3	3	2	-	-	-	-	-	-	-

25ETHS103	TECHNICAL ENGLISH	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To ensure the students with good vocabulary
- To make the students participate actively in writing activities
- To practice the unique qualities of professional writing style
- To develop the students the proficiency in communicative skills
- To ensure the students to face the demand of their profession

Unit I: Vocabulary Building

- 1.1 The concept of Word Formation
- 1.2 Root words from Foreign languages (Greek, Latin and French) and their use in English
- 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Count and Non count nouns.
- 1.4 Synonyms, antonyms and standard abbreviations.
- 1.5 Homophones, Homonyms, and one word substitution.

Unit II: Basic Writing Skills

- 2.1 Use of phrases and clauses in sentences.
- 2.2 Sentence Structures and Transformation of Sentences.
- 2.3 Importance of proper punctuation.
- 2.4 Creating coherence and Techniques for writing precisely.
- 2.5 Note making Techniques

Unit III: Identifying Common Errors in Writing

- 3.1 Subject-verb Agreement
- 3.2 Noun, Pronoun Agreement
- 3.3 Articles and Prepositions
- 3.4 Active and Passive voice
- 3.5 Common errors in writing

Unit IV: Nature and Style of sensible Writing

- 4.1 Describing and Defining
- 4.2 Classifying and Providing Evidences and Examples with Introduction and Conclusion
- 4.3 Essay Writing–Writing analytical essays and issue-based essays.
- 4.4 Comprehension
- 4.5 Letter Writing – Formal, Informal and Job application with CV

Unit V: Writing Practices and Oral Communication

- 5.1 Dialogue Writing and conversation in the work place

- 5.2 Report Writing – Preparing agenda, Minutes of meeting and a Circular
- 5.3 Mechanics of Presentation
- 5.4 Public speaking and Interview Skills
- 5.5 E-mail– etiquette

TEXT-CUM-REFERENCE BOOKS

1. Practical English Usage, Michael Swan, Oxford University Press, 2016.
2. Remedial English Grammar, F.T.Wood.Macmillan, 2007.
3. On Writing Well, William Zinsser, Harper Resource Book, 2001
4. Study Writing, Liz Hamp-Lyons and Ben Heasley, Cambridge University Press. 2006.
5. Communication Skills, Sanjay Kumar and Pushp Lata, Oxford University Press. 2011.
6. Exercises in Spoken English, Parts. I-III, CIEFL, Hyderabad. Oxford University Press.
7. Raman Meenakshi and Shama, Sangeetha –Technical Communication Principles and Practice, Oxford University Press, New Delhi, 2014.

Course Outcomes:

At the end of this course work, students will be able to

1. Comprehend, to write creatively and improve speaking skills. Get an exposure of vocabulary and gain a good glossary.
2. Get knowledge regarding the use of grammar while conversing and writing.
3. Acquire a knowledge of remembering, understanding, applying, analyzing, evaluating & creative writing.
4. Develop the skill to articulate effectively to a various of listeners.
5. Acquire ability to speak and write effectively in English.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	2	-	2	-	-	-	-	3	-	3
CO2	-	2	-	2	2	-	-	-	3	-	3
CO3	-	-	3	-	-	2	2	-	3	-	3
CO4	-	-	2	-	2	2	2	-	3	-	3
CO5	-	-	3	2	-	-	-	2	3	-	3

25ETHS104	HERITAGE OF TAMILS				L	T	P/D	C
	தமிழர் மரபு				1	0	0	1

அலகு I: மொழி மற்றும் இலக்கியம்:

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமணப் பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II: மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை:

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III: நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV: தமிழர்களின் திணைக் கோட்பாடுகள்:

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V: இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:

3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

UNIT-I: Language and Literature: Language Families in India - Dravidian Languages - Tamil as a Classical Language - Classical Literature in Tamil -Secular Nature of Sangam Literature -Distributive Justice in Sangam Literature -Management Principles in Thirukural -Tamil Epics and Impact of Buddhism & Jainismin in Tamil Land -Bakthi Literature Azhwars and Nayanmars.- Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyaar and Bharathidhasan.

UNIT-II: Heritage - Rock art paintings to modern art - Sculpture: Hero stone to modern sculpture -Bronze icons -Tribes and their handicrafts-Art of temple car making -Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT-III: Folk and Martial arts - Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT-IV: Thinaï concept of Tamils -Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT-V: Contribution of Tamils to Indian National Movement and Indian Culture: Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India -Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine -Inscriptions & Manuscripts -Print History of Tamil Books.

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல்)
2. மற்றும் கல்வியியல் பணிகள் கழகம்).
3. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
4. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
- 4.. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of TamilStudies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of TamilStudies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, TamilNadu)
10. StudiesintheHistoryofIndiawithSpecialReferencetoTamilNadu(Dr.K.K.Pillay)(Publish edby: The Author)
11. PorunaiCivilization(JointlyPublishedbyDepartmentofArchaeology&TamilNaduText Book and Educational Services Corporation, TamilNadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

25ETES105	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P/D	C
		2	0	0	2

Course Objectives:

- Understand the fundamental principles of electrical circuits and their analysis
- Explore the construction, working principles, and applications of various electrical machines
- Gain knowledge of electrical measurement techniques and instrumentation used in the measurement of electrical parameters
- Develop an understanding of analog electronics and their applications
- To teach the basics of digital electronics.

UNIT I: ELECTRICAL CIRCUITS

DC Circuits-Basic circuit elements and sources-Ohm's law- Kirchhoff's laws- AC Circuits-Alternating voltages and currents-RMS, average, maximum values- real power, reactive power and apparent power- Power Factor- Three phase balanced systems-Star and delta connections (simple problems only)

UNIT II: ELECTRICAL MACHINES

Construction, working principle, types and applications of DC Machines, Transformers, Three phase Induction motors, Three-phase Alternators, Three-phase Synchronous Motors, Single phase induction motors and universal motor.

UNIT III: MEASUREMENTS AND INSTRUMENTATION

Functional elements of an instrument, Construction, Operating Principle, types-Moving Coil and Moving Iron meters, Dynamometer Wattmeter, Energy Meter, Instrument Transformers-CT and PT

UNIT IV: ANALOG ELECTRONICS

Characteristics: PN junction diode, Zener diode, BJT- Applications: Rectifier, Voltage regulator, Operational amplifier

UNIT V: DIGITAL ELECTRONICS

Number system – Logic Gates – Boolean Algebra– De-Morgan's Theorem – Half Adder and Full Adder – Flip Flops- multiplexers and de-multiplexers

Course Outcomes:

By the end of this course, students will be able to:

1. Analyze and solve electrical circuit problems.
2. Understand the construction, operation, and applications of various electrical machines and select appropriate machines for practical applications.
3. Interpret and use electrical measuring instruments for the accurate measurement of electrical parameters in both AC and DC circuits.
4. Design and analyze analog electronic circuits and apply them in real-world scenarios.
5. Apply digital electronics concepts to design and implement simple combinational and sequential circuits such as adders, flip-flops, and multiplexers.

TEXT BOOKS

1. R.Muthusubramanian, S.Salivahanan, Basic Electrical and Electronics Engineering, McGraw Hill Education, 2024.
2. A K Theraja & B L Theraja, Fundamentals of Electrical Engineering and Electronics, S Chand Publishing, 2022.

REFERENCE BOOKS

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education, 2019.
2. S. K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson India, 2017
3. R. K. Rajput, Basic Electrical and Electronics Engineering, Laxmi Publications, 2013

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	-	-	2	-	-	-	3
CO2	3	2	2	-	-	-	2	-	-	-	3
CO3	3	2	2	-	-	-	2	-	-	-	3
CO4	3	2	2	-	-	-	2	-	-	-	3
CO5	3	2	2	-	-	-	2	-	-	-	3

25ETES106	BASIC ENGINEERING - MECHANICAL	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The main objectives of the course for the students is

- To familiarize the functions of different types of Boilers and Turbines
- To provide basic knowledge about the functions of Internal Combustion Engines and Electric Vehicles
- To provide fundamental knowledge on the various conventional machining operations and Metal forming operations
- To illustrate the concepts of various metal joining techniques, brazing and soldering
- To understand the fundamentals of CNC machining and Additive Manufacturing process

UNIT I

Steam generators: Boilers – Classification –Construction and working of Cochran boiler and Babcock & Wilcox boiler –Boiler Mountings and Accessories – Pressure gauge, Water level indicator, Safety valve— Applications of Boilers. Prime Movers: Steam turbines – Types – Working Principles of Impulse and Reaction turbines – Comparison – Gas turbines: Working Principles of Open cycle and Closed cycle gas turbines.

UNIT II

Internal Combustion Engines: Classification – Description and of I.C. engines– Two stroke - Four stroke– Comparison – Petrol and diesel engines –Comparison - Fuel system for Petrol and Diesel engines – Concepts of CRDI and MPFI fuel injection systems – Applications– Electric Vehicles: Architecture - Battery Electric Vehicles (BEV) - Hybrid Electric vehicles (HEV).

UNIT III

Metal Machining: Description and Types of operations performed on various machine tools -Lathe, Drilling machine and Milling machine. Metal Forming: Hot and cold working - Principle of forging –Types –Rolling: definition - roll mill configurations - Extrusion: Definition –Direct and indirect extrusion.

UNIT IV

Metal Casting: Green Sand Molding –Principle - Steps – Solid and split pattern - Injection Molding Metal Joining: Gas welding -Oxy-acetylene welding – principle– Equipment - Advantages and Disadvantages – Arc welding: Shielded Metal Arc Welding (SMAW) - principle – Equipment - Advantages and Disadvantages. Brazing – Soldering - comparison.

UNIT V

Computer Numerical Control (CNC) machining – Classifications – co-ordinates – codes - Applications – Advantages - Limitations – Machining centre – concept. Additive Manufacturing Process – Definition - Classifications - Stereo-lithography (SLA) process – Direct Metal Laser Sintering (DMLS) - Applications - Advantages – Disadvantages.

TEXT BOOKS:

1. Prabhu, T, J., ,Jaiganesh Vand Jebaraj S. (2000).Basic Mechanical Engineering, Scitech Publications Pvt. Ltd., Chennai.
2. Venugopal and Prabhuraj T J. (1996). Basic Mechanical Engineering, ARS publishers, Sirkali.
3. P. Radhakrishnan, S.Subramanyan. (1994). CAD/CAM/CIM, New Age International Publishers pvt, Ltd, New Delhi.

REFERENCE BOOKS:

1. Hajra Choudhury S. K., Nirjhar Roy, Hajra Choudhury A. K.(2008). Elements of Workshop Technology (Vol 1 and Vol II), Media Promoters Pvt. Ltd.
2. Rao P.N.(2013).Manufacturing Technology: Foundry, Formingand Welding–Vol1, McGraw Hill Education.
3. Steven R.Schmid, Serope Kalpakjian. (2009). Manufacturing Processes for Engineering Materials (English), 5th Edition, Pearson India.

COURSE OUTCOMES

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

1. Understand the functions of Water tube and Fire tube Boilers and Turbines
2. Know the functions of Internal Combustion Engines and Electric Vehicles
3. Acquire the fundamental knowledge on the various conventional machining operations and the metal forming operations
4. Understand the fundamentals of Metal Molding and various Metal Joining techniques
5. Understand the concept of CNC machining and Additive Manufacturing process.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	-	1	-	-	-	-	-	1
CO2	3	2	-	1	-	-	-	-	1	-	-
CO3	2	2	-	1	-	1	1	-	-	1	1
CO4	2	2	1	-	1	-	-	-	1	-	-
CO5	3	3	2	1	2	1	1	-	-	1	1

25ETBP107/ 25ETBP207	PHYSICS LABORATORY	L	T	P/D	C
		0	0	3	1.5

(25ETBP107 for Group 'A' branches and 25ETBP207 for Group 'A' branches)

Course objectives

1. To develop a strong understanding of wave optics and interference phenomena by performing experiments such as Air Wedge, Newton's Rings, and Young's Double Slit.
2. To gain hands-on experience with optical instruments like spectrometers and diffraction gratings for determining wavelengths and dispersive properties of light sources.
3. To experimentally determine mechanical properties of materials, including Young's modulus, moment of inertia, and rigidity modulus using bending and torsion methods.
4. To explore classical mechanics through pendulum-based experiments, enabling the calculation of time periods, acceleration due to gravity, and related physical constants.
5. To investigate fluid and wave dynamics, including viscosity measurements and ultrasonic velocity in liquids using acoustic diffraction methods.

S.No	LIST OF EXPERIMENTS
1.	Air-Wedge; To determine the thickness(diameter) of a thin wire by forming interference fringes.
2.	Newtons rings; To find the radius of curvature of the given plano convex lens by the Newton's rings.
3.	Dispersive power of the prism; To find the dispersive power of the material of the prism using spectrometer.
4.	Spectrometer Grating; To determine the wavelength of the prominent spectral lines of the Mercury(Hg) spectrum using grating.
5.	Laser Grating; To determine the wavelength of a given laser source by using diffraction grating method
6.	Youngs Modulus - Non-Uniform bending; To find the Young's modulus

	of the material of a uniform bar (metre scale) by non-uniform bending.
7.	Youngs Modulus -Uniform bending; To determine the Youngs modulus of the beam (metre scale) by uniform bending
8.	Simple Pendulum; To determine the time period of a simple pendulum for different lengths.
9.	Torsion Pendulum; To determine (i) Moment of inertia of a disc and (ii) Rigidity modulus of a wire by torsional pendulum.
10.	Compound Pendulum; To determine the value of acceleration due to gravity(g) using compound pendulum
11.	Acoustic diffraction grating; To determine the ultrasonic velocity in liquid by acoustical grating method.
12.	Co-efficient of Viscosity by Stokes method; To verify stokes law and hence to determine the co-efficient of viscosity of a highly viscous liquid.
13.	Youngs double slit experiment; To determine the nature of the light by observing interference patterns using double slit.

Course Outcomes:

1. Demonstrate an understanding of optical interference and diffraction by accurately conducting experiments such as Air Wedge, Newton's Rings, and diffraction grating methods.
2. Apply spectrometry techniques to analyze the spectral properties of light and determine physical constants like wavelength and dispersive power.
3. Evaluate mechanical properties of materials, such as Young's modulus and rigidity modulus, through bending and torsional experiments.
4. Measure and analyze pendulum motion to determine gravitational acceleration and understand the dynamics of simple, compound, and torsion pendulums.
5. Investigate fluid and wave behavior by experimentally determining viscosity and ultrasonic velocity using Stokes' method and acoustic diffraction techniques.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	-	3	2	1	-	-	-
CO2	3	3	-	-	-	3	1	1	-	-	-
CO3	3	2	2	-	-	3	1	1	-	-	1
CO4	3	2	2	-	-	3	1	1	-	-	1
CO5	3	2	2	-	-	3	1	1	-	-	1

25ETSP108	DESIGN THINKING	L	T	P/D	C
		1	0	2	2

Course Objectives

1. To introduce the concept and principles of design thinking.
2. To develop empathy and understanding of users through observation and research.
3. To foster creative problem-solving and ideation skills.
4. To equip students with prototyping and testing techniques.
5. To encourage a user-centered mindset in real-world problem solving.

Unit I: Introduction to Design Thinking:

Definition, history, and evolution - Principles and mindset of design thinking - Design thinking vs. traditional problem-solving - Overview of the 5-step process: Empathize, Define, Ideate, Prototype, Test.

Unit II: Empathize – Understanding Users:

Importance of empathy in design - User research methods: interviews, observation, shadowing - Empathy mapping - Identifying user pain points and needs-Exercise on Empathizing.

Unit III: Define – Framing the Problem:

Synthesizing user research - Point-of-view statements - Problem definition and opportunity framing - Design challenges and "How Might We" questions- Exercise on Problem Framing.

Unit IV: Ideate – Generating Ideas:

Divergent and convergent thinking - Brain storming techniques - Story boarding and sketching ideas - Evaluating and selecting ideas. Edward de Bono's Lateral Thinking: Random Entry Idea Generation; Challenge and Provocation Techniques, Concept Extraction-Exercise on Idea Generation.

Unit V: Prototype and Test:

Importance of prototyping in design thinking - Types: low-fidelity vs high-fidelity, digital vs physical - Storyboards, wireframes, role-playing- User testing methods: Think-Aloud, A/B testing-Iterative improvement cycles-Reflecting and learning loops.

Laboratory Activities:

The student has to empathize, define, ideate, prototype and test for five real world design thinking projects in his/her branch of study and submit a report.

Course Outcomes:

By the end of the course, students will be able to:

1. Explain the principles, mind set and five step process of design thinking, compare it with traditional problem-solving approaches.
2. Apply empathy-driven research methods to understand user behaviours, needs and pain points.
3. Analyze and synthesize user data to frame meaningful problem statements and design challenges.
4. Generate and evaluate creative solutions using divergent and convergent thinking, including lateral thinking techniques.
5. Develop and iteratively redefine prototypes based on user feedback to test and validate design solutions.

Text Books

1. Brown, Tim. “Change by Design: How Design Thinking Creates New Alternatives for Business and Society”, Harvard Business Review Press, 2009.
2. Luedtke, Jeanne, and Tim Ogilvie. “Designing for Growth: A Design Thinking Tool Kit for Managers”, Columbia University Press, 2011.
3. De Bono, Edward, “Lateral Thinking: Creativity Step by Step”, Harper Perennial, 2015.

Reference Books

1. Kolko, Jon. “Well-Designed: How to Use Empathy to Create Products People Love”. Harvard Business Review Press, 2014.
2. Cross, Nigel. “Design Thinking: Understanding How Designers Think and Work”. Berg Publishers, 2011.
3. Ball, Philip. “Critical Mass: How One Thing Leads to Another”. Farrar, Straus and Giroux, 2006.
4. Norman, Donald A, “The Design of Everyday Things”, Basic Books, Revised Edition, 2013.

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

25ETSP109	PROGRAMMING FOR PROBLEM SOLVING LABORATORY	L	T	P/D	C
		0	0	3	1.5

COURSE OBJECTIVES

- To enable students to code, compile and test C programs.
- To enable students to design algorithms using appropriate programming constructs for problem solving.
- Identify tasks in which the numerical techniques learned are applicable and apply them to write programs.
- To enable students to segregate large problems into functions using modular programming concepts.
- To enable students to apply pointer and structures in programs effectively.

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given].

Tutorial 1:	Problem solving using computers
Lab1:	Familiarization with programming environment
Tutorial 2:	Variable types and type conversions
Lab 2:	Simple computational problems using arithmetic expressions
Tutorial 3:	Branching and logical expressions
Lab 3:	Problems involving if-then-else structures
Tutorial 4:	Loops, while and for loops
Lab 4:	Iterative problems e.g., sum of series

Tutorial 5:	1D Arrays: searching, sorting
Lab 5:	1D Array manipulation
Tutorial 6:	2D arrays and Strings
Lab 6:	Matrix problems, String operations
Tutorial 7:	Functions, call by value:
Lab 7:	Simple functions
Tutorial 8 and 9:	Numerical methods (Root finding, numerical differentiation, numerical integration)
Lab 8 and 9:	Programming for solving Numerical methods
Tutorial 10:	Recursion, structure of recursive calls
Lab 10:	Recursive functions
Tutorial 11:	Pointers, structures and dynamic memory allocation
Lab 11:	Pointers and structures
Tutorial 12:	File handling
Lab 12:	File operations

COURSE OUTCOMES

At the end of this course, the students will be able to

1. Analyze program requirements and develop programs using conditional and looping statements.
2. Write programs for handling arrays and strings.
3. Create C programs with user defined functions and recursive function calls.
4. Utilize pointers and structures for dynamic memory allocation in C programming.
5. Develop C programs for handling files.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	-	2	-	-	-	-	-	-
CO2	2	1	1	-	2	-	-	-	-	-	-
CO3	2	1	1	-	2	-	-	-	-	-	-
CO4	1	1	1	-	2	-	-	-	-	-	-
CO5	1	1	1	-	2	-	-	-	-	-	-

25ETBS201/ 25ETBS101	CHEMISTRY	L	T	P	C
		3	0	0	3

(25ETBS201 for Group 'A' branches and 25ETBS101 for Group 'B' branches)

Course Objectives

- To understand water treatment techniques and basic knowledge on surface chemistry.
- To provide knowledge on electrochemical cells and chemistry involved in corrosion.
- To learn various processes involved in fuel refining and mechanism involved in energy storage devices.
- To develop knowledge about synthesis of various types of polymers, nano materials and Phase rule.
- To get basic knowledge on Refractories, Lubricants, Spectroscopical techniques and Explosives

Unit – I : Water Chemistry and Surface Chemistry

Hardness of water–Types –Units - Estimation of hardness by EDTA method. Softening of hard water by Ion exchange method and Zeolite method. Desalination of brackish water by Reverse Osmosis. Boiler feed water–boiler troubles – Internal treatment methods. Municipal water treatment –Sedimentation, Coagulation, Filtration, Sterilization – Break point chlorination.

Adsorption –Types of Adsorption –Freundlich and Langmuir adsorption isotherms – Applications of adsorption.

Unit – II : Electrochemistry and Corrosion

Electrode potential–Electrochemical cell–Measurement of EMF–Nernst equation for cell EMF– Concentration cells– Electrochemical series – Conductometry – Conductance, Specific conductance (molar and equivalent), Cell constant–Conductometric titrations (types of acid-base titrations). Potentiometry–Principle, Acid-base titration.

Corrosion – Dry and wet corrosion – Galvanic and Concentration cell corrosion (Pitting) – Control of corrosion – Cathodic Protection (Sacrificial anodic method, Impressed voltage method) – Metal coatings –Galvanizing and Tinning.

Unit – III : Fuels and Storage Devices

Fuels– Calorific values (HCV and LCV)– Classification– Coal - Analysis of coal (Proximate and Ultimate analysis)– Crude Petroleum- Refining and fractional distillation- Cracking of heavy oil (Fixed bed Method)– Synthetic petrol (Fischer–Tropsch process). Gaseous Fuel (Producer gas, Water gas LPG, CNG). Flue gas analysis using Orsat apparatus.

Batteries– Primary cell- Dry cell (Leclanche cell, Alkali cell)- Secondary cell (Lead acid storage battery, Ni-Cd battery, Lithium -ion battery)– Flow Cell (H_2 - O_2 fuel cell and Solid oxide fuel cell).

Unit – IV : Polymers, Nano Materials and Phase rule

Polymers – Polymerization – Types (Addition, condensation and copolymerization) – Mechanism of addition polymerization (Free radical). Plastics– Types (Thermoplastics and Thermosetting plastics) – Preparation, properties and uses of polyethylene, polyvinyl chloride, polystyrene, Nylon and Bakelite. Elastomers – Vulcanization – Synthetic Rubber (Buna-S, Buna-N, Neoprene) – Silicone Rubber.

Nanochemistry – Introduction to nano-materials– Synthesis (Precipitation, sol-gel, Electro deposition and chemical vapour deposition methods) - Carbon nano tubes, Fullerenes, Nano wires and Nano rods.

Phase Rule– Introduction, Definition of terms with examples. One component system (Water and Sulphur).

Unit – V : Engineering Materials Spectroscopic Techniques and Explosives

Refractories – Classification, characteristics (Refractoriness, RUL, Thermal spalling, porosity) and uses, Lubricants – Classification, properties (cloud and pour point, flash and fire point, viscosity index) and applications. Principles of spectroscopy – Beer – Lambert's Law– UV Visible and IR spectroscopy– Basic principles and instrumentation (block diagram).

Explosives– Structure, Preparation, properties and uses of some important explosives (Lead azide, Dynamite, TNT, PETN and RDX).

Text Books

1. Jain, P.C. and Monica Jain (2010) “Engineering Chemistry” Dhanpat Rai & Sons, New Delhi
2. Dara, S.S. and Umare, S.S. (2014) “Text Book of Engineering Chemistry” S. Chand & Co. Ltd., New Delhi.
3. Gopalan, R., Venkappaya, D. and Nagarajan, S. (2008) “Engineering Chemistry” Tata Mc Graw Publications Ltd., New Delhi.
4. Puri, B.R., Sharma, L.R. and Pathania, M.S. (2013) “Principles of Physical Chemistry” Vishal Publication Company, New Delhi.
5. Sharma, Y.R. (2010) “Elementary Organic Spectroscopy, Principle and Chemical Applications” S. Chand Publishers, New Delhi.
6. Asim K Das and Mahua Das (2017) “An Introduction to Nanomaterials and Nanoscience” CBS Publishers & Distributors Pvt. Ltd., New Delhi.

Course Outcomes

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

1. Develop innovative methods in soft water production for industrial uses and about adsorption analysis.
2. Describe the concept of electrochemistry and its applications; corrosion and its controlling methods.

- Understand the properties of fuels and applications of energy storage devices.
- Synthesize various polymers and understand about nano materials and Phase rule.
- Gain knowledge on Refractories, Lubricants, Explosives and understand the concepts of certain spectroscopic techniques.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	2	-	-	-	-	-	-	-
CO2	1	2	-	2	1	-	-	-	-	-	-
CO3	3	-	3	-	-	-	-	-	-	-	-
CO4	3	2	-	-	1	-	-	-	-	-	-
CO5	1	2	3	2	-	-	-	-	-	-	-

25ETBS202	MATHEMATICS – II	L	T	P	C
		3	1	0	4

Course Objectives:

- To familiarize linear system of equation and matrices.
- To solve ordinary differential equations of first and second order.
- To make the student to learn vector differentiation and integration.
- To acquaint the student with the techniques in the theory of analytic functions.
- To Introduce the fundamentals of complex integrations.

Unit I: Matrices

Linear Systems of Equations; Linear Independence; Rank of a Matrix; Determinant, Inverse of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Orthogonal transformation; Diagonalization of matrices; Cayley-Hamilton Theorem.

Unit II: Ordinary differential equations

Exact, linear and Bernoulli's equations. Second order linear differential equations with constant coefficients, Second order linear differential equations with variable coefficients: Euler-Cauchy equations, solution by variation of parameters

Unit III: Vector Calculus

Vectors-Gradient, divergence and curl- Directional derivative-unit normal vector-Irrotational and Solenoidal vectors- Line, Surface and Volume integrals - Gauss

divergence theorem (without proof) - Green's theorem in the plane (without proof) - Stokes theorem (without proof). Verification of the above theorems.

Unit IV: Complex Variable – Differentiation

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Unit V: Complex Variable – Integration

Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof).

Text Books:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

Reference Books

1. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson publishers, Reprint, 2002.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Course Outcomes:

At the end of this course, students will be able to

1. The essential tool of matrices and linear algebra in a comprehensive manner.
2. Solve First order and Second order linear differential equations with constant coefficients
3. Apply effective mathematical tools for the solutions of vector calculus.
4. Construct analytic functions and analyze conformal mappings.
5. Acquaint the techniques in the theory of the complex integrals.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	2	-	-	-	-	-	1
CO2	3	3	3	2	2	-	-	-	-	-	1
CO3	3	3	3	2	2	-	-	-	-	-	1
CO4	3	3	3	2	2	-	-	-	-	-	1
CO5	3	3	3	2	2	-	-	-	-	-	1

25ETHS203	UNIVERSAL HUMAN VALUES	L	T	P/D	C
		2	0	0	2

COURSE OBJECTIVES

- To impart of a holistic perspective based on self-exploration about themselves (human being), family, society and nature / existence.
- To develop clarity about the harmony within the human being, as well as in the family, society and nature / existence.
- To strengthen the capacity of self-reflection.
- To foster commitment and courage to act to act in alignment with universal human values.
- To equip students with the knowledge and skills to address problems through sustainable and ethical solutions.

UNIT I

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

- 1.1 Purpose and motivation for the course, recapitulation from Universal Human Values-I.
- 1.2 Self-Exploration-what is it? - Its content and process; Natural Acceptance and Experiential Validation- as the process for self-exploration.
- 1.3 Continuous Happiness and Prosperity- A look at basic Human Aspirations.
- 1.4 Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority.
- 1.5 Understanding happiness and Prosperity correctly-A critical appraisal of the current scenario.

- 1.6 Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT II

UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF!

- 2.1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'.
- 2.2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility.
- 2.3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).
- 2.4. Understanding the characteristics and activities of 'I' and harmony in 'I'.
- 2.5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
- 2.6. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs. dealing with disease

UNIT III

UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP

- 1.1 Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.
- 1.2 Understanding the meaning of Trust; Difference between intention and competence.
- 1.3 Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
- 1.4 Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.
- 1.5 Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life example, teacher-student relationship, goal of education etc.

Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

UNIT IV

UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE

- 1.1 Understanding the harmony in the Nature.
- 1.2 Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature.
- 1.3 Understanding Existence as Co-existence of mutually interacting units in all- pervasive space.
- 1.4 Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT V

IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

- 1.1 Natural acceptance of human values.
- 1.2 Definitiveness of Ethical Human Conduct.
- 1.3 Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
- 1.4 Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- 1.5 Case studies of typical holistic technologies, management models and production systems.
- 1.6 Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations.
- 1.7 Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

TEXT / REFERENCES

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, ExcelBooks, New Delhi, 2010

2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F. Schumacher.
7. Slow is Beautiful - Cecile Andrews
8. Economy of Permanence - J. C. Kumarappa
9. Bharat Mein Angreji Raj - Pandit Sunderlal
10. Rediscovering India - by Dharampal
11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
12. India Wins Freedom - Maulana Abdul Kalam Azad
13. Vivekananda - Romain Rolland (English)
14. Gandhi - Romain Rolland (English)

COURSE OUTCOMES

At the end of the course, students will demonstrate the ability to

1. Demonstrate increased awareness of themselves and their surroundings, including family, society, and nature.
2. Act more responsibly in life and address problems with sustainable solutions, keeping human relationships and the well-being of nature in mind.
3. Exhibit enhanced critical thinking and reflective abilities.
4. Show greater sensitivity and commitment toward the values they have understood, such as human values, human relationships, and the role of the individual in society.
5. Apply the concepts learned to their own lives in day-to-day situations, initiating positive changes in their personal and social behavior.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	3	2	-	-	-	-	-
CO2	-	-	2	2	2	2	-	-	-	-	-
CO3	-	-	2	-	-	-	-	-	-	-	-
CO4	-	-	-	-	2	-	-	-	-	-	-
CO5	-	-	-	2	2	-	-	-	-	-	-

25ETHS204	TAMILS AND TECHNOLOGY தமிழரும் தொழில்நுட்பமும்	L	T	P/D	C
		1	0	0	1

அலகு I: நெசவு மற்றும் பாணைத் தொழில்நுட்பம்: 3
சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II: வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு III: உற்பத்தித் தொழில் நுட்பம்: 3
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV: வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: 3
அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குழுவித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

அலகு V: அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3
அறிவியல் தமிழின் வளர்ச்சி -கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் 3 தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் V தமிழ் மின் நூலகம் 3 இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

Unit I: Weaving and Ceramic Technology: Weaving Industry during Sangam Age - Ceramic technology - Black and Red Ware Potteries (BRW) - Graffiti on Potteries.

Unit II: Design and Construction Technology: Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age - Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple) -Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

Unit III: Manufacturing Technology: Art of Ship Building - Metallurgical studies

- Iron industry-Iron smelting, steel - Copper and gold - Coins as source of history - Minting of Coins - Beads making - Industries Stone beads - Glass beads - Terracotta beads - Shell beads/bone beads - Archeological evidences - Gem stone types described in Silappathikaram.

Unit IV: Agriculture and Irrigation Technology: Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries - Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

Unit V: Scientific Tamil & Tamil Computing: Development of Scientific Tamil - Tamil computing - Digitalization of Tamil Books - Development of Tamil Software - Tamil Virtual Academy -Tamil Digital Library - Online Tamil Dictionaries - Sorkuvai Project.

TEXT-CUM-REFERENCEBOOKS:

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு) பொருளை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
4. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
5. Social Life of the Tamils The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
6. Historical Heritage of the Tamils (Dr.S.V.Subatamanian,Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
7. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
8. Keeladi - 'Sangam City Civilization on the bank so friver Vaigai'(Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Service Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

25ETES205	BASIC CIVIL ENGINEERING	L	T	P/D	C
		3	0	0	3

COURSE OBJECTIVES

- To inculcate a knowledge on essentials of Civil Engineering.
- To impart knowledge on construction materials and their properties.
- To expose the students on the role, significance and contributions of Civil Engineering in satisfying the social needs.
- To understand the basic knowledge on building construction.
- To understand various materials, methods and special structures in the field of Civil Engineering.

UNIT I: INTRODUCTION TO CIVIL ENGINEERING

Introduction to Civil Engineering - Various disciplines of Civil Engineering – Various components of Residential Building or Structure – Functions of a building - Types of buildings – NBC – Selection of site for buildings – Orientation of a building – Introduction to Surveying - Simple definitions – Plinth area, Carpet area, Built-up area, Floor area – Floor Space Index – Undivided Divided Share (UDS).

UNIT II: CONSTRUCTION MATERIALS

Introduction to various building materials - Stone – Bricks - Steel - Cement - Aggregates - Timbers - Plywood – Glass - Tiles - Paints - Other building materials – Properties, Characteristics, types and uses of materials – Merits and Demerits.

UNIT III MASONRY, ROOF AND FLOOR

Definitions and terms used in masonry – Brick masonry - Characteristics requirements of good masonry – Bonds in brick work – Header, Stretcher, English, Flemish – Stone masonry - Characteristics requirements of stone masonry – Walls – Types of walls – Concrete block walls – Types of building blocks.

Types of roofs – Flat, Sloped and Curved – Types of Roof coverings – Aluminum and iron sheets – Drainage in roofs – Floors - Types of floors and finishes – Finishing materials and types - Advantages and Disadvantages

UNIT IV BUILDING CONSTRUCTION

Building construction – Foundations – Bearing Capacity of Soil – Types of foundations - Centre line marking – Columns and Beams – Lintel and Sunshades – Functions – Structural systems - Load transfer mechanism - Plastering – Electrical works – Plumbing works - Finishing – Septic Tank – Water supply and Sanitation – Water treatment and Sewage disposal – Conservation of water and Rain water harvesting.

UNIT V SPECIAL STRUCTURES IN CIVIL ENGINEERING

Introduction to different types of structures coming under Civil Engineering – Industrial structures - Irrigation structures - Highways and Railways - Harbour and Ports – Retaining walls – Underground and Overhead Water Tanks - Bridges and Dams - Underground and Multi-storeyed structures – Tunnels - etc.

TEXT BOOKS

1. Building Construction by Punmia et al., Laxmi publications Ltd., 2023
2. Building Construction by S.C.Rangwala, Charotar publishing Housr (P) Ltd., 2022
3. Building Materials by Duggal SK, New Age International (P) Ltd., 2019
4. Construction Materials by Vargheese PC, Prentice Hall India P.Ltd.,2015

REFERENCES

1. Palanichamy M.S., Basic Civil Engineering, Tata McGraw Hill Publishing Company Ltd, 2000.
2. Ramamrutham V, Basic Civil Engineering, DhanpatRai Publishing Co. (P) Ltd., 1999.
3. Natarajan K V, Basic Civil Engineering, Dhanalakshmi Publications, Chennai, 2005.
4. Civil Engineering Materials and Construction Practice by RK. Gupta and Jain, Charotar Publishing House, 2019
5. Building Materials by Surendra Singh, Vikas Publishing Company, 1996
6. Civil Engineering Materials by Neil Jhonson and Dhir, RK.Mcmillan Publishers Ltd., 1997
7. Building Construction by Vargheese PC, Prentice Hall India P.Ltd.,2017
8. Building Construction by SP.Arora and Sp.Bindra. Dhanpat Rai Publications, 2014
9. National Building Code.

COURSE OUTCOMES

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

1. Describe the role of civil engineering in society and recognize the different functions in civil engineering.
2. Identify common construction materials and explain their properties, applications, and advantages/disadvantages for various construction projects.
3. Recognize different construction methods and practices used in buildings
4. Explain different steps involved in construction of buildings and practice and also to assess the environmental impacts and eco-friendly practices to minimize negative effects.

5. Understand the different structures and their purposes in the field civil engineering.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	3	1	1	1	1	1
CO2	3	-	-	-	1	3	2	1	1	1	1
CO3	3	-	-	-	-	3	-	-	-	-	-
CO4	3	-	-	-	-	3	-	-	-	2	1
CO5	3	-	-	-	-	2	-	-	-	-	1

25ETES206	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To realize the importance of environment for engineering students.
- To understand the basis of ecosystems
- To make aware the student about global environmental problems and natural disasters.
- To give the ideas about advance technologies of Engineering that will useful to protect environment.

UNIT I: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, scope and importance - Need for public awareness. Natural resources - Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - Role of an individual in conservation of natural resources.- Equitable use of resources for sustainable lifestyles.

UNIT II: ECOSYSTEMS

Concept of an ecosystem - Structure and function of an ecosystem - Producers,

consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological - pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT III: BIODIVERSITY AND ITS CONSERVATION

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

UNIT IV : ENVIRONMENTAL POLLUTION

Definition - Cause, effects and control measures of Air pollution - Water pollution - Soil pollution - Marine pollution- Noise pollution - Thermal pollution - nuclear hazards- Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster management: floods, earthquake, cyclone and landslides. Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, and watershed management - Resettlement and rehabilitation of people; its problems and concerns. - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

Wasteland reclamation - Consumerism and waste products - Environment Protection Act - Air (Prevention and Control of Pollution) Act - Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Issues involved in enforcement of environmental legislation.

UNIT V: HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations - Population explosion – Family Welfare Programme - Environment and human health - Human Rights - Value Education - HIV/AIDS - Women and Child Welfare - Role of Information Technology in Environment and human health -Case Studies.

FIELD WORK

Visit to a local area to document environmental assets-river/forest/grassland hill/mountain - Visit to a local polluted site-Urban/Rural/Industrial/Agricultural - Study of common plants, insects, birds -Study of simple ecosystems-pond, river, hill slopes, etc. **(Field work equal to 5 lecture hours)**

TEXT BOOKS

1. Agarwal, K.C. Environmental Biology, Nidi Publ, Ltd. Bikaner, 2001
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad – 380 013, India, Email:mapin@icenet.net

REFERENCES

1. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
2. Clark R.S., Marine Pollution, Clanderson Press Oxford
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001,
4. Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
5. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
6. Down to Earth, Centre for Science and Environment
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev.,
8. Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p.
9. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural
10. History Society, Bombay
11. Heywood, V.H & Weston, R.T. 1995. Global Biodiversity Assessment.
12. Cambridge Univ. press 1140p.
13. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
14. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
15. Mhaskar A.K., Matter Hazardous, Techno-Science Publication
16. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co.
17. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
18. Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
19. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut Survey of the Environment, The Hindu (M)
20. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science.
21. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media.
22. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication.
23. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p.

COURSE OUTCOMES

At the end students can able to

1. Understand the importance of environment.
2. Analyze the importance of environment in engineering.
3. Apply their own ideas and demonstrate advanced technologies that will be useful to protect environment.

- Employ awareness among the society about environmental problems and natural disasters.
- Practice according to the present and future environmental issues.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-
CO4	3	-	2	-	2	2	-	-	-	-	-
CO5	3	-	2	-	-	2	-	-	-	-	-

25ETSP207/ 25ETSP107	CHEMISTRY LABORATORY	L	T	P/D	C
		0	0	3	1.5

(25ETSP207 for Group 'A' branches and 25ETSP107 for Group 'B' branches)

Course Objectives:

- To list the water quality standards.
- To assess the composition of an alloy.
- To appreciate the practical significance of acidimetry, alkalimetry, permananganometry, conductometry and potentiometry.
- To analyze quantitatively the amount of a substance present in a given sample.

List of Experiments:

- Determination of surface tension and viscosity
- Thin layer chromatography
- Ion exchange column for removal of hardness of water
- Determination of chloride content of water
- Determination of the rate constant of a reaction
- Determination of cell constant and conductance of solutions
- Potentiometry - determination of redox potentials and emfs
- Saponification/acid value of an oil

9. Determination of the partition coefficient of a substance between two immiscible liquids
10. Adsorption of acetic acid by charcoal
11. Volumetric analysis

Course Outcomes:

At the end of the course the students will be able to

1. Determine the physical properties like surface tension and viscosity.
2. Determine rate of reactions and saponification of oil.
3. Calculate the quantity of adsorbate adsorbed by charcoal.
4. Determine the impurity from Pharmaceutical products and hardness of water.
5. Determine exact concentration of acid and bases present in the industrial wastes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	-	1	-	-	-	-	-	-	-
CO2	2	1	1	-	-	1	-	-	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-
CO4	3	-	1	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-

25ETHP208	ENGLISH COMMUNICATION LAB	L	T	P/D	C
		0	0	3	1.5

COURSE OBJECTIVES

- To facilitate computer assisted multimedia instruction enabling individualized and Independent Language Learning.
- To sensitize the students to the nuances of English speech sounds, word accent, Intonation and Rhythm.
- To bring about a consistent accent and intelligibility in student pronunciation of English by providing an opportunity for practice in speaking.
- To improve the fluency of students in spoken English
- To train students to use Language appropriately for public speaking, group discussion and interviews.

Theoretical Session (Internal Assessment only)

1. English sound pattern and Sounds of English
2. Pronunciation, Stress and Intonation
3. Common Situations – Conversations and Dialogues
4. Communication at work place
5. Oral presentations – Prepared or Extempore
6. ‘Just a Minute’ sessions (JAM)
7. Interviews
8. Formal Presentations

Suggested Software Package: EWL and Globarena Package for communicative English.

The Globarena Package consists of the following exercises.

1. Reading comprehension
2. Listening comprehension
3. Vocabulary exercises
4. Phonetics
5. Role Play in dialogues
6. Auto Speak

TEXT BOOKS

1. Daniel Jones Current, "English Pronouncing Dictionary", Edition with CD.
2. R. K. Bansal and J. B. Harrison, "Spoken English", Orient Longman 2006 Edn.
3. J. Sethi, Kamlesh Sadanand & D.V. Jindal, "A Practical course in English Pronunciation, (with two Audio cassettes)", Prentice-Hall of India Pvt. Ltd., New Delhi.
4. T. Balasubramanian, "A text book of English Phonetics for Indian Students", (Macmillan).
5. "English Skills for Technical Students", WBSCTE with British Council, OL.

COURSE OUTCOMES

At the end of this course work, Students will be able to

1. Student will heighten their awareness of correct usage of English Grammar in writing and speaking.
2. Acquire speaking ability in English both in terms of fluency and comprehensibility.
3. Enhance competence in the four modes of literacy; Writing, Speaking, Reading and listening.
4. Ensure student to improve their accuracy and fluency in producing and understanding spoken and written English
5. Exposure of the grammatical forms of English and the use of these forms in specific communicative contexts.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	3	2		-	-	2	-	2	-	3
CO2	-	3	2	2	-	-	-	-	3	-	3
CO3	-	-	2	-	-	2	-	-	3	-	3
CO4	-	2	-	-	-	-	-	2	3	-	3
CO5	-	-	3	-	-	-	2	-	3	2	3

25ETSP209	ELECTRICAL WIRING AND EARTHING PRACTICE LABORATORY	L	T	P/D	C
		0	0	2	1

COURSE OBJECTIVES

- To create an awareness on the electrical safety in industrial and commercial environment.
- To enable the understanding on the principles of different types of electrical wiring.
- To offer exposure on the need for earthing and earthing practices.
- To provide practical knowledge on the various types of lighting circuits.
- To introduce methods for measuring the variables in electric circuits.

LIST OF EXPERIMENTS

1. Residential Wiring
2. Fluorescent lamp wiring
3. Staircase Wiring
4. Godown Wiring
5. Ceiling fan wiring
6. Industrial Wiring
7. Series and Parallel Lamp Circuits
8. Measurement of Earth Resistance
9. Measurement of Parameter sin a Single-Phase AC Circuit
10. Measurement of Voltage, Current, Power and Power factor in a Resistive Circuit
11. SolderingPractice-Componentsdevicesandcircuits-usinggeneralpurposePCB
12. Corridor Wiring

13. Test the operation and control circuit for LED Fluorescent Lamp(18W)
14. Study of various categories of Fuses and Insulators
15. Study and test the operation of Automatic Iron Box
16. Testing the buck/boost functions of the domestic stabilizer

COURSE OUTCOMES

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

1. Familiarize with the electrical safety measures.
2. Identify the different types of electrical wiring.
3. Know the necessity of Earthing.
4. Gain knowledge on the different types of lighting circuits.
5. Understand the methods for measuring electrical variables.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	2	-	-	2	2	-	-	3
CO2	3	-	-	2	-	-	2	2	-	-	3
CO3	3	-	-	2	-	-	2	2	-	-	3
CO4	3	-	-	2	-	-	2	2	-	-	3
CO5	3	-	-	2	-	-	2	2	-	-	3

25ETSP210	ENGINEERING GRAPHICS AND DESIGN	L	T	P/D	C
		1	0	4	3

TRADITIONAL ENGINEERING GRAPHICS

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Reading a Drawing; Sectional Views; Dimensioning, True Length, Angle.

COMPUTER GRAPHICS

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM).

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

COURSE OBJECTIVES

- To develop the ability to produce simple engineering drawing and sketches based on current practice
- To develop the means for communication of ideas, thoughts and design of objects, related to engineering applications, to others through drawing
- To develop the skills to read manufacturing and construction drawings used in industry
- To develop a working knowledge of the layout of plant and equipment
- To develop skills in abstracting information from calculation sheets and schematic diagrams to produce working drawings for manufacturers, installers and fabricators

UNIT I: INTRODUCTION TO ENGINEERING DRAWING

Introduction to Engineering Drawing: Lettering, Dimensioning and use of drawing instruments. Conic sections: Eccentricity method of/for drawing ellipse, parabola and hyperbola- Tangent and Normal from a point on the curve.

UNIT II: ORTHOGRAPHIC PROJECTIONS

Orthographic projections: Introduction -Projections of points Projections of Straight lines: Determination of true length and true angle of inclinations using half cone and trapezoidal methods -drawing the projections of straight lines using half cone method from true length and true angle of inclinations.

UNIT III: PROJECTIONS OF REGULAR SOLIDS

Projections of solids in simple position: Projections of cube, Tetrahedron, prisms, Pyramids, cone and cylinder. Projections of solids: Auxiliary projections -projections of prisms, pyramids, cylinder and cone when the axis is inclined to only one plane.

UNIT IV: SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS

Sections of solids: Sections of prisms, pyramids, cylinder and cones -true shape of section. Developments of solids: Developments of lateral surfaces of solids using parallel and radial line methods.

UNIT V: ISOMETRIC PROJECTIONS

Isometric projections: Projections of simple solids. Conversion of pictorial view of simple objects into orthographic projections (only elevation and plan)

OVERVIEW OF COMPUTER GRAPHICS COVERING

Introduction to CAD software: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars). The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.

CUSTOMIZATION & CAD DRAWING

Consisting of setup of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines and other basic geometric entities.

ANNOTATIONS, LAYERING & OTHER FUNCTIONS

Applying dimensions to objects and annotations to drawings; Setting up and use of Layers, Printing document stop a per using the print command; orthographic projection techniques Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation;

TEXT/REFERENCE BOOKS

1. Bhatt, N.D., Panchal V.M.& Ingle P.R.,(2014), Engineering Drawing, Charotar Publishing House.
2. Shah, M.B. &Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
3. Agrawal B. &Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
5. (Corresponding set of) CAD Software Theory and User Manuals.

COURSE OUTCOMES

At the end of this course work, Students will be able to

1. Utilize drawing instruments effectively and able to present engineering drawings and sketches.
2. Describe the concept of orthographic, isometric projections of points, lines and regular solids.
3. Visualize the images and drawings in engineering perspective.
4. Practice sectioning of bodies like machines and equipment's.
5. Develop their technical communication skills and promote life-long learning.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO9	PO9	PO10	PO11
CO1	-	-	2	-	2	-	-	-	2	-	2
CO2	3	3	3	2	2	-	-	2	2	-	2
CO3	2	-	2	-	-	-	-	-	-	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	3	-	3

ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF CIVIL AND STRUCTURAL ENGINEERING

B.E. CIVIL AND STRUCTURAL ENGINEERING

REGULATIONS & SYLLABI
(Students Admitted from the Academic Year 2025-2026)

VISION

To impart high quality education and technical expertise to the students and inculcate in them humanistic attitude, scientific temper, sense of commitment to the profession and spirit of participation in nation building.

MISSION

- M1** Provide quality education and knowledge base to the students in structural engineering.
- M2** Prepare the students as nationally competitive and trend setters for the future generation in the realm of technical education.
- M3** Enable the students to assimilate the available theories, explore new frontiers, to propound new theories which will result in improving the quality of the life of the student community.
- M4** Develop personality of the students in a healthy way and to provide opportunity to acquire knowledge in state-of-the-art research.
- M5** Provide service to the university, engineering profession, and the public through consultancy services.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

PEO1	To develop the technical and engineering skills of the students and to train them in applying fundamental principles in the domain, feeding the needs of global expectations with professional competence.
PEO2	To explore the students in the field of Civil and Structural Engineering areas both in theory and practice and tuning the academic programmes periodically to make the students fit for professional jobs, research assignment or self-employment.
PEO3	To demonstrate their ability to deal effectively with ethical and professional issues, considering the broader societal implications.
PEO4	To impart communication, analytical and soft skills for the students towards either placing them in a comfort zone in their profession or a path to pursue higher studies.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

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)

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1	Apply the knowledge of mathematics, science and fundamentals of engineering in the engineering problems to provide suitable, viable and economic solutions by the individual or a team of engineers or experts.
PSO2	Students can identify the problem, analyze and design according to the needs of the society and to come up with environmental friendly sustainable solutions even for the complex problems with the ethical standards.
PSO3	Apply modern tools and management techniques for the complex engineering problems, design of new experiments based on the researches, interpretation and analysis of data to make valid conclusions, and also to become entrepreneurs.

Mapping PEO with Mission					
	M1	M2	M3	M4	M5
PEO1	3	3	1	1	1
PEO2	2	2	3	1	1
PEO3	1	1	1	3	3
PEO4	1	1	1	3	3

Mapping PO with PEO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
PEO1	3	1	2	1	1	2	2	1	1	1	1
PEO2	3	2	1	1	2	1	1	1	1	1	1
PEO3	1	1	1	1	1	3	3	2	2	3	1

ANNAMALAI UNIVERSITY
 FACULTY OF ENGINEERING AND TECHNOLOGY
B.E. Civil and Structural Engineering
Choice Based Credit System (CBCS)
REGULATIONS 2025

Course code	Category	Semester – III	L	T	P/D	CA	FE	Total	Credits
25ETBS301	BS-V	Mathematics for Structural Engineering	3	-	-	25	75	100	3
25CZES302	ES-V	Excel Programming for Structural Engineering Problems	3	-	-	25	75	100	3
25CZPC303	PC-I	Strength of Materials	3	-	-	25	75	100	3
25CZPC304	PC-II	Fluid Mechanics	3	-	-	25	75	100	3
25CZPC305	PC-III	Concrete Technology	3	-	-	25	75	100	3
25CZPE306	PE-I	Professional Elective-I	3	-	-	25	75	100	3
25CZCP307	PCP-I	Strength of Materials Lab	-	-	3	40	60	100	1.5
25CZCP308	PCP-II	Concrete and Construction Materials Lab	-	-	3	40	60	100	1.5
25CZCP309	PCP-III	Building planning and Drawing	-	-	3	40	60	100	1.5
Total Credits									22.5

Course code	Category	Semester – IV	L	T	P/D	CA	FE	Total	Credits
25CZBS401	BS-VI	Solid Mechanics	3	-	-	25	75	100	3
25ETES402	ES-VI	Computer Programming for Structural Engineering Problems	3	-	-	25	75	100	3
25CZPC403	PC-IV	Geotechnical Engineering	3	-	-	25	75	100	3
25CZPC404	PC-V	Surveying and	3	-	-	25	75	100	3

		Geomatics							
25CZPC405	PC-VI	Structural Concrete Design-I	3	-	-	25	75	100	3
25CZPE406	PE-II	Professional Elective-II	3	-	-	25	75	100	3
25CZCP407	PCP-IV	Geo-Technical Lab	-	-	3	40	60	100	1.5
25CZCP408	PCP-V	Survey Lab	-	-	3	40	60	100	1.5
25CZCP409	PCP-VI	Hydraulic Engineering Lab	-	-	3	40	60	100	1.5
Total Credits									22.5

Course code	Category	Semester – V	L	T	P/D	CA	FE	Total	Credits
25CZPC501	PC-VII	Structural Analysis-I	3	-	-	25	75	100	3
25CZPC502	PC-VIII	Structural Concrete Design-II	3	-	-	25	75	100	3
25CZPC503	PC-IX	Structural Steel Design-I	3	-	-	25	75	100	3
25CZPC504	PC-X	Environmental Engineering	3	-	-	25	75	100	3
25CZPE505	PE-III	Professional Elective-III	3	-	-	25	75	100	3
25CZOE506	OE-I	Open Elective-I	3	-	-	25	75	100	3
25CZCP507	PCP-VII	Structural Design & Detailing Lab	-	-	3	40	60	100	1.5
25CZCP508	PCP-VIII	Environmental & Highway Engineering Lab	-	-	3	40	60	100	1.5
25CZIT509	IT-I	Industrial Training / Rural Internship / Innovation / Entrepreneurship							4
Total Credits									25

Course code	Category	Semester – VI	L	T	P/D	CA	FE	Total	Credits
25CZPC601	PC-XI	Structural Analysis-II	3	-	-	25	75	100	3
25CZPC602	PC-XII	Structural Steel Design-II	3	-	-	25	75	100	3
25CZPC603	PC-XIII	Construction Project and Scheduling	3	-	-	25	75	100	3
25CZHS604	HS-V	Business Management	3	-	-	25	75	100	3
25CZPE605	PE-IV	Professional Elective-IV	3	-	-	25	75	100	3
25CZPE606	PE-V	Professional Elective-V	3	-	-	25	75	100	3
25CZOE607	OE-II	Open Elective-II	3	-	-	25	75	100	3
25CZCP608	PCP-IX	Advanced Structural Material Testing Lab	-	-	3	40	60	100	1.5
25CZCP609	PCP-X	Construction Engineering & Practice Lab	-	-	3	40	60	100	1.5
Total Credits									24

Course code	Category	Semester – VII	L	T	P/D	CA	FE	Total	Credits
25CZES701	ES-VII	Research Methodology	2	-	-	25	75	100	2
25CZPC702	PC-XIV	Prestressed Concrete	3	-	-	25	75	100	3
25CZPC703	PC-XV	Earthquake Resistant Design	3	-	-	25	75	100	3
25CZPE704	PE-VI	Professional Elective-VI	3	-	-	25	75	100	3
25CZPE705	PE-VII	Professional Elective-VII	3	-	-	25	75	100	3
25CZOE706	OE-III	Open Elective-III	3	-	-	25	75	100	3
25CZCP707	PCP-XI	Finite Element Method & Earthquake Lab	-	-	3	40	60	100	1.5
25CZCP708	PCP-XII	Advanced Computer Lab	-	-	3	40	60	100	1.5
25ETIT709	IT-II	Industrial Training / Rural Internship / Innovation / Entrepreneurship							4
Total Credits									24

Course code	Category	Semester – VIII	L	T	P/D	CA	FE	Total	Credits
25CZOE801	PE-VIII	Professional Elective-VIII	3	-	-	25	75	100	3
25CZOE802	PE-IX	Professional Elective-IX	3	-	-	25	75	100	3
25CZPV803	PV-I	Project Work and Viva-Voce	-	-	-	25	75	100	6
Total Credits									12

Code	Category
BS	Basic Science
BSP	Basic Science Practical
ES	Engineering Science
ESP	Engineering Science Practical
HS	Humanities and Social Science
HSP	Humanities and Social Science Practical
PC	Professional Core
PCP	Professional Core Practical
PE	Professional Elective
OE	Open Elective
IT	Industrial Training / Rural Internship/Innovation / Entrepreneurship
PV	Project Work and Viva-Voce

Semester	Credits
I	21
II	21
III	22.5
IV	22.5
V	25
VI	24
VII	24
VIII	12
Total	172

Total Credits: 172

BS-20, BSP -3, ES-16, ESP-7.5, HS-9, HSP-1.5, PC-45, PCP-18, PE-21, OE-15, IT-8, PV-6, NCC / NSS / YRC / Sports-2.

(**Note:** The Naan Mudhalvan courses may be offered in PE-I/PE-II slots. The student must study Open Elective courses offered by other Departments in FEAT or Naan Mudhalvan courses or SWAYAM/NPTEL courses for the slots OE-I, OE-II, and OE-III. The student may opt to study SWAYAM/NPTEL courses or Open Elective courses offered in the concerned program for OE-IV and OE-V slots.)

PROFESSIONAL ELECTIVES

1. Building planning, Cost and Estimation.
2. Hydraulic Engineering
3. Highway Engineering
4. Foundation Engineering
5. Advanced Structural Concrete Design
6. Repair and Rehabilitation of Concrete Structures
7. Water Resource Engineering
8. Valuation of Building
9. Coastal & Offshore Structures
10. Advanced Concrete Technology
11. Engineering Seismology
12. Irrigation Engineering
13. Urban & Rural Planning
14. Railway Engineering
15. Design of Load Bearing Structures
16. Prefabricated Structures
17. Solid Waste Management
18. Traffic Engineering
19. Town Planning
20. Remote Sensing and GIS
21. Planning for Sustainable Development
22. Environmental Impact Assessment
23. Composite Materials for Construction

OPEN ELECTIVES

1. Construction Engineering
2. Construction Techniques and Equipments
3. Smart Materials and Structures
4. Smart Cities
5. Repair and Rehabilitation of Buildings
6. Services in High Rise buildings
7. Structural Audit
8. Advanced Construction Techniques

HONOURS ELECTIVES									
Course Code	Category	Course	L	T	P/D	CA	FE	Total	Credits
	HE-I	Construction Techniques and Equipment	3	-	-	25	75	100	3
	HE-II	Behaviour of Reinforced Concrete Structures	3	1	-	25	75	100	4
	HE-III	Ground Improvement Techniques	3	-	-	25	75	100	3
	HE-IV	Bridge Engineering	3	-	-	25	75	100	3
	HE-V	Dynamics of Structures	3	-	-	25	75	100	3
	HE-VI	Finite Element Method	3	1	-	25	75	100	4
Total Credits									20
MINOR ENGINEERING ELECTIVES									
Course Code	Category	Course	L	T	P/D	CA	FE	Total	Credits
OE1	ME-I	Construction Engineering	3	-	-	25	75	100	3
OE2	ME-II	Construction Techniques and Equipments	3	1	-	25	75	100	4
OE3	ME-III	Smart Materials and Structures	3	-	-	25	75	100	3
OE4	ME-IV	Smart Cities	3	-	-	25	75	100	3
OE5	ME-V	Repair and Rehabilitation of Buildings	3	1	-	25	75	100	4
OE6	ME-VI	Services in High Rise buildings	3	-	-	25	75	100	3
Total Credits									20

NAAN MUDHALVAN ELECTIVES (By TN Govt.)

1. Modern Construction Materials
2. Plastic Waste Management
3. Digital Land Surveying and Mapping
4. Principles of Construction Management
5. Project Planning and Control
6. Revit for Architectural Design
7. Revit for Structural Design
8. Civil 3D for Infrastructure Design
9. BIM in Architecture, Engineering and Construction
10. Transportation Infrastructure at Airports, Metros and Seaport
11. Design and Construction of Steel Buildings
12. High Rise Buildings

25CZBS301	MATHEMATICS FOR STRUCTURAL ENGINEERING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To learn Partial Differential equations, Applications Fourier Series and Boundary Value Problems.
- To learn the Probability Concepts, Joint distributions and conditional distributions.
- To gain the knowledge of linear regressions.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations – Solutions of second and higher order homogenous linear equations with constant coefficients-Nonlinear partial differential equations with standard types only- Lagrange 's linear equation – Solution of linear partial differential equations of higher order with constant coefficients for Structural Engineering Problems

UNIT II FOURIER SERIES

Dirichlet's condition – Fourier Series – Odd and even function – Half range sine series and cosine series – Complex of Fourier Series – parseval's identity. Determination of deflection of beams using Fourier Series

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of partial differential equations –Method of separation of variables-Solution of one-dimensional wave equation – One dimensional heat equation – Steady state solution of two-dimensional heat equation in Cartesian coordinate Problems related to Structural Dynamics.

UNIT IV PROBABILITY AND RANDOM VARIABLES

Probability Concepts – Random variables - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Uniform, Normal distributions and Probability distributions. Application related to Structural Engineering problems

UNIT V TWO DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and conditional distributions – Expectation of two-dimensional random variables – Covariance – Correlation and linear regression- Transformation of random variables.

TEXTBOOKS

1. Grewal B. S, Higher Engineering Mathematics. 44th Edition, Khanna Publishers, New Delhi, 2022.
2. Ross. S.M, Introduction to Probability and Statistics for Engineers and Scientists. 5th Edition, Elsevier, 2014.
3. R.A., Miller, I and Freund J, Probability and Statistics for Engineers, Pearson Education, Asia, 8th Edition, 2015

REFERENCES

1. Ramana. B.V, Higher Engineering Mathematics. McGraw Hill Education Pvt. Ltd, New Delhi, 2017.
2. Jain R.K. and Iyengar S.R.K, Advanced Engineering Mathematics. Narosa Publications, 5th Edition, New Delhi, 2016.
3. Srimanta Pal and Suboth. C. Bhunia, Engineering Mathematics Oxford University Press, New Delhi, 2015.
4. Devore. J.L, Probability and Statistics for Engineering and the Sciences Cengage Learning, New Delhi, 9th Edition, 2020.
5. M.R., Schiller. J. and Srinivasan. R.A, Schaum's Outlines on Probability and Statistics Spiegel. Tata McGraw Hill Edition, 4th Edition, 2012.

COURSE OUTCOMES

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

CO1: Explain the partial differential equations that emerge in practical application.

CO2: Compute solutions for partial differential equations utilizing Fourier series.

CO3: Explain the fundamental concepts of one-dimensional Structural problems and random variables

CO4: Probability distribution functions, and their applications in structural engineering domains

CO5: Understanding joint, marginal, and conditional distributions, calculating expectations, covariance, and correlation for two-dimensional random variables, performing linear regression, and applying transformations to random variables.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2			1	1		1			1	2	1	1
2	3		1		1	1		1			1	2	1	1
3	3		1		1	1		1			1	2	1	1
4	3				1	1		1			1	2	1	1
5	3		3		1	1		1			1	2	1	1

25CZES302	EXCEL PROGRAMMING FOR STRUCTURAL ENGINEERING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To create, modify, save and develop an excel worksheets for Structural Engineering problems.

UNIT 1 THE EXCEL ENVIRONMENT AND ENTERING AND EDITING DATA

Navigating a worksheet - Spreadsheet terminology - Getting help - Entering and editing text and values - Entering and editing formulas - Saving and updating workbooks- Downloading from Account Reconciliation - The Excel environment - The Sparkline - The Trendline.

UNIT 2 MODIFYING A WORKSHEET

Moving and copying data - Moving and copying formulas – Inserting and deleting ranges, rows, and columns - Cell comments - Create an outline and consolidate data - Create subtotals in a list - Use multiple subtotal functions – SUBTOTAL- SUMIF - Create custom views to save different sets of worksheets display and print settings

UNIT 3 USING FUNCTIONS AND SUBTOTAL FUNCTIONS

Entering functions – AutoSum - Other common functions- Using IF and SUMIF functions to calculate a value based on specified criteria - Use ROUND function to round off numbers - Use VLOOKUP to find values in worksheet data - Use HLOOK. Create an outline and consolidate data - Create subtotals in a list - Use multiple subtotal functions – SUBTOTAL- SUMIF - Create custom views to save different sets of worksheets display and print settings

UNIT 4 FORMATTING AND PIVOT TABLES

Text formatting - Row and column formatting - Number formatting - Conditional formatting - Additional formatting options - Prepare data in a table format and name the table - Create a PivotTable for analyzing - Use the Download Actuals page in Account - Reconciliation as example - Modify or re-arrange fields

UNIT 5 PRINTING CHARTS AND CASE STUDIES

Preparing to print - Page Setup options - Printing worksheets - Chart basics - Pie Chart - Bar Chart - Modifying existing worksheet - Use shortcut keys - Create and email worksheet

TEXT BOOKS

- S. C. Bloch, Excel for Engineers and Scientists, Wiley & Sons, 2003
- Bill Dillon, Microsoft Excel for Civil and Structural Engineers, McGraw Hill Publishers, 2010

REFERENCES

- James W. Dally & Robert J. Bonenberger, Structural Engineering Formulas Excel: Spreadsheet Tools for Structural Design, ICE Publishers, 2015
- Ilya Mikhelson, Structural Engineering Formulas, McGraw Hill Publishers, 2013
- Microsoft Excel Official Documentation; <https://support.microsoft.com/en-us/excel>

COURSE OUTCOMES

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

CO1: Use of various Spreadsheet terminology.

CO2: Creation of custom views to different sets of worksheets display and print settings.

CO3: Consolidation of data, creation of subtotals in a list and use multiple subtotal functions

CO4: Preparation of data in a table format and interchanging of data from tables

CO5: Use shortcut keys and creation of email worksheet with links

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3				2	2		1	1	1	1	3	1	1
2	3	1	1		2	2		1	1	3	1	3	1	1
3	3	1			2	2		1	1	3	1	3	1	1
4	3	1	1		2	2		1	1	2	1	3	1	1
5	3				2	2		1	1	1	1	3	1	1

25CZPC303	STRENGTH OF MATERIALS	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the concept of stresses and strains and associated deformations of solid bodies due to various loading conditions with the application to bars, beams, columns, etc.
- To understand the concept of shear force, bending moments, slope and deflection of different beams under various loadings.
- To understand the concept of determinate structures and their equilibrium conditions.
- To understand the behaviour of torsion, thin and thick cylinders and springs.

UNIT I INTRODUCTION TO EQUILIBRIUM OF FORCES

Forces at a point, Systems of forces, 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. Friction - Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction.

UNIT II CENTROID AND MOMENT OF INERTIA

Centroid and Centre of Gravity Determination of Centroid of Sections of Different Geometry - Centre of Gravity of a Body- Area Moment of Inertia - Parallel Axis Theorem - Perpendicular Axis Theorem - Determination of Moment of Inertia of Rectangular, Triangular, Circular and Semi-circular areas from the first principle - Moment of Inertia of structural Steel Sections of Standard Flanged and Composite Sections - Polar Moment of Inertia - Radius of Gyration- Principal Moment of Inertia

UNIT III CONCEPT OF STRESS AND STRAIN

Simple stresses and strains at a point - Normal and shear Stresses - Hooke's Law - Young's modulus - Bars subjected to axial Forces - simple problems - Thermal stresses - compound bars. Changes in dimensions and volume - Poisson's ratio - Modulus of Rigidity - Surface and volume strains - Bulk modulus - Relation between Elastic constants - Simple Tension Test on Mild/HYSD Steel rods - Stress-strain diagrams - Concept of Factor of Safety and permissible stresses.

UNIT IV BENDING OF BEAMS

Types of Beams - Types of loads - Shear force and Bending Moment - Relationship between loading intensity, shear force and bending moment - Shear force and bending moment diagrams for statically determinate beams – Point of contraflexure. Theory of simple bending – Section modulus - Stress distribution due to bending moment and shear force – Shear stress variations for different cross sections – Problems.

UNIT V TORSION AND SPRINGS

Torsion – Theory of Pure torsion - Solid and hollow circular shafts - Power transmitted through shafts - Strain energy due to torsion - Combined bending and torsion – Springs - Types of springs – Stiffness of springs - Close and Open coiled helical springs – Springs connected in parallel and series - Problems.

TEXTBOOKS

1. Rajput R.K, Essentials of Strength of Materials, S.Chand & Company Ltd., New Delhi, 2015
2. Bansal R.K, Strength of Materials. Laxmi Publications, New Delhi, 2018.

REFERENCES

1. Negi L.S, Strength of Materials. Tata Mc Graw Hill Education Pvt. Ltd, 2017.
2. Shames, Engineering Mechanics: Statics and Dynamics. Irving H. 7th Ed., Pearson, 2018.
3. Beer F.P, Johnston E.R, DeWolf J.T. and Mazurek D, Mechanics of Materials McGraw-Hill Higher Education, 6th Edition, 2011.
4. Lehri A.S & Lehri R.S, Strength of Materials . S K Kotaria & Press, New Delhi, 2012.
5. Punmia B.C, Mechanics of Materials. Ashok jain and Arun jain, Lakshmi Publications, New Delhi, 2017
6. Sadhu Singh, Strength of Materials, Khanna Publishers, New Delhi, 2016
7. Hibbeler, Mechanics of Materials. Russell C. 10th ed., Pearson, 2023.

ONLINE RESOURCES

1. <https://nptel.ac.in/courses/105105108/>
2. <https://nptel.ac.in/courses/112106141/>

COURSE OUTCOMES

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

CO1: Compute the equilibrium of forces at a point.

CO2: Apply centroid and moment of inertia concepts to solve engineering problems.

CO3: Calculate stress, strain, and dimensional changes in solids under various loadings.

CO4: Construct the shear force and bending moment variations for determinate beams and their stress variations across the section.

CO5: Analyze, design and solve problems related to torsional stress, deformation and Spring behavior by applying theoretical principles.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	3	3	1	1			1		1	3	1	1
2	3	3	2	2	1	1			1		1	3		1
3	3	3	2	2	1	1			1		2	3		1
4	3	3	2	2	2	2			1		3	2		1
5	3	3	2	2	1	1			1		1	3	1	1

25CZPC304	FLUID MECHANICS	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To introduce the basic concepts, role and application of fluid mechanics in various fields and the basic properties of fluid.
- To understand principles of fluid statics and dynamics and to solve the problems related to it.
- To apply the important equations like continuity equation, Bernoulli's equation to solve various fluid flow problems.
- To know the concepts of pipe flow Darcy's equation major and minor losses through pipes.

UNIT I PROPERTIES OF FLUIDS

Basic Concepts and Definitions — Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

UNIT II FLUID PRESSURE

Pressure measurement-Fluid 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-manometers. Pressure gauges - Fluid Statics - Hydrostatic pressure and force: Total pressure and Centre of pressure horizontal - vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT III FLUID FLOW

Fluid Kinematics-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; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates.

UNIT IV FLUID DYNAMICS

Fluid Dynamics- Surface and body forces; Equations of motion — Euler's equation; Bernoulli's equation-derivation; Energy Principle; Practical applications of Bernoulli's equation: venturimeter, orifice meter and pitot tube

UNIT V DIMENSIONAL ANALYSIS

Flow through pipe - Reynolds number - laminar and turbulent flow in pipes major and minor losses in pipes energy gradient flow between reservoirs size of pipe for the given discharge pipes in series and parallel transmission through pipes.

TEXT BOOKS

- 1.Modi PM and SM Seth, Hydraulics and Fluid Mechanics, Standard Book House, New Delhi 2015.
2. Bansal, R.K, A text book of Fluid Mechanics and Hydraulic Machines, Lakshmi Publications Pvt., Ltd. 2019,
- 3.Streeter, V.L. Wylie, E.B. and Bedford K.W, Fluid Mechanics, TATA Mc Graw Hill, New Delhi 1998.

REFERENCES

1. Ojha C.S.P, R. Berndtsson and P. N. Chadramouli, Fluid Mechanics and Machinery, Oxford University Press, 2010.
2. Subramanya, K. Theory and Applications of Fluid Mechanics, Tata McGraw Hill, 2nd edition, 2018
3. John Finnemore, E. and Joseph..B. Franzini , Fluid Mechanics with Engineering Applications, Indian Edition, 10th Edition, Mc Graw Hill Education, 2017.
4. Munson, B.R., Okiishi, T.H., Huebsch, W.W. and Rothmayer, A.P. "Fluid Mechanics" Singapore: Wiley, 7th edition 2017
5. Frank M. White, Fluid Mechanics. (Chapter 1: Fundamental Concepts).
6. Introduction to Fluid Mechanics Robert W. Fox (Sections 1.4–1.8).

COURSE OUTCOMES

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

- CO1:** Understand the differences between solids, liquids and gases and the basic properties of fluids.
- CO2:** Understand the concept of fluid pressure and its measurement, principle of hydrostatics, buoyancy and floatation.
- CO3:** Understand the concept of fluid kinematics, know the types of flow and types of flow pattern and apply the continuity principle to fluid flow problems.
- CO4:** Apply the continuity, momentum and energy principles.
- CO5:** Apply dimensional analysis to find the losses when the pipes connected in series and parallel.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	1										3	2	2
2	3	2										3	2	3
3	3	2										2	1	3
4	3	3										3	1	2
5	3	3	1									3	2	2

25CZPC305	CONCRETE TECHNOLOGY	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To know the basic properties of the ingredients of concrete.
- To familiarizes the testing procedures for properties of fresh and hardened concrete.
- To introduce fundamentals and principles of mix design.
- To know the quality check standards as per codal standards.

UNIT I CEMENT AND AGGREGATES

Properties and specific uses of various cements - Tests on cement -Fineness – Setting time - Consistency -Soundness - compressive strength. Properties of Fine and Coarse aggregates (Natural sand, Artificial sand) - Grading – Fineness modulus, Bulking factor. Coarse Aggregate -Crushing strength - Impact strength - Flakiness Index - Elongation Index - Abrasion resistance - Grading – Fineness modulus – Bulking factor.

UNIT II WATER, ADMIXTURES AND CONCRETE MIX DESIGN

Quality of water as per codal Standards for mixing and curing. Admixtures- Accelerators - Retarders (Air-entraining agents, Pozzolonas, Water proofing agents, workability agents, plasticizers, Super plasticizers). Factors affecting mix proportion - Water cement ratio - Aggregate cement ratio - Mix design by I.S. method and ACI method

UNIT III MANUFACTURE OF CONCRETE

Size of Measuring Box for measuring of concrete materials - Volume batching and weigh batching – Hand and machine Mixing of Concrete (mixer machine capacity and its operation)- Transporting of concrete - Placing of concrete - Compaction of concrete - Methods of compacting concrete–Curing of concrete.

UNIT IV PROPERTIES AND TESTS ON FRESH AND HARDENED CONCRETE

Factors affecting fresh concrete properties - Workability Tests - Slump Test - Compacting factor Test - Flow test - Kelly Ball test - Vee Bee consist meter test - Segregation and Bleeding. Hardened concrete properties- Tests on Hardened concrete – Destructive and Non-Destructive - Compressive Strength - Tensile Strength - Modulus of Rupture - Modulus of Elasticity – Bond stress - Shrinkage – Creep – Permeability of concrete - Factors affecting shrinkage, creep & permeability - Thermal properties – NDT Tests.

UNIT V QUALITY CONTROL AND SPECIAL CONCRETES

Sampling - Frequency of sampling - Standard deviation - acceptance criteria as per IS 456 - 2000. High strength concrete - High performance concrete - Self compacting concrete - Lightweight concrete - Fibre Reinforced Concrete - High density Concrete - Polymer Concrete. Pouring Concrete by Chutes - Ready mixed Concrete -Shotcreting - Hot weather concreting - Cold weather concreting.

TEXTBOOKS

1. Shetty M.S, Concrete Technology. S.Chand and Company Ltd, New Delhi, 2019.
2. Neville.A.M, Properties of Concrete. Pearson Education Limited, 2017.

REFERENCES

1. Santhakumar A.R, Concrete Technology. Oxford University Press, New Delhi, 2018
2. Krishnasamy K.T, Concrete Technology. Dhanpat Rai, New Delhi, 2014.
3. Gambhir M.L, Concrete Technology .Tata McGraw Hill Publishing Company
4. Limited, New Delhi, 2017.
5. IS 456- 2000: Indian Standard Code of Practice for Plain and Reinforced Concrete, BIS,
6. New Delhi.
7. IS 10262-2019: Guidelines for Concrete Mix Design proportioning.

ONLINE RESOURCES

1. <https://nptel.ac.in/courses/105102012>
2. <https://nptel.ac.in/courses/105106176>

COURSE OUTCOMES

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

- CO1:** Summarize the cement and aggregates, including properties, uses, tests, and characterization methods for quality assessment.
- CO2:** Importance of water quality, admixtures, and mix design parameters for manufacturing of concrete.
- CO3:** Demonstrate the concrete manufacturing processes, mixing, transportation, placement, compaction, and curing methods for quality assurance.
- CO4:** Demonstrate fresh and hardened concrete tests and various types of testing for quality Evaluation.
- CO5:** Summarize the sampling methods, frequency, standard deviation, and adherence to IS 456-2000 criteria.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	2								2	2	1
2	3	2	1	2								2	2	1
3	3	2	1	2								2	2	1
4	3	2	1	2								2	2	1
5	3		1									1	1	1

25CZCP307	STRENGTH OF MATERIALS LABORATORY	L	T	P/D	C
		-	-	3	1.5

COURSE OBJECTIVES

- To provide practical training on the testing and studying the stress –deformation response under axial and transverse loading conditions of conventional engineering materials like steel and wood.

LIST OF EXPERIMENTS

- 1) Tension test on Steel rods
- 2) Double Shear test on Steel rods
- 3) Flexure test on Steel, Wood and Hollow specimens
- 4) Deflection test on Steel and Wooden beams
- 5) Compression test on wooden specimen
- 6) Impact tests
- 7) Hardness tests on different metals
- 8) Test on Helical springs
- 9) Torsion Test.

TEXTBOOKS

1. Bansal.R.K, Strength of Materials, Lakshmi Publications, New Delhi, December 2005.
2. Strength of Materials Lab Manual.

REFERENCES

1. Rajput.R.K, Strength of Materials, S.Chand& Co., New Delhi, September 2000.
2. V. B. John, Mechanical Testing of Materials. (PHI Learning)
3. K.Srinivasa, Material Testing Laboratory Manual. (Scitech Publications)

COURSE OUTCOMES

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

- CO1:** Determine the mechanical properties of construction materials through laboratory testing.
- CO2:** Operate the testing machines and handling the tools and instruments for ensuring accurate data collection and analysis.
- CO3:** Demonstrate the experiments, ability to record observations, analyze the experimental data, and to compare it with standard Codal specifications.
- CO4:** Prepare the lab reports with proper interpretation of results and graphical representations along with the ethical responsibility.
- CO5:** Develop communication skills for coordinating with team members and instructors through oral presentations to manage the projects.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	1	1		2	1		2		2	1	3	1	1
2	3	1	1		2	1		2		2	1	3		1
3	3	1	1		2	1		2		2	1	3		1
4	3	1	1		2	1		2		2	1	2		1
5	3	1	1		3	1		2		2	1	3	1	1

25CZPC308	CONCRETE AND CONSTRUCTION MATERIALS LABORATORY	L	T	P/D	C
		-	-	3	1.5

COURSE OBJECTIVES

- To train the students in standard testing procedures for different construction materials as per IS Codes
- Compositions of building materials and provides them an opportunity to design a concrete mix.

LIST OF EXPERIMENTS

1. Standard tests on Cement
2. Standard tests on fine and coarse aggregates
3. Workability tests on Fresh Concrete
4. Tests on Hardened Concrete, Bricks and Tiles
5. Concrete Mix design as per IS 10262: 2019

TEXTBOOKS

1. Shetty M.S, Concrete Technology, S. Chand & Co., New Delhi, 2022 - Eighth Edition.
2. Gambhir M.L, Concrete Technology, Tata McGraw Hill Co., New Delhi, 2004.

REFERENCES

1. Neville A.M, Properties of Concrete, Pitman Publishing Limited, London, 2011.
2. P. Bartos, Fresh Concrete: Properties and Tests (Elsevier)
3. Testing of Hardened Concrete, John A. Bickley & R. D. Hooton (CRC Press)
4. Concrete Technology lab Manual.

STANDARDS

1. IS 269: 2013 Specification for Ordinary Portland cement, 33 grade (fourth revision), Bureau of Indian Standards, New Delhi
2. IS 383: 2016, Specification for Coarse and Fine Aggregate from Natural Sources for Concrete, Bureau of Indian Standards, New Delhi.
3. IS 516: 2021, Method of Test for Strength of Concrete (with Amendment No.2), Bureau of Indian Standards, New Delhi
4. IS 2386 (Part I to VIII) :1963 (R 2016), Method of Test for Aggregate for Concrete, Bureau of Indian Standards, New Delhi
7. IS 10262: 2019, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.
8. IS 12269-2013, Specification for 53 grade Ordinary Portland cement (with Amendment No. 3) Bureau of Indian Standards, New Delhi.
9. SP 23:1982 Hand book on Concrete Mixes, Bureau of Indian Standards, New Delhi.
10. SP 34: 1987, Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi

COURSE OUTCOMES

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

- CO1:** Identify and explain the fundamental properties of construction materials such as cement, aggregates, water, bricks, concrete and admixtures.
- CO2:** Conduct the tests on materials to determine their important properties and apply quality control measures to ensure that the materials meet the design specifications and standards (IS Codes, ASTM Standards)
- CO3:** Evaluate and analyze the test results critically, identifying possible issues related to material quality or testing procedures.
- CO4:** Work effectively in teams to plan and execute laboratory experiments, sharing tasks and responsibilities with group projects, practicing ethical standards ensuring accurate and efficient completion of tasks.
- CO5:** Prepare technical lab reports based on observations including procedures, diagrams, calculations, graphs, results, and effectively communicate the implications of test results to peers, instructors, and industry professionals.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	1			2				2	1	1
2	3	2	1	1	1			2				2	1	1
3	3	2	1	1	1			2				2	1	1
4	3	2	1	1	1			2				2	1	1
5	3	2	1	1				1				2	1	1

25CZCP309	BUILDING PLANNING & DRAWING LABORATORY	L	T	P/D	C
		-	-	3	1.5

COURSE OBJECTIVES

- Initiating the student to different building bye-laws and regulations.
- Imparting the planning aspects of residential buildings and public buildings.
- Giving training exercises on various signs and bonds.
- Giving training exercises on different building units.
- Imparting the skills and methods of planning of various buildings.

LIST OF EXPERIMENTS

1. Detailing & Drawing of Sign Conventions.
2. Detailing & Drawing of English Bond.
3. Detailing & Drawing of Flemish Bond.
4. Detailing & Drawing of Doors.
5. Detailing & Drawing of Windows.
6. Detailing & Drawing of Ventilators & Roofs.
7. Drawing of Line Diagram of Residential Buildings by using Building Bye-Laws.
8. Drawing of Plan, Elevation & Section from line diagram for a Single Storey Building.
9. Drawing of Plan, Elevation & Section for Hospital Building.
10. Drawing of Plan, Elevation & Section for Industrial Building.

TEXTBOOKS

1. Gurcharan Singh and Jagdish Singh, Planning, designing and Scheduling, Publisher, Standard Publishers Distributors, 2006.
2. M.Chakraborti, Building planning and drawing. Publisher M. Chakraborti, 2019; ASIN: B0DBQJX5D3
3. M G Shah, C M Kale and S Y Patki, Building drawing, Tata McGraw Hill, 2000, New Delhi.

REFERENCES

1. National Building Code 2016 (Volume-I & II).
2. MG Shah and C M Kale, Principles of Building Drawing, Trinity Publications, New Delhi, 2011.
3. B. P. Verma, Civil Engineering drawing and House planning, Khanna publishers, New Delhi, 2000.
4. Suraj Singh, Civil Engineering Building practice, CBS Publications, New Delhi, and Chennai, 1998
5. G. C Saha and Joy Gopal Jana, Building Materials and Construction, Mc Graw Hill Education (P)India Ltd. New Delhi, 1995.

COURSE OUTCOMES

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

- CO1:** Apply the principles of planning and building bye-laws to develop functional building layouts for residential, public, and commercial structures.
- CO2:** Interpret architectural and structural drawings using appropriate symbols, notations, and conventions as per BIS (Bureau of Indian Standards) guidelines.
- CO3:** Develop 2D and 3D building plans, elevations, and sectional views using both manual drafting and computer-aided design (CAD) tools.
- CO4:** Evaluate the spatial, lighting, and ventilation requirements for different types of buildings based on user needs and local climatic conditions.
- CO5:** Prepare comprehensive set of working drawings with technical reports to integrate various building components such as staircases, doors, windows, and roofs as per the guidelines also execute it through oral presentations.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3			1	3	2	2	1	2		1	1	1	2
2	3		1	1	3	1	1	1	2	1	1	1	1	2
3	3		2		3	2		1	2	1	1	1	1	2
4	3	2	2		2	2		1	2	1	1	1	1	1
5	3		1	1	3	1	1	1	3	1	1	1	1	2

25CZBS401	SOLID MECHANICS	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To learn the fundamental concepts of Stress in simple and complex states.
- To know the mechanism of load transfer in beams and the induced stresses due to simple bending and unsymmetrical bending
- To determine the deformation in determinate beams
- To know the basic concepts of theories of failures

UNIT I DEFLECTION OF DETERMINATE BEAMS

Introduction to statically determinate & indeterminate trusses, beams & frames. Governing differential equation - slope and deflection of beams - Double Integration method - Macaulay's method - Moment area method - Conjugate beam method

UNIT II DEFLECTION OF INDETERMINATE BEAMS

Propped Cantilever and Fixed Beams – Fixed end moments reactions, slope and deflection for standard cases of loading — Continuous beams – support reactions and moments – Theorem of three moments – Shear Force and Bending Moment Diagrams.

UNIT III THEORY OF COLUMNS

Introduction to Short and Slender columns - Short columns -Stresses due to axial and combined bending and axial Force - Kern of section - Elastic buckling of long columns - Euler's theory for long Columns - Critical loads with different end conditions - limitations of Euler's theory - Rankine's formula.

UNIT IV UNSYMMETRICAL BENDING

Introduction to unsymmetrical sections - Unsymmetrical Bending of beams - Shear centre - Thin and Thick cylinders

UNIT V THEORIES OF FAILURES

Theories of failure – Principal stress, principal strain, shear stress, strain energy and distortion energy theories – application problems – Lamé's Theory

TEXTBOOKS

1. Rajput, R.K, Essentials of Strength of Materials. S.Chand & Company Ltd., New Delhi, 2015
2. Bansal R.K, Strength of Materials. Laxmi Publications, New Delhi, 2018.

REFERENCES

1. Carlos de Sa, Computational Mechanics of Solids. John Wiley & Sons 2020
2. David J. Inman, Introduction to Continuum Mechanics|| John Wiley & Sons 2018
3. Punmia B.C, Mechanics of Materials|| Ashok Jain and Arun Jain, Lakshmi Publications, New Delhi, 2017

4. Sadhu Singh, Strength of Materials, Khanna Publishers, NewDelhi,2016

ONLINE RESOURCES

1. <https://nptel.ac.in/courses/105105108/>
2. <https://nptel.ac.in/courses/112106141/>

COURSE OUTCOMES

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

CO1: Analyze the statically determinate beams subjected to point load and uniformly distributed load for slope and deflection

CO2: Analyze the statically indeterminate beams subjected to point load and uniformly distributed load for shear force and bending moment.

CO3: Compute the stresses due to combined bending and axial load for short column and critical load calculation for long columns

CO4: Calculate stresses and deflections in thin-walled open sections subjected to unsymmetrical bending, accurately incorporating the location of the shear centre.

CO5: Apply failure theories (e.g., maximum principal stress, maximum shear stress, and distortion energy) to predict material failure under complex loading conditions in strength of materials.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	1	1	1	2		1			1	2	1	1
2	3	3	1	1	1	2		1			1	2	1	1
3	3	3	1	1	1	2		1			1	2	1	1
4	3	3	1	1	1	2		1			1	2	1	1
5	3	3	1	1	1	2		1			1	2	1	1

25ETES402	COMPUTER PROGRAMMING FOR STRUCTURAL ENGINEERING	L	T	P/D	C
		4	-	-	3

COURSE OBJECTIVES

- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python

UNIT I INTRODUCTION DATA, EXPRESSIONS, STATEMENTS

Introduction to Python and installation, data types: Int, float, Boolean, string, and list; variables, expressions, statements, precedence of operators, comments; modules, functions- function and its use, flow of execution, parameters and arguments. Use of Variables, Expressions and Statements for Structural Engineering Problems

UNIT II CONTROL FLOW, LOOPS

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-if-else); Iteration: while, for, break, continue. Applications Related to Structural Engineering Problems Using Simple Statements if-else.

UNIT III FUNCTIONS, ARRAYS

Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Python arrays, Access the Elements of an Array, array methods.

UNIT IV LISTS, TUPLES, DICTIONARIES

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters, list comprehension; Tuples: tuple assignment, tuple as return value, tuple comprehension; Dictionaries: operations and methods, comprehension.

UNIT V FILES, EXCEPTIONS, MODULES, PACKAGES

Files and exception: text files, reading and writing files, command line arguments, errors and exceptions, handling exceptions, modules (date time, time, OS, calendar, math module), Explore packages.

TEXT BOOKS

1. How to Think Like a Computer Scientist Think Python by Allen B. Downey, 3rd edition, Shroff / O'Reilly Publishers, 2016.
2. Python Programming by R. Nageswara Rao, Wiley Publishers, 2010.
3. Python Programming- A Modern Approach, Vamsi Kurama Pearson, Kindle Edition, 2018

REFERENCE BOOKS

1. Hans Petter Langtangen, A Primer on Scientific Programming with Python, Springer Science & Business Media, 2009; ISBN, 3642024750.
2. Core Python Programming, W.Chun, Pearson, Prentice Hall, 2006
3. Kenneth A. Lambert, Introduction to Python, Cengage Learning, ISBN: 978- 1111822705

COURSE OUTCOMES

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

CO1: Use various data types and operators in formation of expressions.

CO2: Write and execute programs using control statements.

CO3: Perform relevant operations on Sequence data types.

CO4: Create functions in modules.

CO5: Use object-oriented approach and features in writing python programs and handle data files and exceptions.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	1	3	1		1		1			1	2	1	
2	3	1	3	1		1		1			1	2	1	
3	3	1	3	1		1		1			1	2	1	
4	3	1	3	1		1		1			1	2	1	
5	3	1	3	1		1		1			1	2	1	

25CZPC403	GEOTECHNICAL ENGINEERING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification.
- To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils.
- To impart knowledge of design of both finite and infinite slopes.

UNIT I SOIL CLASSIFICATION AND COMPACTION

Formation of soil - Soil description – Particle – Size shape and colour – Composition of gravel, sand, silt, clay particles – Particle behaviour – Soil structure – Phase relationship – Index properties – Significance – BIS classification system – Unified classification system – Compaction of soils – Theory, Laboratory and field tests – Field Compaction methods – Factors influencing compaction of soils.

UNIT II EFFECTIVE STRESS AND PERMEABILITY

Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena– Permeability interaction – Hydraulic conductivity – Darcy’s law – Determination of Hydraulic Conductivity – Laboratory Determination (Constant head and falling head methods) and field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils – Seepage - Two-dimensional flow – Laplace’s equation – Introduction to flow nets – Simple problems. (Sheet pile and weir).

UNIT III STRESS DISTRIBUTION AND SETTLEMENT

Stress distribution in homogeneous and isotropic medium – Boussinesq theory – (Point load, Line load and UDL) Use of New marks influence chart –Components of settlement — Immediate and consolidation settlement – Terzaghi’s one dimensional consolidation theory – Computation of rate of settlement - $\sqrt{t}$ and $\log t$ methods– e - $\log p$ relationship.

UNIT IV SHEAR STRENGTH

Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction.

UNIT V SLOPE STABILITY

Stability Analysis - Infinite slopes and finite slopes – Total stress analysis for saturated clay – Friction circle method – Use of stability number – Method of slices – Fellenious and Bishop’s method - Slope protection measures.

TEXT BOOKS

1. Murthy, V.N.S, Soil Mechanics and Foundation Engineering, CBS Publishers Distribution Ltd., New Delhi. 2015
2. Gopal Ranjan and Rao, A.S.R., Basic and Applied Soil Mechanics, New Age Ltd. International Publisher New Delhi (India) 2006.

REFERENCES

1. McCarthy, D.F, Essentials of Soil Mechanics and Foundations. Prentice-Hall, 2006.
2. Coduto, D.P, Geotechnical Engineering - Principles and Practices, Prentice Hall of India Pvt.Ltd. New Delhi, 2010.
3. Das, B.M, Principles of Geotechnical Engineering. Brooks / Coles / Thompson Learning Singapore, 8th Edition, 2013.
4. Punmia, B.C, Soil Mechanics and Foundations, Laxmi Publications Pvt. Ltd. New Delhi, 2005.

COURSE OUTCOMES

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

CO1: Demonstrate an ability to identify various types of soils and its properties, formulate and solve engineering Problems

CO2: Understand of flow through soil medium and its impact of engineering solution

CO3: Understand the basic concept of stress distribution in loaded soil medium and soil settlement due to consolidation

CO4: Understand shear strength of soils and its impact of engineering solutions to the loaded soil medium and also will be aware of contemporary issues on shear strength of soils.

CO5: Demonstrate an ability to design both finite and infinite slopes, component and process as per needs and specifications.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	1	2		1			1	3	1	1
2	3	2	1	1	1	1		1			1	3	1	1
3	3	2	1	1	1	1		1			1	3	1	1
4	3	2	1	1	1	1		1			1	3	1	1
5	3	2	1	1	2	1		1			1	3	1	1

25CZPC404	SURVEYING AND GEOMATICS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To describe the function of surveying in civil engineering construction.
- To apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities
- To measure horizontal, vertical, and zenith angles with a transit, theodolite, total station or survey grade GNSS instruments.
- To calculate azimuths, latitudes and departures, error of closure; adjust latitudes and departures determine coordinates for a closed traverse.

UNIT I INTRODUCTION TO SURVEYING

Definition-Classifications - Basic principles - Equipment and accessories for ranging and chaining-Methods of ranging-Compass-Basic Principles-Types - Bearing-System and conversions-Sources of errors and Local Attraction-Magnetic Declination-Dip-compass traversing - Plane table and its accessories-Radiation method -Merits and demerits

LEVELLING: Level line - Horizontal Line-Datum-Benchmarks-Levels and staves - Temporary and permanent adjustments - Methods of levelling - Fly Levelling-Check Levelling-Procedure in levelling-Booking-Reduction-Curvature and refraction-Reciprocal levelling - Precise levelling.

UNIT II TRIANGULATION AND TRILATERATION

Triangulation and Trilateration- Theodolite - Measurement Methods of horizontal angle and Vertical angle-horizontal control and vertical control-Triangulation - Classifications-Signals - Base line measurement-Intervisibility- Satellite stations

UNIT III SIMPLE AND COMPOUND CURVES

CURVES: Types of curves - Simple curves-necessity-elements of curve -setting out methods of simple curve-difficulties in setting out of simple curve-related problems.

Compound and reverse curves- elements of compound curve Transition curves-length of transition curve-Vertical curves

UNIT IV MODERN SURVEYING

Modern Surveying: Basic Principles of Total Station, Classifications. EDM-EDM types - Advantages-Parts and accessories-working principle - Observables-Errors - COGO functions - Field procedure and applications. GPS Advantages-System Components-Signal Structure-Selective availability and antspoofing - receiver components and antenna - Planning and data acquisition - Data processing - Errors in GPS-Field procedure and applications.

UNIT V PHOTOGRAMMETRY

Photogrammetry: Basic concepts-perspective geometry of aerial photographs-Relief and Tilt Displacement-Scale of Photographs -Flight Planning-stereoscopy-Overlaps-Vertical and Tilted photographs distortion in aerial photographs-photographic mapping-Mosaics-stereoscopic plotting Instruments.

TEXT BOOKS

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
2. Manoj K, Arora and Badjatia, “Geomatics Engineering”, Nem Chand & Bros, 2011.

REFERENCES

1. Bhavikatti S.S, Surveying and Levelling, Vol. I and II, I.K. International, 2010.
2. ChandraA.M, Higher Surveying, Third Edition, New Age International (P) Ltd, 2002.
3. Anji Reddy, M, Remote sensing and Geographical information system, B.S. Pub,2001.
4. AroraK.R, Surveying, Vol-I, II and III, Standard Book House Publishing, 2015.

COURSE OUTCOMES

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

CO1: Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities.

CO2: Translate the knowledge gained for the implementation of Civil infrastructure facilities

CO3: Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.

CO4: Be familiar with the principals of recording accurate, orderly, complete, and logical field notes from surveying operations, whether recorded manually or with automatic data collection methods.

CO5: Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station or survey grade GNSS instruments.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	1			2	1		1		1	1	3	1	1
2	3	1			2	1		1		1	1	3	1	1
3	3	1			2	1		1		1	1	3	1	3
4	3	1			2	1		1		1	1	3	1	3
5	3	1			2	1		1		1	1	3	1	1

25CZPC405	STRUCTURAL CONCRETE DESIGN-I	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To introduce the different types of Philosophies related to design of basic RCC structural elements such as slab, beam and column which forms the part of any structural system with reference to Indian Standard Code of Practice.

UNIT I MATERIALS FOR CONCRETE AND CONCEPT OF LIMIT STATE DESIGN

IS code regulations - Materials for concrete - Stress - Strain curve for concrete in compression – Concrete Grades - Types of reinforcement, Grades – Stress - strain curve for reinforcing steel. Concept of LSD - Characteristic loads and strengths - Partial safety factor. Design of singly reinforced rectangular beams for flexure, shear and torsion.

UNIT II LIMIT STATE DESIGN OF BEAMS

Design of doubly reinforced rectangular and flanged beams for flexure, shear and torsion. Design of continuous beams using B.M. and S.F. coefficients as per IS code - Detailing as per SP34.

UNIT III LIMIT STATE DESIGN OF SLABS

Types of slabs - Design of one-way simply supported and continuous slab using BM and SF co-efficient as per IS code - Design of two way- Design of continuous slab as per the I.S code B.M. and S.F. coefficients. Design of dog legged staircase slab - Detailing as per SP34.

UNIT IV LIMIT STATE DESIGN OF COLUMNS

Design of short rectangular and circular columns subjected to axial compressive load - Design of short columns subjected to combined axial compressive load, uni-axial and biaxial bending moments using Interaction Charts from SP-16- Detailing as per SP34.

UNIT V LIMIT STATE DESIGN OF FOOTINGS

Design of wall footings - Design of isolated square, rectangular and circular footings –Detailing as per SP34.

TEXTBOOKS

- S. Ramakrishnan, Reinforced Concrete Design. Tata McGraw-Hill Education Co, New Delhi, 2018.
- Varghese PC, Limit State Design of Reinforced Concrete, Prentice Hall of India Pvt. Ltd., 2017
- S.Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design , Tata McGraw-Hill Education Co, New Delhi, 2008.

REFERENCES

- Sinha N.C and Roy S.K, Fundamentals of Reinforced Concrete S.Chand and Company,

New Delhi, 2013.

2. IS: 456 - 2000, Indian Standard Code of Practice for Reinforced Concrete, Bureau of Indian Standards, New Delhi.
3. SP- 16 - 2016, Design Aids for reinforced Concrete (Third Revision), Bureau of Indian Standards, New Delhi.
4. SP-34: 2016, Detailing of Reinforcement in Concrete (Second Revision), Bureau of Indian Standards New Delhi.
5. Ashok K Jain, Reinforced Concrete Limit State Design New Chand Bros, Roorkee, 2012.
6. S.N Sinha, Reinforced Concrete Design. Tata McGraw Hill Publishing Co, New Delhi, 2011.

ONLINE RESOURCES

1. <https://nptel.ac.in/courses/105/105/105105105>

COURSE OUTCOMES

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

CO1: Identify the material properties of concrete and steel, evaluate the strength parameters as per LSM and IS 456-2000 for computing member capacity.

CO2: Analyze and design the beams for flexure, shear, and torsion.

CO3: Design the solid slabs to assess ultimate and serviceability limit states using IS 456 - 2000.

CO4: Design the columns for axial load and bending load using SP16 interaction charts as per LSM and IS 456-2000

CO5: Analysis and design of footings using IS 456-2000 guidelines

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	2	2	3	2	1	1			1	3	2	3
2	3	2	3	2	3	2	1	1			1	3	2	3
3	3	2	3	2	3	2	1	1			1	3	2	3
4	3	2	3	2	3	2	1	1			1	3	2	3
5	3	3	3	2	3	2	1	1			1	3	3	3

25CZCP407	GEOTHECNICAL LAB	L	T	P/D	C
		-	-	3	1.5

COURSE OBJECTIVES

- To train the students in various aspects of soil investigation.
- To determine the basic soil properties, strength, deformation and permeability characteristics of soils through which the students can try to be successful geotechnical engineers

LIST OF EXERCISES

1. Field Density using Core Cutter method.
2. Field Density using Sand replacement method.
3. Natural moisture content using Oven Drying method.
4. Specific gravity of Soils.
5. Grain size distribution by Sieve Analysis.
6. Consistency limits by Liquid limit
7. Consistency limits by Plastic limit
8. Permeability test using Constant-head test method.
9. Permeability test using Falling-head method.
10. Proctor Compaction test
11. Consolidation Test.
12. Direct Shear Test
13. Unconfined Compression Strength Test.

TEXTBOOKS

1. B.C.Punmia, Soil Mechanics and Foundation Engineering, Laxmi publishers, 2005
2. Soil Mechanics Lab Manual

REFERENCES

1. Craig R.F, Chapman & Hall, Soil Mechanics
2. Taylor, John Wiley & Sons, Fundamentals of Soil Engineering.
3. Holtz R.D and Kovacs, W.D, Prentice, An Introduction to Geotechnical Engineering, Hall, NJ.
4. Braja M. Das, Cengage Learning, Principles of Geotechnical Engineering
5. Braja M. Das, Cengage Learning, Principles of Foundation Engineering
6. David F. McCarthy, Essentials of Soil Mechanics and Foundations: Basic Geotechnics
7. Karl Terzaghi, Ralph B. Peck, and Gholamreza, Soil Mechanics in Engineering Practice Mesri.
8. V.N.S. Murthy, Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering).

COURSE OUTCOMES

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

CO1: Develop proficiency in performing essential soil mechanics tests such as grain size analysis, Atterberg limits, compaction tests, and consolidation tests.

CO2: Analyze experimental data to determine fundamental soil properties including moisture content, density, permeability, and shear strength and classify the soils by its sizes and type.

CO3: Interpret test results and draw conclusions on the suitability of different soil types for various engineering applications.

CO4: Present experimental findings in the form of well-organized technical reports with clear analysis, discussions, and conclusions.

CO5: Communicate soil testing procedures, observations, diagrams, calculations, graphs, results, and recommendations effectively, both verbally and in writing.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1		1	1	1	1		1	1	2	2	1
2	3	3	1		1	1	1	1		1	1	2	2	1
3	3	2	1		1	1	1	1		1	1	2	2	1
4	3	2	1		1	1	1	1		1	1	2	2	1
5	3	2	1		1	1	1	1		1	1	2	2	1

25CZCP408	SURVEY LAB	L	T	P/D	C
		-	-	3	1.5

COURSE OBJECTIVES

- To conduct experiments on surveying and levelling.
- To understand the principles of surveying
- To know about compass surveying and plane tables surveying.
- To understand the concepts of leveling and its applications.
- To understand the concepts of theodolite surveying.

LIST OF EXERCISES

I Chain Surveying

1. Study of Chains and its accessories
2. Ranging a line and taking offsets
3. Cross-Staff Survey (Area of a traversing by Chain triangulation)

II COMPASS SURVEYING

1. Study of prismatic compass and its accessories
2. Determination of area of an extent by radiation methods
3. Determination of distance of two inaccessible points

III LEVELLING

1. Study of Dumpy level and telescopic staff
2. Simple Levelling – Determination of Reduced levels
3. Differential Levelling - Determination of Reduced levels

IV THEODOLITE AND TRIGONOMETRIC SURVEYING

1. Study of transit theodolite, fundamental of various axes
2. Measurement of horizontal angle by repetition method
3. Measurement of horizontal angle by reiteration method
4. Heights and distances

V TACHOMETRIC SURVEYING

1. Determination of tachometric constants
2. Distance and elevation by stadia method
3. Distance and elevation by tangential method
4. Determination of Gradient of a line

DEMONSTRATION

1. Study of GPS
2. Study of Total Station.

The syllabus includes a **Survey Camp** for about one week

TEXT BOOKS

1. Punmia.B.C, Surveying Volume-1, Laxmi Publications, New Delhi, 2005.
2. Survey Lab manual.

REFERENCES

1. Kanetkar.T.P & Kulkarni.S.V, Surveying - Vol. I & II, Vidyarthi Griharakashan, Pune, 1968.
2. Arora, Surveying - Vol.I & II, 12th Edition Standard Publishers & Distributors, New Delhi, 2019.
3. Agor.R, Surveying & Levelling, Oscar Publications, Delhi, 2019.
4. Rangwala.S.C, Surveying and Levelling, Charotar Publishing House, Gujarat, 2005.

GEOMATICS LAB

1. Pacing and taping
2. Differential levelling
3. Familiarization with TS
4. Closed traverse
5. Construction lab
6. Horizontal curve
7. GPS
8. GIS and auto-CADD
9. Plant and profile

COURSE OUTCOMES

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

CO1: Do chain surveying, compass surveying, plane table surveying and levelling.

CO2: Carry out Theodolite survey and Tachometric survey.

CO3: Handle the survey instruments, their care and adjustments and the principles of chain surveying

CO4: Understand the concepts of total station and carry out the contouring.

CO5: Prepare the detailed survey reports including procedures, observations, diagrams, calculations, graphs, results, and recommendations effectively in writing; and also, through oral presentations.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3		1		2	1		1		1	1	2	1	1
2	3		1		2	1		1		1	1	2	1	1
3	3		1		3	1		1		1	1	2	1	3
4	2		1		3	1		1		1	1	2	1	3
5	2		1		3	1		1		1	1	2	1	1

25CZCP409	HYDRAULIC ENGINEERING LAB	L	T	P/D	C
		-	-	3	1.5

COURSE OBJECTIVES

- Understand fluid flow behaviour, pressure, and energy principles.
- Operate and analyse hydraulic equipment like pumps, turbines, and flow-measuring devices.
- Perform experiments on open channel flow, pipe flow, and hydraulic structures.
- Develop skills in data collection, analysis, and interpretation for real-world applications.
- Apply theoretical knowledge to design and evaluate hydraulic systems relevant to Indian water resource challenges.

LIST OF EXPERIMENTS

1. Determination of Co-efficient of discharge of Orifice.
2. Determination of Co-efficient of discharge of Venturi meter.
3. Determination of Co-efficient of discharge of Rectangular Notch.
4. Determination of Co-efficient of discharge of Triangular Notch.
5. Determination of co-efficient of Head loss due to Pipe friction.
6. Determination of co-efficient of Head loss due to Change in section.
7. Determination of Metacentric height of a ship model.
8. Determination of co-efficient of Impact of jet on vanes
9. Study of Performance Characteristics of Elmo Pump (Centrifugal Pump)
10. Study of Performance Characteristics of Sump Pump (Centrifugal Pump)
11. Study of Performance Characteristics of Submersible Pump (Centrifugal Pump)
12. Study of Performance characteristics of Gould's Pump (Reciprocating Pump)
13. Study of performance of characteristic of Francis Turbine.
14. Study of Performance characteristics of Pelton Turbine.

TEXT BOOKS

1. R.K. Bansal. Fluid Mechanics and Hydraulic Machines
2. Fluid Mechanics Lab Manual

REFERENCES

1. R.K. Bansal, Fluid Mechanics and Hydraulic Machines. - A widely used textbook in Indian engineering colleges that covers theoretical and practical aspects of fluid mechanics and hydraulic systems.
2. P.N. Modi and S.M. Seth, Hydraulics and Fluid Mechanics - Another popular book that provides a comprehensive understanding of hydraulic principles and applications.

COURSE OUTCOMES

CO1: Demonstrate practical understanding of fluid flow, pressure, and energy principles through experiments.

CO2: Operate and analyse hydraulic equipment such as pumps, turbines, and flow-measuring devices.

CO3: Conduct experiments to study open channel flow, pipe flow, and hydraulic structures and the experimental data to be used to solve real-world hydraulic engineering problems.

CO4: Apply theoretical knowledge to design and evaluate hydraulic systems relevant to Indian water resource challenges.

CO5: Prepare the detailed technical reports including procedures, observations, diagrams, calculations, graphs, results, and recommendations effectively in writing; and also, through oral presentations.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2				1	1	1			1	2	2	1
2	3	3	1		1	1	1	1		1	1	2	2	1
3	3	1			1	1	1	1		1	1	2	2	1
4	3	2	1	2	1	1	1	1		1	1	2	2	1
5	3	1		1	1	1	1	1		1	1	2	2	1

25CZPC501	STRUCTURAL ANALYSIS I	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- Understand the concepts of equilibrium, stability, and determinacy in structures.
- Analyze beams, trusses, and frames using methods like moment distribution, slope-deflection, and energy principles.
- Develop skills to calculate reactions, shear forces, bending moments, and deflections in structural members.
- Apply theoretical knowledge to solve real-world structural engineering problems relevant to Indian construction practices.
- Prepare students for advanced topics in structural analysis and design as per Indian codes and standards (e.g., IS 800, IS 456).

UNIT I FUNDAMENTALS OF STRUCTURAL ANALYSIS

Elastic theorems and energy principles: Strain energy and complementary energy - review of strain energy due to axial load - bending, shear and torsion - principle of superposition - principle of virtual work - Castigliano's theorem for deflection - theorem of complementary energy - Betti's theorem - Maxwell's law of reciprocal deflections - application of method of virtual work (unit load method) and strain energy method for determination of deflections of statically determinate beams

UNIT II ANALYSIS OF TRUSSES

Analysis of determinate trusses - method of joints - method of sections - Deflections of pin-jointed plane frames - lack of fit - change in temperature Analysis of Pin-jointed plane and space trusses by Method of Tension coefficient - Externally and internally redundant trusses - effects of support settlement and pre-strains.

UNIT III MOMENT DISTRIBUTION METHOD

Stiffness - distribution and carry over factors -- Analysis of continuous Beams- Plane rigid frames with and without sway -- Support settlement - symmetric frames with symmetric and skew-symmetric loadings.

UNIT IV SLOPE DEFLECTION METHOD

Slope deflection equations -- Equilibrium conditions - Analysis of continuous beams and rigid frames -- Rigid frames with inclined members - Support settlements - symmetric frames with symmetric and skew-symmetric loadings.

UNIT V CONSISTANT DEFORMATION & STRAIN ENERGY METHODS

Indeterminate Beams and Frames: Deflection of rigid frames of different geometry by consistent deformation method & Strain Energy Methods

TEXTBOOKS

1. Bhavikatti, S.S, Structural Analysis, Vol.1, & 2, Vikas Publishing House Pvt.Ltd., New Delhi-4, 2014.
2. Punmia.B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2004.

REFERENCES

1. William Weaver, Jr and James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, Second Edition, Delhi, 2004
2. Reddy .C.S, "Basic Structural Analysis", Tata McGraw Hill Publishing Company, 2005.
3. Hibbeler, R. C. Structural Analysis. Pearson.
4. Kassimali, A. Structural Analysis. Cengage Learning.
5. Reddy, C. S. Basic Structural Analysis. Tata McGraw-Hill.
6. Ghali, A. Structural Analysis: A Unified Classical and Matrix Approach. CRC Press.

COURSE OUTCOMES

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

CO1: Apply energy concepts and theorems to find the deflection of statically determinate structures.

CO2: Analyse statically determinate trusses and to find the deflections.

CO3: Analyse statically indeterminate beams by moment distribution methods.

CO4: Analyse the continuous beams and rigid frames by slope deflection method.

CO5: Analyse statically indeterminate beams and rigid frames by Consistent Deformation Method.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3					2				2	3	3	
2	3	3					2				2	3	3	
3	3	3					2				2	3	3	
4	3	3					2				2	3	3	
5	3	3					2				2	3	3	

25CZPC502	STRUCTURAL CONCRETE DESIGN II	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the concepts of advanced structural design of building frames, raft foundations, pile foundations and water tanks.
- To enhance the structural design skill to develop confidence in structural design.

UNIT I YIELD LINE THEORY

Introduction to yield line theory of slabs - Application to square, rectangular, triangular and circular slabs with simply supported or fixed boundary conditions subjected to uniformly distributed loads (by upper bound theorem).

UNIT II LIMIT STATE OF SERVICEABILITY

General aspects of serviceability – Service loads- load combination as per code for serviceability Design- Deflection limits as per IS 456-2000- Calculation of deflection of simple flexural members (short and long term) - Estimation of crack width of flexural members.

UNIT III LIMIT STATE DESIGN OF GRADE & ECCENTRIC COMBINED FOOTINGS

Design of grade beam, plinth beams- Design of combined eccentric rectangular footings – Detailing as per SP34.

UNIT IV DESIGN OF RAFT FOUNDATION

Design of Raft foundation (IS:2950 (Part I) -1981) - Design of Strap footings - Reinforcement detailing as per SP 34: 1987.

UNIT V DESIGN OF BORED PILES

Design of Bored Pile foundations with Pile cap for two column loads, three column loads, four column loads IS: 2911 (Part 1/Sec 2)- 2010 – Reinforcement detailing as per SP 34 : 1987

TEXT BOOKS

1. Krishnaraju.N, Advanced R.C.Design, CBS Publishers & Distributors Pvt Ltd, NewDelhi 2012.
2. Punmia.B.C, R.C.Structures - Vol.I & II, Laxmi Publications (P) LTD, New Delhi 1995.
3. S.Unni krishnaPillai and Devdas menon , Reinforced Concrete Design , Tata McGraw-Hill Education Co, New Delhi, 2008.

REFERENCES

1. Johansen, K. W. Yield Line Theory. Cement and Concrete Association.
2. Park, R. & Gamble, W. Reinforced Concrete Slabs. Wiley.
3. Neville, A. M. Properties of Concrete. Pearson.
4. Gilbert, R. I. Reinforced Concrete Design. CRC Press.

5. Punmia, B. C. Design of Reinforced Concrete Structures. Laxmi Publications.

COURSE OUTCOMES

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

CO1: Analyse the slabs by yield line theory.

CO2: Students will understand the principles of the limit state of serviceability.

CO3: Analysis and design of footings using IS 456-2000 guidelines

CO4: The students will have the knowledge of analysis and design of the pile foundation.

CO5: Students will learn the principles and methods for designing bored piles.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3		2	1		3	1					3	2
2		3	3	2					1				3	
3	3	2	1			1			1		1		3	
4		3	2	2		2					1		3	
5	3	2	2			2					1	2	3	

25CZPC503	STRUCTURAL STEEL DESIGN-I	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the fundamentals of the design of steel Structures.
- To design simple steel elements and the corresponding fastening systems.

UNIT I INTRODUCTION TO STRUCTURAL STEEL DESIGN

Limit State Design Concept-Structural Steel Sections-Loads on Structure-Load Combination-Bolted and Welded Connection for Axial Forces-Eccentric Connection With Bolt And Weld

UNIT II CONNECTIONS

Beam to beam connection - framed connection. Beam to column connection - Unstiffened seat connection – stiffened seat connection - double stiffener angle. Moment resistant connections. column and column bases connections subjected to axial and eccentric loads.

UNIT III TENSION MEMBERS

Design of tension members subjected to axial tension- tension member subjected to bending - lug angles. Design of Tension Splice - Concept of Shear lag.

UNIT IV BEAMS

Design of laterally and unsupported supported beam for flexure, shear, web crippling and buckling and deflection. Built-up Beams - cross sections - beams with restrained and unrestrained compression flange.

UNIT V COMPRESSION MEMBERS

Design of compression members with single rolled steel sections - Angle struts. Design of built-up compression members - Design of lacings and battens - Eccentrically loaded column - column splices-(Column bases; simple base-gustad base-column base subjected to moment and axial load-design anchor bolt)

TEXTBOOKS

1. Subramanian.N, Design of Steel Structures , Oxford University Press, New Delhi, 2016.
2. Duggal.S.K , Limit State Design of Steel Structures , Tata McGraw Hill Publication, 2019.

REFERENCES

1. Mark Ambrose, 6th Edition, Handbook of Steel Design. McGraw-Hill Education, New York, NY, 2024.
2. Ramachandra, Virendra Gehlot, Limit State Design of Steel Structures Scientific Publishers, Jodhpur, 2017.
3. Gambir M.L., Fundamentals of Structural Steel Design. Tata McGraw Hill Publication, New Delhi, 2013
4. Bhavikatti.S.S, Design of Steel Structures by Limit State Design, I.K International Pvt.

Ltd., New Delhi 2011.

5. IS 800- 2007, Code of Practice for use of Structural Steel in General Building Construction
Bureau of Indian Standards, New Delhi

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/105105162>
2. <https://nptel.ac.in/courses/105106113>

COURSE OUTCOMES

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

CO1: Apply WSD & LSD methods, analyze steel behavior (stress-strain) & plastic design (hinges, moments) and design of bolted/welded connections (axial & eccentric).

CO2: Calculate the member capacities and connection requirements for different member forces of standard steel structural elements

CO3: Apply tension member design for axial & bending loads and analyze tension splices & shear lag effects.

CO4: Apply design methods for compression members with or without lacings/battens subjected to eccentric loads and design of column splices.

CO5: Apply beam design for flexure, shear, buckling, deflection and analysis for built-up sections and flange restraint effects

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2				1					1	3	3	
2	3	2	3								1	3	3	
3	3	2	3			1					1	3	3	
4	3	2	3			1					1	3	3	
5	3	2	3								1	3	3	

25CZPE504	ENVIRONMENTAL ENGINEERING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

1. To realize the importance of environment for engineering students.
2. To understand the basis of ecosystems
3. To make aware the students about global environmental problems and natural disasters.
4. To give the ideas about advance technologies of engineering that will useful to protect environment.

UNIT I NATURAL RESOURCES

Forest resources: Use and over-exploitation and deforestation. Water resources: Use and over-utilization of surface and ground water. Dams - benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources

UNIT II ENVIRONMENTAL POLLUTION

Sources, causes, effects and management of air pollution, water pollution, soil pollution and radioactive pollution. Solid waste management

UNIT III ECOSYSTEM AND BIODIVERSITY

Concept of an ecosystem- structure and functions- food chain and food webs Biodiversity-types, Importance and values of biodiversity, India as a mega diversity nation, hot spots of biodiversity, Threats to biodiversity, conservation of biodiversity

UNIT IV GREEN CHEMISTRY

Significance of green chemistry - basic components of green chemistry. Industrial applications of green chemistry-green fuels-e-green propellants and bio catalysts

UNIT V GLOBAL ENVIRONMENTAL ISSUES AND MANAGEMENT

Water conservation, Rain water harvesting, Climate change, Ozone depletion, Acid rain, Greenhouse effect and global warming. Disaster management- Earthquakes, Floods, Landslides and cyclones.

TEXT BOOKS

1. S.S.Dara , Text book of Environmental chemistry and Pollution Control , S.Chand & Company Ltd, New Delhi, 2011
2. R.Rajagopalan , Environmental Studies , Oxford University Press New Delhi, 2015

REFERENCES

1. Surinder Deswal & Dr.Anupama Deswal, A Basic course in Environmental Studies. Dhanpat Rai & Co (P) Ltd, New Delhi, 2013.
2. Benny joseph, Environmental Studies. Tata McGraw-Hill Publishing company Limited, New Delhi, 2018.

3. Anubha Kaushik & C.P,Kaushik, Environmental Science and Engineering
New Age International Publishers, 2nd Edition, 2006.
4. Dr.S.Amalraj, Introduction to Environmental Science and Technology Laxmi publications
(P) Ltd, New Delhi , New Edition, 2005.
5. Vidhya Thakur, A Text book of Environmental Science, Scientific Publishers (India) 2019.

COURSE OUTCOMES

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

CO1: Apply the concept of natural resources.

CO2: Implement the remedial measures to control environmental pollution

CO3: Use the concept of conserve the biodiversity

CO4: Apply the components of green chemistry in environment

CO5: Develop remedy for global environmental issues

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	3	3	3	1	3	3	2	2	1	1	3	2	2
2	2	3	3	2	1	3	3	2	2	1	1	3	2	2
3	2	3	3	2	1	3	3	2	2	1	1	3	2	2
4	2	3	3	3	1	3	3	2	2	1	1	3	2	2
5	2	3	2	2		3	3	2	2	1	1	3	2	3

25CZCP507	STRUCTURAL DESIGN AND DETAILING LABORATORY	L	T	P/D	C
		-	-	3	1.5

COURSE OBJECTIVES

- To train the students to know the appropriate detailing of every structural element involved in the field of structural engineering applications and reinforcement bar bending and fitting procedures

LIST OF EXERCISES

Reinforcement details as per SP 34: 1987, IS 13920: 2016.

1. Singly and Doubly Reinforced Concrete Beams
2. Flanged beams: T Beams L Beams
3. Rectangular Continuous Beams
4. Lintel Beams with sunshade
5. Roof Slabs a) One way slab b) Two way slab
6. Continuous Beams and slabs
7. Staircases
8. Isolated Footings: a) Rectangular Column b) Circular Column
9. Reinforcement details as per IS: 2911 (Part 1/Sec 1) - 2010, IS 2911 (Part III): 1980 and SP 34: 1987.
 - a. Pile with Pile cap (Two pile group)
 - b. Pile with Pile cap (Three pile group)
 - c. Pile with Pile cap (Four pile group)
10. Reinforcement details as per SP 34: 1987.
 - a. Cantilever Type Retaining Wall
 - b. Counter fort Type Retaining Wall

TEXTBOOKS

1. M. L. Gambhir "Reinforced Concrete Detailing Manual" (Tata McGraw Hill)
2. S. N. Sinha "Reinforced Concrete Design" (McGraw Hill)

REFERENCES

1. Krishnaraju.N, "Structural Design and Drawing", Oscar Publications, Delhi, 2005.
2. Punmia, B.C, "Reinforced Concrete Structure Vol. I", Standard Publishers Distributors, New Delhi, 2007.

STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi
2. IS 13920: 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces -Code of Practice, Bureau of Indian Standards, New Delhi
3. SP 34: 1987, Handbook On Concrete Reinforcement And Detailing, Bureau of Indian Standards, New Delhi.

4. IS: 2950 (Part I) -1981, Code of Practice for Design and Construction of Raft Foundations, Bureau of Indian Standards, New Delhi
5. IS: 2911 (Part 1/Sec 1)- 2010, Design and Construction of Pile Foundations - Code of Practice, Bureau of Indian Standards, New Delhi.
6. IS 2911 (Part III): 1980, Code of Practice for Design and Construction of Pile Foundation Under-reamed piles), Bureau of Indian Standards, New Delhi,
7. IS 3370 (Part IV):2009, Code Of Practice For Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

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

CO1: Having the knowledge of how to represent the detailing in the form of drawings for practical applications.

CO2: Draw the detailed drawings showing reinforcement details.

CO3: Able to give the reinforcement detailing for the structures like beams, columns, footings, foundations, water tanks, retaining walls, etc.

CO4: Able to understand the codal provisions for detailing of reinforcements and how to implementing the drawings.

CO5: Able to check the bar bending and reinforcement fittings for different structural elements.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2			2						1		3	2
2	3	1		2	1						2		2	2
3	3	2			2						1		2	
4	3	1		2	1						1		2	2
5	3	2	2	1	1					2	1		2	1

25CZCP508	ENVIRONMENTAL & HIGHWAY ENGINEERING LAB	L	T	P/D	C
		-	-	3	1.5

COURSE OBJECTIVES

- To quantify water and wastewater pollutants.
- To determine concentration of air pollutants.
- To analyse the characteristics of water, wastewater and ambient air.
- To study the growth of microorganisms and its quantification.
- To Learn the Principle and Procedure of Testing of Aggregates
- To Learn the Principle and Procedure of Testing of Binding Material

LIST OF EXPERIMENTS FOR ENVIRONMENTAL LAB.

1. Determination of Chloride content in water sample.
2. Determination of Dissolved Oxygen in water sample.
3. Determination of pH in water sample.
4. Determination of Hardness in water sample.
5. Determination of Total Solids (TDS, TSS) in water sample.
6. Determination of Turbidity of various water and wastewater samples using Nephelo Turbidity meter.
7. Determination of Electrical Conductivity of water samples.
8. Determination of Chemical Oxygen Demand for water sample.
9. Determination of Bio - Chemical Oxygen Demand for water sample.
10. Determination of Residual Chlorine in water sample.
11. Determination of Chlorine Demand for water sample.
12. Determination of optimum dosage of coagulant using Jar test apparatus.
13. Determination of infiltration capacity using Double ring in filtrometer.

LISTS OF EXPERIMENTS FOR HIGHWAY ENGG.LAB.

1. TEST ON AGGREGATES

Elongation and Flakiness Index Test
Deval Abrasion Test
Impact Value Test

2. TEST ON AGGREGATES

Penetration Test
Viscosity Test
Softening Point Test
Ductility Test
Flash and Fire point

3. TEST ON BITUMINOUS MIXES

Marshall Stability and Flow Values (**DEMO**)

TEXTBOOKS

1. S.K. Khanna & C.E.G. Justo, Highway Engineering. (Nem Chand & Bros)
2. L.R. Kadiyali, Principles and Practices of Highway Engineering. (Khanna Publishers)

REFERENCES

1. Chandand Bros, Highway Materials and Pavement Testing Nem. Roorkee, Revised Fifth Edition, 2009
2. Methods for testing tar and bituminous materials, IS1201-1978 to IS1220-1978, Bureau of Indian Standards
3. Methods of test for aggregates, IS2386-1978, Bureau of Indian Standards
4. Mix Design Methods Asphalt Institute Manual Series No. 2, Sixth Edition, 1997, Lexington, KY. USA.
5. AWWA, WEF, Standard Methods for the Examination of Water and Wastewater, APHA, 2005.
6. Sawyer, C.N., McCarty, P.L., and Parkin, G.F., Chemistry for Environmental Engineering, 4th Edition, Tata McGraw - Hill Publishing Company Limited, 2000.

COURSE OUTCOMES

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

CO1: Quantify the pollutant concentration in water, wastewater and ambient air and recommend the degree of treatment required for water and wastewater.

CO2: Analyse the survival conditions for the microorganisms and their growth rate.

CO3: Understand the properties and test procedures of aggregate, bituminous materials, composites and recycled waste products.

CO4: Learn the properties of various aggregates and bitumen used as pavement materials through relevant tests to arrive at the stability value of bituminous mix.

CO5: Prepare technical reports for various tests of water and highway materials as lab record with observations, procedures, graphs and diagrams, also have to do oral presentation.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	1		2		1	1						2	1	2
2	1		2		1	1						1	2	
3	1				1	3						1	2	
4	1			2	1	3					1	1	1	
5						3		2				1	2	

25CZCP509	INDUSTRIAL TRAINING / RURAL INTERNSHIP / INNOVATION / ENTREPRENEURSHIP	L	T/TR	S	C
		-	3	3	4

COURSE OBJECTIVES

- To encourage the students to study advanced engineering developments.
- To Prepare and present technical reports.
- To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

METHOD OF EVALUATION

- During the seminar session each student is expected to prepare and present the topic on the relevant engineering project topics for duration of about 8 to 10 minutes.
- In a session of 3 periods per week, 15 students are expected to present the seminar.
- Each student is expected to present at least twice during the semester and the student is evaluated based on that.
- At the end of the semester, he/she can submit a report on his/her topic of seminar and marks are given based on the reports.
- A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.
- Evaluation is 100% Internal.

COURSE OUTCOMES

At the end of the internship, students will be able to

1. Know the advanced engineering developments.
2. Prepare and present technical reports of learning during internship.
3. Able to use various teaching aids such as power point presentation and demonstrative models.
4. Able to present in front of the experts about a topic or technical matters.
5. Able to adapt themselves in the situation needed.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	3	3	2	1	3	3	1	3	1	1	3	2	2
2	2	3	3	2	1	3	3	1	3	1	1	3	2	2
3	2	3	3	2	1	3	3	1	1	1	1	3	2	2
4	2	3	3	2	1	3	3	1	1	1	1	3	2	2
5	3	3	2	2	2	3	3	1	1	1	1	3	2	3

25CZPC501	STRUCTURAL ANALYSIS I	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- Understand the concepts of equilibrium, stability, and determinacy in structures.
- Analyze beams, trusses, and frames using methods like moment distribution, slope-deflection, and energy principles.
- Develop skills to calculate reactions, shear forces, bending moments, and deflections in structural members.
- Apply theoretical knowledge to solve real-world structural engineering problems relevant to Indian construction practices.
- Prepare students for advanced topics in structural analysis and design as per Indian codes and standards (e.g., IS 800, IS 456).

UNIT I FUNDAMENTALS OF STRUCTURAL ANALYSIS

Elastic theorems and energy principles: Strain energy and complementary energy - review of strain energy due to axial load - bending, shear and torsion - principle of superposition - principle of virtual work - Castigliano's theorem for deflection - theorem of complementary energy - Betti's theorem - Maxwell's law of reciprocal deflections - application of method of virtual work (unit load method) and strain energy method for determination of deflections of statically determinate beams

UNIT II ANALYSIS OF TRUSSES

Analysis of determinate trusses - method of joints - method of sections - Deflections of pin-jointed plane frames - lack of fit - change in temperature Analysis of Pin-jointed plane and space trusses by Method of Tension coefficient - Externally and internally redundant trusses - effects of support settlement and pre-strains.

UNIT III MOMENT DISTRIBUTION METHOD

Stiffness - distribution and carry over factors -- Analysis of continuous Beams- Plane rigid frames with and without sway -- Support settlement - symmetric frames with symmetric and skew-symmetric loadings.

UNIT IV SLOPE DEFLECTION METHOD

Slope deflection equations -- Equilibrium conditions - Analysis of continuous beams and rigid frames -- Rigid frames with inclined members - Support settlements - symmetric frames with symmetric and skew-symmetric loadings.

UNIT V CONSISTANT DEFORMATION & STRAIN ENERGY METHODS

Indeterminate Beams and Frames: Deflection of rigid frames of different geometry by consistent deformation method & Strain Energy Methods

TEXTBOOKS

1. Bhavikatti, S.S, Structural Analysis, Vol.1, & 2, Vikas Publishing House Pvt.Ltd., New Delhi-4, 2014.
2. Punmia.B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2004.

REFERENCES

1. William Weaver, Jr and James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, Second Edition, Delhi, 2004
2. Reddy .C.S, "Basic Structural Analysis", Tata McGraw Hill Publishing Company, 2005.
3. Hibbeler, R. C. Structural Analysis. Pearson.
4. Kassimali, A. Structural Analysis. Cengage Learning.
5. Reddy, C. S. Basic Structural Analysis. Tata McGraw-Hill.
6. Ghali, A. Structural Analysis: A Unified Classical and Matrix Approach. CRC Press.

COURSE OUTCOMES

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

CO1: Apply energy concepts and theorems to find the deflection of statically determinate structures.

CO2: Analyse statically determinate trusses and to find the deflections.

CO3: Analyse statically indeterminate beams by moment distribution methods.

CO4: Analyse the continuous beams and rigid frames by slope deflection method.

CO5: Analyse statically indeterminate beams and rigid frames by Consistent Deformation Method.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3					2				2	3	3	
2	3	3					2				2	3	3	
3	3	3					2				2	3	3	
4	3	3					2				2	3	3	
5	3	3					2				2	3	3	

25CZPC502	STRUCTURAL CONCRETE DESIGN II	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the concepts of advanced structural design of building frames, raft foundations, pile foundations and water tanks.
- To enhance the structural design skill to develop confidence in structural design.

UNIT I YIELD LINE THEORY

Introduction to yield line theory of slabs - Application to square, rectangular, triangular and circular slabs with simply supported or fixed boundary conditions subjected to uniformly distributed loads (by upper bound theorem).

UNIT II LIMIT STATE OF SERVICEABILITY

General aspects of serviceability – Service loads- load combination as per code for serviceability Design- Deflection limits as per IS 456-2000- Calculation of deflection of simple flexural members (short and long term) - Estimation of crack width of flexural members.

UNIT III LIMIT STATE DESIGN OF GRADE & ECCENTRIC COMBINED FOOTINGS

Design of grade beam, plinth beams- Design of combined eccentric rectangular footings – Detailing as per SP34.

UNIT IV DESIGN OF RAFT FOUNDATION

Design of Raft foundation (IS:2950 (Part I) -1981) - Design of Strap footings - Reinforcement detailing as per SP 34: 1987.

UNIT V DESIGN OF BORED PILES

Design of Bored Pile foundations with Pile cap for two column loads, three column loads, four column loads IS: 2911 (Part 1/Sec 2)- 2010 – Reinforcement detailing as per SP 34 : 1987

TEXT BOOKS

1. Krishnaraju.N, Advanced R.C.Design, CBS Publishers & Distributors Pvt Ltd, NewDelhi 2012.
2. Punmia.B.C, R.C.Structures - Vol.I & II, Laxmi Publications (P) LTD, New Delhi 1995.
3. S.Unni krishnaPillai and Devdas menon , Reinforced Concrete Design , Tata McGraw-Hill Education Co, New Delhi, 2008.

REFERENCES

1. Johansen, K. W. Yield Line Theory. Cement and Concrete Association.
2. Park, R. & Gamble, W. Reinforced Concrete Slabs. Wiley.
3. Neville, A. M. Properties of Concrete. Pearson.
4. Gilbert, R. I. Reinforced Concrete Design. CRC Press.

5. Punmia, B. C. Design of Reinforced Concrete Structures. Laxmi Publications.

COURSE OUTCOMES

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

CO1: Analyse the slabs by yield line theory.

CO2: Students will understand the principles of the limit state of serviceability.

CO3: Analysis and design of footings using IS 456-2000 guidelines

CO4: The students will have the knowledge of analysis and design of the pile foundation.

CO5: Students will learn the principles and methods for designing bored piles.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3		2	1		3	1					3	2
2		3	3	2					1				3	
3	3	2	1			1			1		1		3	
4		3	2	2		2					1		3	
5	3	2	2			2					1	2	3	

25CZPC503	STRUCTURAL STEEL DESIGN-I	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the fundamentals of the design of steel Structures.
- To design simple steel elements and the corresponding fastening systems.

UNIT I INTRODUCTION TO STRUCTURAL STEEL DESIGN

Limit State Design Concept-Structural Steel Sections-Loads on Structure-Load Combination-Bolted and Welded Connection for Axial Forces-Eccentric Connection With Bolt And Weld

UNIT II CONNECTIONS

Beam to beam connection - framed connection. Beam to column connection - Unstiffened seat connection – stiffened seat connection - double stiffener angle. Moment resistant connections. column and column bases connections subjected to axial and eccentric loads.

UNIT III TENSION MEMBERS

Design of tension members subjected to axial tension- tension member subjected to bending - lug angles. Design of Tension Splice - Concept of Shear lag.

UNIT IV BEAMS

Design of laterally and unsupported supported beam for flexure, shear, web crippling and buckling and deflection. Built-up Beams - cross sections - beams with restrained and unrestrained compression flange.

UNIT V COMPRESSION MEMBERS

Design of compression members with single rolled steel sections - Angle struts. Design of built-up compression members - Design of lacings and battens - Eccentrically loaded column - column splices-(Column bases; simple base-gustad base-column base subjected to moment and axial load-design anchor bolt)

TEXTBOOKS

1. Subramanian.N, Design of Steel Structures , Oxford University Press, New Delhi, 2016.
2. Duggal.S.K , Limit State Design of Steel Structures , Tata McGraw Hill Publication, 2019.

REFERENCES

1. Mark Ambrose, 6th Edition, Handbook of Steel Design. McGraw-Hill Education, New York, NY, 2024.
2. Ramachandra, Virendra Gehlot, Limit State Design of Steel Structures Scientific Publishers, Jodhpur, 2017.
3. Gambir M.L., Fundamentals of Structural Steel Design. Tata McGraw Hill Publication, New Delhi, 2013
4. Bhavikatti.S.S, Design of Steel Structures by Limit State Design, I.K International Pvt.

Ltd., New Delhi 2011.

5. IS 800- 2007, Code of Practice for use of Structural Steel in General Building Construction
Bureau of Indian Standards, New Delhi

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/105105162>
2. <https://nptel.ac.in/courses/105106113>

COURSE OUTCOMES

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

CO1: Apply WSD & LSD methods, analyze steel behavior (stress-strain) & plastic design (hinges, moments) and design of bolted/welded connections (axial & eccentric).

CO2: Calculate the member capacities and connection requirements for different member forces of standard steel structural elements

CO3: Apply tension member design for axial & bending loads and analyze tension splices & shear lag effects.

CO4: Apply design methods for compression members with or without lacings/battens subjected to eccentric loads and design of column splices.

CO5: Apply beam design for flexure, shear, buckling, deflection and analysis for built-up sections and flange restraint effects

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2				1					1	3	3	
2	3	2	3								1	3	3	
3	3	2	3			1					1	3	3	
4	3	2	3			1					1	3	3	
5	3	2	3								1	3	3	

25CZPE504	ENVIRONMENTAL ENGINEERING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

1. To realize the importance of environment for engineering students.
2. To understand the basis of ecosystems
3. To make aware the students about global environmental problems and natural disasters.
4. To give the ideas about advance technologies of engineering that will be useful to protect environment.

UNIT I NATURAL RESOURCES

Forest resources: Use and over-exploitation and deforestation. Water resources: Use and over-utilization of surface and ground water. Dams - benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources

UNIT II ENVIRONMENTAL POLLUTION

Sources, causes, effects and management of air pollution, water pollution, soil pollution and radioactive pollution. Solid waste management

UNIT III ECOSYSTEM AND BIODIVERSITY

Concept of an ecosystem- structure and functions- food chain and food webs Biodiversity-types, Importance and values of biodiversity, India as a mega diversity nation, hot spots of biodiversity, Threats to biodiversity, conservation of biodiversity

UNIT IV GREEN CHEMISTRY

Significance of green chemistry - basic components of green chemistry. Industrial applications of green chemistry-green fuels-green propellants and bio catalysts

UNIT V GLOBAL ENVIRONMENTAL ISSUES AND MANAGEMENT

Water conservation, Rain water harvesting, Climate change, Ozone depletion, Acid rain, Greenhouse effect and global warming. Disaster management- Earthquakes, Floods, Landslides and cyclones.

TEXT BOOKS

1. S.S.Dara , Text book of Environmental chemistry and Pollution Control , S.Chand & Company Ltd, New Delhi, 2011
2. R.Rajagopalan , Environmental Studies , Oxford University Press New Delhi, 2015

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2. Benny Joseph, Environmental Studies. Tata McGraw-Hill Publishing company Limited, New Delhi, 2018.

3. Anubha Kaushik & C.P,Kaushik, Environmental Science and Engineering
New Age International Publishers, 2nd Edition, 2006.
4. Dr.S.Amalraj, Introduction to Environmental Science and Technology Laxmi publications
(P) Ltd, New Delhi , New Edition, 2005.
5. Vidhya Thakur, A Text book of Environmental Science, Scientific Publishers (India) 2019.

COURSE OUTCOMES

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

CO1: Apply the concept of natural resources.

CO2: Implement the remedial measures to control environmental pollution

CO3: Use the concept of conserve the biodiversity

CO4: Apply the components of green chemistry in environment

CO5: Develop remedy for global environmental issues

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	3	3	3	1	3	3	2	2	1	1	3	2	2
2	2	3	3	2	1	3	3	2	2	1	1	3	2	2
3	2	3	3	2	1	3	3	2	2	1	1	3	2	2
4	2	3	3	3	1	3	3	2	2	1	1	3	2	2
5	2	3	2	2		3	3	2	2	1	1	3	2	3

25CZCP507	STRUCTURAL DESIGN AND DETAILING LABORATORY	L	T	P/D	C
		-	-	3	1.5

COURSE OBJECTIVES

- To train the students to know the appropriate detailing of every structural element involved in the field of structural engineering applications and reinforcement bar bending and fitting procedures

LIST OF EXERCISES

Reinforcement details as per SP 34: 1987, IS 13920: 2016.

1. Singly and Doubly Reinforced Concrete Beams
2. Flanged beams: T Beams L Beams
3. Rectangular Continuous Beams
4. Lintel Beams with sunshade
5. Roof Slabs a) One way slab b) Two way slab
6. Continuous Beams and slabs
7. Staircases
8. Isolated Footings: a) Rectangular Column b) Circular Column
9. Reinforcement details as per IS: 2911 (Part 1/Sec 1) - 2010, IS 2911 (Part III): 1980 and SP 34: 1987.
 - a. Pile with Pile cap (Two pile group)
 - b. Pile with Pile cap (Three pile group)
 - c. Pile with Pile cap (Four pile group)
10. Reinforcement details as per SP 34: 1987.
 - a. Cantilever Type Retaining Wall
 - b. Counter fort Type Retaining Wall

TEXTBOOKS

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2. S. N. Sinha "Reinforced Concrete Design" (McGraw Hill)

REFERENCES

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2. Punmia, B.C, "Reinforced Concrete Structure Vol. I", Standard Publishers Distributors, New Delhi, 2007.

STANDARDS

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2. IS 13920: 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces -Code of Practice, Bureau of Indian Standards, New Delhi
3. SP 34: 1987, Handbook On Concrete Reinforcement And Detailing, Bureau of Indian Standards, New Delhi.

4. IS: 2950 (Part I) -1981, Code of Practice for Design and Construction of Raft Foundations, Bureau of Indian Standards, New Delhi
5. IS: 2911 (Part 1/Sec 1)- 2010, Design and Construction of Pile Foundations - Code of Practice, Bureau of Indian Standards, New Delhi.
6. IS 2911 (Part III): 1980, Code of Practice for Design and Construction of Pile Foundation Under-reamed piles), Bureau of Indian Standards, New Delhi,
7. IS 3370 (Part IV):2009, Code Of Practice For Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

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

CO1: Having the knowledge of how to represent the detailing in the form of drawings for practical applications.

CO2: Draw the detailed drawings showing reinforcement details.

CO3: Able to give the reinforcement detailing for the structures like beams, columns, footings, foundations, water tanks, retaining walls, etc.

CO4: Able to understand the codal provisions for detailing of reinforcements and how to implementing the drawings.

CO5: Able to check the bar bending and reinforcement fittings for different structural elements.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2			2						1		3	2
2	3	1		2	1						2		2	2
3	3	2			2						1		2	
4	3	1		2	1						1		2	2
5	3	2	2	1	1					2	1		2	1

25CZCP508	ENVIRONMENTAL & HIGHWAY ENGINEERING LAB	L	T	P/D	C
		-	-	3	1.5

COURSE OBJECTIVES

- To quantify water and wastewater pollutants.
- To determine concentration of air pollutants.
- To analyse the characteristics of water, wastewater and ambient air.
- To study the growth of microorganisms and its quantification.
- To Learn the Principle and Procedure of Testing of Aggregates
- To Learn the Principle and Procedure of Testing of Binding Material

LIST OF EXPERIMENTS FOR ENVIRONMENTAL LAB.

1. Determination of Chloride content in water sample.
2. Determination of Dissolved Oxygen in water sample.
3. Determination of pH in water sample.
4. Determination of Hardness in water sample.
5. Determination of Total Solids (TDS, TSS) in water sample.
6. Determination of Turbidity of various water and wastewater samples using Nephelo Turbidity meter.
7. Determination of Electrical Conductivity of water samples.
8. Determination of Chemical Oxygen Demand for water sample.
9. Determination of Bio - Chemical Oxygen Demand for water sample.
10. Determination of Residual Chlorine in water sample.
11. Determination of Chlorine Demand for water sample.
12. Determination of optimum dosage of coagulant using Jar test apparatus.
13. Determination of infiltration capacity using Double ring in filtrometer.

LISTS OF EXPERIMENTS FOR HIGHWAY ENGG.LAB.

1. TEST ON AGGREGATES

Elongation and Flakiness Index Test
Deval Abrasion Test
Impact Value Test

2. TEST ON AGGREGATES

Penetration Test
Viscosity Test
Softening Point Test
Ductility Test
Flash and Fire point

3. TEST ON BITUMINOUS MIXES

Marshall Stability and Flow Values (**DEMO**)

TEXTBOOKS

1. S.K. Khanna & C.E.G. Justo, Highway Engineering. (Nem Chand & Bros)
2. L.R. Kadiyali, Principles and Practices of Highway Engineering. (Khanna Publishers)

REFERENCES

1. Chandand Bros, Highway Materials and Pavement Testing Nem. Roorkee, Revised Fifth Edition, 2009
2. Methods for testing tar and bituminous materials, IS1201-1978 to IS1220-1978, Bureau of Indian Standards
3. Methods of test for aggregates, IS2386-1978, Bureau of Indian Standards
4. Mix Design Methods Asphalt Institute Manual Series No. 2, Sixth Edition, 1997, Lexington, KY. USA.
5. AWWA, WEF, Standard Methods for the Examination of Water and Wastewater, APHA, 2005.
6. Sawyer, C.N., McCarty, P.L., and Parkin, G.F., Chemistry for Environmental Engineering, 4th Edition, Tata McGraw - Hill Publishing Company Limited, 2000.

COURSE OUTCOMES

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

CO1: Quantify the pollutant concentration in water, wastewater and ambient air and recommend the degree of treatment required for water and wastewater.

CO2: Analyse the survival conditions for the microorganisms and their growth rate.

CO3: Understand the properties and test procedures of aggregate, bituminous materials, composites and recycled waste products.

CO4: Learn the properties of various aggregates and bitumen used as pavement materials through relevant tests to arrive at the stability value of bituminous mix.

CO5: Prepare technical reports for various tests of water and highway materials as lab record with observations, procedures, graphs and diagrams, also have to do oral presentation.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	1		2		1	1						2	1	2
2	1		2		1	1						1	2	
3	1				1	3						1	2	
4	1			2	1	3					1	1	1	
5						3		2				1	2	

25CZCP509	INDUSTRIAL TRAINING / RURAL INTERNSHIP / INNOVATION / ENTREPRENEURSHIP	L	T/TR	S	C
		-	3	3	4

COURSE OBJECTIVES

- To encourage the students to study advanced engineering developments.
- To Prepare and present technical reports.
- To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

METHOD OF EVALUATION

- During the seminar session each student is expected to prepare and present the topic on the relevant engineering project topics for duration of about 8 to 10 minutes.
- In a session of 3 periods per week, 15 students are expected to present the seminar.
- Each student is expected to present at least twice during the semester and the student is evaluated based on that.
- At the end of the semester, he/she can submit a report on his/her topic of seminar and marks are given based on the reports.
- A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.
- Evaluation is 100% Internal.

COURSE OUTCOMES

At the end of the internship, students will be able to

1. Know the advanced engineering developments.
2. Prepare and present technical reports of learning during internship.
3. Able to use various teaching aids such as power point presentation and demonstrative models.
4. Able to present in front of the experts about a topic or technical matters.
5. Able to adapt themselves in the situation needed.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	3	3	2	1	3	3	1	3	1	1	3	2	2
2	2	3	3	2	1	3	3	1	3	1	1	3	2	2
3	2	3	3	2	1	3	3	1	1	1	1	3	2	2
4	2	3	3	2	1	3	3	1	1	1	1	3	2	2
5	3	3	2	2	2	3	3	1	1	1	1	3	2	3

25CZES701	RESEARCH METHODOLOGY	L	T	P/D	C
		2	-	-	2

COURSE OBJECTIVES

- To train the students towards identifying research problems
- To familiarise the students with technical paper and research proposal writing
- To familiarise the students with patenting
- To make the students understand the patent rights
- To familiarise the students with new developments in IPR

UNIT I Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, an analysis, interpretation, Necessary instrumentations.

UNIT II Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT III Nature of Intellectual Property: Patents, Designs, Trade and Copyright - Process of Patenting and Development: technological research, innovation, patenting, and development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT IV Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

REFERENCES

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction" Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
3. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
4. Mayall, "Industrial Design", McGraw Hill, 1992.
5. Niebel, "Product Design", McGraw Hill, 1974.

6. Asimov, “Introduction to Design”, Prentice Hall, 1962.
7. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
8. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

COURSE OUTCOMES

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

CO1: Identify good research problems

CO2: Write sound technical papers and research proposals

CO3: Understand the concepts of patenting

CO4: Understand the patent rights

CO5: Utilize the new developments in IPR

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3		1		1	2	1	1		1	1	2	1	1
2	3		1		1	2	1	1		1	1	2	1	1
3	3		1		1	2	1	1		1	1	2	1	1
4	3	1	1		1	2	1	1	1	1	1	2	1	1
5	3		1		1	2	1	1		1	1	2	1	1

25CZES702	PRESTRESSED CONCRETE	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To inculcate the basics of pre-stressing techniques to understand the design concepts used for design of bridge structures.

UNIT I CONCEPTS OF PRESTRESSING AND LOSSES

Basic Prestressing concepts, Grade of concrete -Grade of steel-Advantages, Principles of prestressing, Methods and systems of prestressing - Classification of prestressed concrete structures- Losses in prestress, Losses in pretensioned and post tensioned beams. Loss due to elastic shortening, creep, shrinkage, relaxation, friction - Approximate percentage of various losses in pretensioned and post tensioned beams.

UNIT II DESIGN OF FLEXURE MEMBERS

Theory and Flexural behaviour of prestressed concrete beams - Design of Prestressed concrete beams - Check for Transfer and ultimate load stages (Limit State Design), calculation of deflections- Design of beams for shear

UNIT III END BLOCK DESIGN, TENSION, COMPRESSION AND COMPOSITE MEMBERS

Design of Anchorage Zone by Guyon's method (simple problems)-Concept of Magnel's method, IS 1343:2012, recommendations. Design of PreStressed Concrete Tie member- Design of PreStressed Concrete Columns -Columns subjected to bending moment and axial compression-- Calculation of stresses at propped and unpropped constructions-Design of shear connectors- Differential Shrinkage stress.

UNIT IV INTRODUCTION TO IRC STANDARDS

Introduction IRC Standards- IRC Truck and Wheeled Loading standards with impact factor — Positioning of IRC loads for maximum moment and shear- Use of Pigeaud's curves- Design of Slab culverts (Using prestressed concrete and Reinforced Concrete) as per IRC: 6-2014 and IRC 21:2000. Detailing aspects as per IRC Standards

UNIT V PRE-STRESSED CONCRETE GIRDERS FOR BRIDGES

Design of Pre-stressed Concrete Bridge Girders- Design and Detailing as per IS 1343:2012, IRC: 6-2016 and IRC 21: 2000. Calculation of Maximum and Minimum pre-stressed forces using Eccentricity charts- Dead load and Live load moments and shears - Cable zone in girder - Check for stresses - Diaphragms- End block - Short-term and long-term deflections

TEXTBOOKS

- Prestressed Concrete by Krishna Raju.N, Tata McGraw Hill, New Delhi, 2022.
- Limit State Design of Prestressed Concrete by V.N. Vazirani and M.M. Ratwani, Tata McGraw Hill Education, 2020

REFERENCES

1. Design of Prestressed Concrete Structures by P.C. Varghese, PHI Learning Private Limited, 2021.
2. Prestressed Concrete Design and Analysis by P.L. Deodhar, Laxmi Publications, 2023.
3. Handbook on Prestressed Concrete Structures by V.K. Raina, Tata McGraw Hill Education, 2017.
4. IS 1343:2012 - Code of Practice for Prestressed Concrete, Bureaus of Indian Standards, New Delhi.
5. IS 456:2000 - Code of practice for Plain and Reinforced Concrete, Bureaus of Indian Standards, New Delhi.

ONLINE RESOURCES:

1. <https://archive.nptel.ac.in/courses/105/106/105106118/>

COURSE OUTCOMES

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

CO1: Analysis of prestressed concrete sections for flexure and calculate the losses

CO2: Analyze prestressed concrete beams for bending and shear, through application of analytical methods and graphical techniques

CO3: Analyze anchorage zones, tension members, and compression members in prestressed concrete sections.

CO4: Apply and implement appropriate design strategies for composite prestressed concrete beams

CO5: Apply the principles of concordant cable, linear transformations, partial prestressing, and circular prestressing in the design of statically indeterminate prestressed structures

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	3		2			1		2		2	3	3
2	3	2	3	1	1			1		2		2	3	3
3	3	2	3		1			1		2		2	3	
4	3	2	3		1			1		2		2	3	3
5	3	3	3		2			1		2		2	3	3

25CZPC703	EARTHQUAKE RESISTANT DESIGN	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To make the students to understand Earthquake excitations are two major dynamic loadings to be considered for many modern civil engineering structures.
- To understand the seismic loadings to ensure the safety and serviceability of structures.

UNIT I INTRODUCTION TO ENGINEERING SEISMOLOGY

Elements of Earth, core, mantle and crust- Engineering Seismology, Plate tectonic theory, originations of earthquake- Volcanic and tectonic origins, Faults, Dips, slips in crust, seismic zoning map of India & its use. Earthquake Effects: Land and rock slides, Liquefaction, Fires, Tsunamis, Floods, Release of poisonous gases and Radiation. Earthquake Phenomenon: - Focus epicentre, Seismic waves, Magnitude, intensity, Richter scale, MM scale, Earthquake recording instruments, and Seismic resistant design guidelines

UNIT II INTRODUCTION TO STRUCTURAL DYNAMICS

Dynamics: Vibration, frequency, D'Alembert's Principle, Dynamic equilibrium equation, inertial force, Damping force, Stiffness force, Mathematical models, and Discrete (lumped parameter) systems: SDOF, MDOF systems, Continuous systems, Formulations of equations of motions for two and three storey building. Free vibration analysis of SDOF systems with and without viscous damping, Experimental methods of assessing viscous damping present in the dynamic systems: logarithmic decrement method, Half power band width method, and simple problems.

UNIT III FORCED VIBRATION ANALYSIS

Forced Vibration Analysis (Harmonic loading) of Single Degree of freedom systems with and without damping under harmonic excitations, Forced vibration response to harmonic base excitation. Formulation of Response Spectrum, Design Response spectrum as per IS:1893-2016, simple problems using the above response spectrums. Forced vibration analysis of multi Degrees of freedom systems (restricted to two degrees of freedom only) using modal superposition technique.

UNIT IV SEISMIC ANALYSIS OF BUILDING FRAMES

Analysis of building frames, Equivalent static method, Response spectrum method as per IS: 1893-2016 Dynamic analysis using mode superposition concept- Push over analysis. Modelling of Building Frames with Brick and Concrete Walls- Centre of Mass locations- Centre of Stiffness locations- Orientation of Shear walls.

UNIT V SEISMIC DESIGN OF BUILDING FRAMES

Philosophy and Principles of Earthquake Resistance design- Strength and Stiffness, Ductility Design and Detailing (IS 13920: 2016), Concept of Energy Absorbing Devices, Concepts of Seismic Base isolation technique and Seismic Active control methods. Lessons learnt from the Past Earthquakes - Case studies of important Indian Earthquakes, Major world Earthquakes.

COURSE OUTCOMES

At the end of the course, the students will be able

CO1: To understand the basics of engineering seismology , earthquake causes , effects and apply to design earthquake resistant design

CO2: To understand the basic concept of structural dynamics and to analyse free vibration of SDOF systems and to asses damping

CO3: To Analyse forced vibration response of SDOF and MDOF system and formulation of response spectrum

CO4: To know seismic analysis methods to building frames and evaluate structural responses

CO5: To understand and apply IS-13920:2016 provisions base isolation and energy dissipation techniques in building design

TEXTBOOKS

- 1.Dowrick, D.J., “Earthquake Resistant Design, John Wiley & Sons”, Winchester, U.K.,1977.
- 2.Paulay, T. and Priestley, M.J.N., “Seismic Design of Reinforced and Masonry Buildings”, John Wiley & Sons, Inc., New York, 1992.

REFERENCES

1. Anil k Chopra, “Dynamics of Structures”, McGraw-Hill International Edition, New Delhi, 1998.
2. Clough, R.W. and Penzien, J., “Dynamics of Structures”, Second Edition, McGraw-Hill International Edition, New Delhi, 1993.
3. Kiyoshi Muto, “Earthquake Resistant Design of Tall Buildings in Japan”, University of California, 1973.
4. Beskos.D.E, “Computer Analysis & Design of Earthquake Resistant Structures- A, Handbook Advances in Earthquake Engineering”, Computational Mechanics Inc, Billerica1997.
5. Hiroshi Akiyama, “Earthquake Resistant Limit State Design for Buildings”,University of Tokyo Press, Tokyo, 1985.
6. Paz, M. and Leigh.W. “Structural Dynamics – Theory & Computation”, 4th Edition,CBS Publishers & Distributors, New Delhi, 2006.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	3	2	2	2	1	1	1	1	2	2	2	2
2	3	2	3	1	1	1	1	1	1	1	2	2	2	2
3	3	2	3	1	1	1	1	1	1	1	2	2	2	2
4	3	3	3	2	3	1	1	1	1	1	2	2	2	2
5	2	1	1	2	2	1	1	1	1	1	2	2	2	2

25CZCP707	FINITE ELEMENT METHODS & EARTHQUAKE ENGINEERING LABORATORY	L	T	P/D	C
		-	-	3	1.5

COURSE OBJECTIVES

- This course aims at providing practical training in understanding the behaviour of the building elements subjected to earthquake.

LIST OF EXPERIMENTS

A) FINITE ELEMENT MODELLING

- 1.Modelling & Analysis of Steel Trusses using Line Model
- 2.Modelling & Analysis pf Building Frames using Line Elements
- 3.Modelling & Analysis of Building Frames Solid Elements
- 4.Modelling & Analysis of Simple Beams with Two Point Loads
- 5.Modelling & Analysis of One Way slab with Two Point loads
- 6.Modelling & Analysis of Portal Frames

B) EARTHQUAKE ENGINEERING

1. Application of accelerometers and their use in structural models
2. Application of digital oscilloscope and their use in structural models
3. Application of signal converter and their use in structural models
4. Free vibration analysis of wooden, Steel and aluminium cantilever beam models.
5. Determination of viscous damping co-efficient for wooden, Steel and aluminium cantileverbeam models.

REFERENCES

1. Alan S Morris, “Measurement and Instrumentation Principles”, Third edition, Butterworth
2. Hienemann, 2001.
3. David A. Bell, “Electronic Instrumentation and Measurements”, Second edition, OxfordPress. 2007.
4. S.Tumanski, “Principle of Electrical Measurement, Taylor & Francis, 2006.
5. Ilya Gertsbakh, “Measurement Theory for Engineers”, Springer Publisher, 2010.
6. Anil K Chopra, “Dynamics of Structures”, McGraw-Hill International Edition, New Delhi, 1998.
7. Clough, R.W. and Penzien, J., “Dynamics of Structures”, Second Edition, McGraw-HillInternational Edition, New Delhi, 1993.
8. Mario Paz, “Structural Dynamics: Theory and Computation”, Van Nostrand Reinhold, New York, 1985.

COURSE OUTCOMES

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

CO1: To Analyse and Design the structural element using FEM Softwares

CO2: To Model the Structures and Analyse using Software packages

CO3: To Measure the Noises and Vibration of Various material using the Instrument and to know the calibration

CO4: To Recommend the material used for construction in the Earthquake prone areas

CO5: Prepare Technical Reports , Diagrams , Calculation , Graphs and Results effectively to communicate to the concerned and also through oral preparations

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	3		2			1		2		2	3	3
2	3	2	3	1	1			1		2		2	3	3
3	3	2	3		1			1		2		2	3	
4	3	2	3		1			1		2		2	3	3
5	3	3	3		2			1		2		2	3	3

25CZCP708	STRUCTURAL ANALYSIS & DESIGN LAB	L	T	P/D	C
		-	-	3	1.5

COURSE OBJECTIVES

- To introduce the fundamentals of structural analysis, design and detailing
- To familiarise the students with the analysis of symmetrical building frames subjected to gravity loading, wind loading and seismic loading using STADD PRO software.
- To familiarise the students with the analysis of unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using STADD PRO Software
- To familiarise the students with the analysis of symmetrical building frames subjected to gravity loading, wind loading and seismic loading using ETABS software
- To familiarise the students with the analysis of unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using ETABS software

LIST OF EXPERIMENTS

1. Analysis of Symmetrical Building Frames subjected to (Gravity load only) uses STADD PRO Software.
2. Analysis of Symmetrical Building Frames subjected to (Wind load only) using STADD PRO Software.
3. Analysis of Symmetrical Building Frames subjected to (Earthquake load only) using STADD PRO Software.
4. Analysis of Un-Symmetrical Building Frames subjected to (Gravity load only) using STADD PRO Software.
5. Analysis of Un-Symmetrical Building Frames subjected to (Wind load only) using STADD PRO Software.

6. Analysis of Un-Symmetrical Building Frames subjected to (Earthquake load only) using STADD PRO Software.
7. Analysis of Symmetrical Building Frames subjected to (Gravity load only) using Etabs Software.
8. Analysis of Symmetrical Building Frames subjected to (Wind load only) using Etabs Software.
9. Analysis of Symmetrical Building Frames subjected to (Earthquake load only) using Etabs Software.
10. Analysis of Un-Symmetrical Building Frames subjected to (Gravity load only) using Etabs Software.
11. Analysis of Un-Symmetrical Building Frames subjected to (Wind load only) using Etabs Software.
12. Analysis of Un-Symmetrical Building Frames subjected to (Earthquake load only) using Etabs Software.

REFERENCES

1. Unnikrishnan Pillai, S. and Devdas Menon, Reinforced Concrete Design, Tata McGraw Hill Publications, New Delhi, 1988.
2. IS 13920:2016, Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces, BIS, New Delhi.
3. SP 34:1987, Handbook on Concrete Reinforcement and Detailing, BIS, New Delhi.
4. STADD PRO Software Working Manual.
5. ETABS Software Working Manual.

COURSE OUTCOMES

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

CO1: To Understand the codal provisions relating to structural design and detailing.

CO2: To model and Analyse symmetrical building frames subjected to gravity loading, wind loading and seismic loading using STADD PRO software.

CO3: To model and Analyse unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using STADD PRO software.

CO4: To model and Analyse symmetrical building frames subjected to gravity loading, wind loading and seismic loading using ETABS software.

CO5: To model and Analyse unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using ETABS software.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	3									3	3	
2	3	3	3									3	3	
3	3	3	3									3	3	
4	3	3	3									3	3	
5	3	3	3									3	3	

25CZCP709	INDUSTRIAL TRAINING / RURAL INTERNSHIP / INNOVATION / ENTREPRENEURSHIP	L	TR	S	C
		-	-	-	4

COURSE OBJECTIVES

- To encourage the students to study advanced engineering developments.
- To Prepare and present technical reports.
- To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

METHOD OF EVALUATIONS

- During the seminar session each student is expected to prepare and present the topic on the relevant engineering project topics for duration of about 8 to 10 minutes.
- In a session of 3 periods per week, 15 students are expected to present the seminar.
- Each student is expected to present at least twice during the semester and the student is evaluated based on that.
- At the end of the semester, he/she can submit a report on his/her topic of seminar and marks are given based on the reports.
- A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.
- Evaluation is 100% Internal.

COURSE OUTCOMES

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

CO1: Know the advanced engineering developments.

CO2: Able to Prepare and present technical reports.

CO3: Able to use various teaching aids such as overhead projectors,
power point presentation and demonstrative models.

CO4: Able to present in front of the experts about a topic or technical matters.

CO5: Able to adapt themselves in the situation needed.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	3	2	1	3	3	1	3	1	1	3	3	2
2	3	3	3	2	1	3	3	1	3	1	1	3	3	2
3	3	3	3	2	1	3	3	1	1	1	1	3	3	2
4	3	3	3	2	1	3	3	1	1	1	1	3	3	2
5	3	3	3	2	1	3	3	1	1	1	1	3	3	3

25CZPV803	PROJECT WORK AND VIVA-VOCE	L	PR	S	C
		-	10	3	6

COURSE OBJECTIVES

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To use knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
- To learn about different methodologies, methods and forms of analysis to produce a suitable research design and justify their design.
- To prepare the final report of project work in standard format.
- To train the students in preparing project reports and to face reviews and viva voce examination

The students will individually undertake research problems in the field of Civil and Structural Engineering in the eighth semester. The student will be guided by a staff member. The progress of the research will be evaluated every month by a team of staff members. The student has to submit the detailed report on the research problem at the end of the eighth semester. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva- voce examination.

COURSE OUTCOMES

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

CO1: Identify real-world civil and structural engineering problems, formulate research questions, and apply appropriate methodologies to address them.

CO2: Demonstrate in-depth knowledge of civil and structural engineering principles, materials, and appropriate methodologies to develop innovative solutions.

CO3: Apply experimental techniques, analytical methods, modelling and computational tools to analyse engineering problems and validate project outcomes.

CO4: Prepare the final project report effectively through written reports, and tables & figures, graphical representations, charts, photographs, diagrams neatly.

CO5: Present their technical findings effectively through oral presentations, and graphical representations while responding to critical questions with clarity.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	3	2	2	1		1			1	3	3	1
2	3	2	2	2	2	1		1			1	3	2	1
3	2	2	3	3	3	1		1			1	2	3	1
4	2	2	2	2	3	1		1			1	2	2	1
5	2	2	2	2	3	1		1			1	2	2	1

LIST OF PROFESSIONAL ELECTIVES

25CZPESCN	BUILDING PLANNING, COST AND ESTIMATION	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- Understand principles of building planning, design, and space utilization.
- Apply building codes, standards, and regulations in planning.
- Analyse site selection and orientation for optimal building performance
- Evaluate sustainability and energy efficiency in building design.
- Plan and manage resources effectively for construction projects.

UNIT I BUILDING PLANNING AND REGULATIONS

Building Planning – Study of general principal of planning – Building Regulations & Guidelines as per Municipal / Corporation (CMDA, DTCP, Chennai Corporation and NBA Norms) – Planning of Residential Building, Public Building and Multi Storeyed Buildings

UNIT II PLANNING OF INDUSTRIAL BUILDING

Study of Industrial Building general principal of planning – Building Regulations & Guidelines as per Municipal / Corporation (CMDA, DTCP, Chennai Corporation and NBA Norms)

UNIT III TOWN PLANNING

History, Ancient plan in India, Origin and Growth of Towns, Satellite Town, Ribbon Development

UNIT IV ESTIMATION OF QUANTITIES

Methods & Types of Estimates, Estimation of Quantities for Earthwork – Brickwork – PCC, RCC, Plastering, Painting – Industrial & Residential Building. Estimation of Slabs, Beams, Brickwork (230mm wall & 115mm Thick walls, Columns, Grade Beams and Footing)

UNIT V SPECIFICATION & RATE ANALYSIS

Specification – Types – Rate Analysis – Purpose & Necessity – Schedule of Rates – Rate Analysis for all Building Work – Detail Estimate and Abstract Estimate

TEXT BOOKS

1. Building Planning and Estimation, M. Chakraborti, M. Chakraborti, 2019
2. Building Materials and Construction, P. C. Varghese, PHI Learning Pvt. Ltd., 2015
3. Estimation and Costing in Civil Engineering, B. N. Dutta, originally published, 1998

REFERENCES

1. Building Estimation and Costing, S.C. Rangwala, Charotar Publishing, 2017

2. National Building Code (NBC) 2016 – BIS (Bureau of Indian Standards)
3. IS 1200 (Parts 1–28) – Methods of Measurement of Building Works
4. CPWD Specifications – Central Public Works Department, 2019
5. MORD Schedule of Rates – For rural infrastructure costing

COURSE OUTCOMES

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

- CO1:** Building planning and evaluate building projects in compliance with regulations, codes and standards ensuring functional, safe, and sustainable structures.
- CO2:** Plan efficient, safe, and compliant industrial buildings, optimizing space, functionality, and structural integrity while adhering to industry standards and regulations.
- CO3:** Planning and developing sustainable, functional, and inclusive urban spaces by applying principles of town planning, zoning, and infrastructure management.
- CO4:** Estimate material quantities, costs, and resources for building projects using standard methods and tools, ensuring efficient project planning and execution.
- CO5:** Prepare detailed specifications, conduct rate analysis, and estimate project costs accurately using standard methods and market rates for construction materials and labor.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3		2		1	2	2	1		2	1	2	2	1
2	3		3		1	2	2			2	2	1	3	2
3	3		1			1				1	1		2	1
4	2	1	2	1	1	2	2	3		2	2	3	1	
5	3		3		1	2	1	1		2	2	3	3	

25CZESCN	HYDRAULIC ENGINEERING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To introduce the students to various hydraulic engineering problems like open channel flows and their computations.
- To understand the methods of dimensional analysis.
- To impart knowledge on characteristics and working principles of hydraulic machines.

UNIT I HYDRAULIC FLOWS

Types of flow in open channels – geometrical properties of channel sections – velocity distribution in a channel section – Chezy's formula – Manning's formula – Most economical sections of a channel – rectangular, trapezoidal, triangular and circular sections – uniform flow computations – specific energy and critical depth – critical flow and its computation.

UNIT II HYDRAULIC JUMPS

Gradually varied flow – dynamic equation – classification of channel bottom slopes – classification of water surface profiles – characteristics of surface profiles – integration of the varied flow equation by the step method. Hydraulic jump in rectangular channels – types of hydraulic jumps – surges in open channels – positive and negative surges.

UNIT III DIMENSIONAL ANALYSIS

Dimensions – Dimensional homogeneity – Methods of dimensional analysis – Rayleigh's method – Buckingham's -method – use of dimensional analysis. Model investigation – similitude – types of similarities – dimensionless numbers – Reynolds, Froude, Euler, Mach and Weber numbers – Model laws – types of models – application of dynamic similarity to specific model investigations

UNIT IV DYNAMIC CHARACTERISTICS OF FLOW

Impulse-momentum principle – dynamic force exerted by fluid jet on the stationary flat plate: (a) plate normal to jet (b) inclined plate – force on moving flat plate – force on the curved stationary plate – force on single moving curved plate – fluid jet on moving curved surface of a turbine blade – velocity diagrams for turbine blades – work done on tangential flow runner – jet propulsion – propulsion of Ships – forces caused by flow round a pipe-bend – angular momentum equation – radial flow over turbine blade – work done by radial runner. Different classification of turbines – Pelton turbine: main components and their functions – design of component parts of Pelton turbine – force, power and efficiency – Francis turbine: different

types – main components – design of components – torque, power and efficiencies – Kaplan turbine: components– force, torque, power and efficiencies – governing of water turbines – selections of turbines.

UNIT V PUMPS

Pumps – classification of pumps – working principle of single acting and double acting pumps – slip and coefficient of discharge – rate of delivery – velocity and acceleration of water – speed indicator diagrams – effect of bent delivery pipe on separation – air vessels – suction in pumps with air vessels – pressure in cylinder on delivery stroke with air vessels –maximum speed of pump with air Vessel – power required to drive the pump fitted with air vessels.

Centrifugal pump - specific speed – layout, accessories and starting of centrifugal pumps –static head, manometric head and gross head – power – overall efficiency – loss of head in pipes and fittings – fundamental equations of centrifugal pumps – work done and manometric efficiency – minimum starting speed – priming of pumps – cavitation in pumps –NPSH – multi-stage pumps – deep well pumps.

TEXT BOOKS

1. Hydraulic machines (including Fluidics), Jagdish Lal, Metropolitan Book Co. Pvt. Ltd. Sixth; Reprint (Edited), 2016
2. Hydraulics and Fluid Mechanics Including Hydraulics Machines, Modi. P.N. and Seth. S.M., 22nd Edition, 2019

REFERENCES

1. Flow in open channels, Subramanya, K., Tata McGraw Hill, New Delhi, 5th edition, 2019.
2. Flow through open channels, Srivastava. R., Oxford University Press, New Delhi, 2008.
3. Open Channel Hydraulics, Ven Te Chow, McGraw Hill, New York, 2009.

WEB REFERENCE

<https://onlinecourses.nptel.ac.in/noc ce35/preview>.

COURSE OUTCOMES

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

- CO1:** Apply knowledge of fluid mechanics in addressing open channel flow problems.
- CO2:** Solve problems in uniform, gradually varied and rapidly varied flow in steady state conditions.
- CO3:** Learn the usage of dimensional analysis and perform model investigation to understand the working principle of pumps.
- CO4:** Understand the working principle of turbines.
- CO5:** Understand the working principle of reciprocating and centrifugal pumps.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	1	1	1		1		1			1	1	1	1
2	3	3	2		1	1		1			1	3	2	1
3	3	1	1	1	1	1		1			1	2	1	1
4	3					1		1			1	1		1
5	3					1		1			1	1		1

25CZPESCN	HIGHWAY ENGINEERING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To impart knowledge on the layout, operations and design of Highways, Railways, Waterways and Airways transportation systems

UNIT I HIGHWAY DEVELOPMENT AND PLANNING

Highway development and planning-Classification of roads, road development in India, Current Road projects in India; highway alignment and project preparation.

UNIT II GEOMETRIC DESIGN OF HIGHWAYS

Geometric design of highways-: Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems

UNIT III TRAFFIC ENGINEERING & CONTROL

Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems

UNIT IV PAVEMENT MATERIALS AND DESIGN

Pavement materials- Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems

UNIT V DESIGN OF PAVEMENTS

Design of pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems

TEXT BOOKS

1. Khanna, S.K, Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised Tenth Edition, Nem Chand & Bros, 2017.
2. Kadiyalai, L.R., Traffic Engineering and Transport Planning, Khanna Publishers.

REFERENCES

1. Principles of Transportation Engineering, Partha Chakraborty, PHI Learning,
2. Principles of Highway, Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski,
3. Engineering and Traffic Analysis, Fourth Edition, John Wiley publisher.
4. Highway Engineering, Srinivasa Kumar, R, Universities Press, 2011.
5. Highway Engineering, Paul H. Wright and Karen K. Dixon, Seventh Edition, WileyStudent Edition, 2009

COURSE OUTCOMES

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

CO1: Carry out surveys involved in planning and highway alignment

CO2: Design the geometric elements of highways and expressways

CO3: To implement the traffic regulation and control measures in intersection design

CO4: Characterize pavement materials and

CO5: Design flexible and rigid pavements as per IRC

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3					1		1			1	1	1	
2	3	1	3	1	1	1		1			1	2	1	1
3	3				1	1		1			1	1	1	1
4	3				1	1		1			1	1	1	1
5	3	1	3		1	1		1			1	2	3	1

25CZPESCN	FOUNDATION ENGINEERING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To impart basic knowledge on design of foundations and its behaviors under different soil conditions to carry out proper foundation design.

UNIT I SOIL INVESTIGATION AND CHOICE OF FOUNDATION

Methods of Soil Exploration - Boring - Sampling - Disturbed and undisturbed Sampling - Sampling techniques - Bore log and soil investigation report - Function and requirements of good foundation - Choice of foundation based on soil conditions.

UNIT II BEARING CAPACITY

Bearing capacity of shallow foundations on homogeneous deposit - Terzaghi's Theory - IS Code method - Field tests - Factors influencing Bearing Capacity - Settlement of foundations - Components of settlement - Allowable and maximum differential settlement - Methods of improving bearing capacity - Methods of minimizing settlements.

UNIT III SETTLEMENT OF SHALLOW FOUNDATIONS

Immediate and consolidation settlements - Differential settlement - Allowable bearing pressure based on tolerable settlement - Plate load test - Provisions of IS 1888 - Interpretation of test results - limitations - Allowable pressure on the basis of settlement criterion for footings on sand on the basis of N value. Allowable bearing pressure for raft foundation on sand - Provisions of IS 8009 (Part 1).

UNIT IV PILE FOUNDATIONS

Types of piles based on their function, composition and method of installation - Determination of vertical load capacity of a single pile - provisions of IS 2911 (Part 1) - static formulae - dynamic pile driving formulae - Engineering News formula - Modified Hiley's equation - pile load test - method of carrying out the test - Determination of allowable load from pile load test data - provisions of IS 2911 (Part 4) - load carrying capacity of piles based on static cone penetration test and standard penetration test results - Group of piles - Number and spacing - pile group efficiency in sands and clays - pile group efficiency equations - settlement of pile groups in clay and sand - examples - Negative skin friction - piles subjected to uplift. Foundations on expansive soil: Identification of expansive soil - Field conditions favoring swelling - Consequences of swelling - concept of under reamed pile - Provisions of IS 2911 (Part 3)

UNIT V EARTH PRESSURE ON RETAINING WALLS

Earth pressure theory - Plastic equilibrium in soils - active and passive state - Rankine's theory - Coulomb's wedge theory - Earth pressure on retaining walls of simple configurations
Stability of retaining wall -Culmann's graphical method for determining earth pressure.

TEXT BOOKS

1. Basic and Applied Soil Mechanics, Gopal Ranjan and Rao, ASR, New Age International (P) Limited Publication, New Delhi, Fifth Edition, 2023.
2. Foundation Engineering (9th Edition), Varghese P.C., McGraw-Hill Education, New York,

REFERENCES

1. Soil Mechanics and Foundation Engineering, K.R. Arora, Standard Publisher Dist., Standard, 2020
2. Soil Mechanics and Foundation Engineering, Geotechnical Engineering Series, Murthy V. N. S., CBS, 2018
3. Principles of Geotechnical Engineering, Braja M. Dass and Khaled Sobhan, Cengage learning, 2017
4. Fundamentals of Geotechnical Engineering, Das, Braja M and Nagaratnam Sivakugan., Cengage Learning, 2017.
5. Geotechnical Engineering, Venkatramaiah, C. New Age International, Sixth Edition, 2018.

ONLINE RESOURCES:

1. <https://archive.nptel.ac.in/courses/105/105/105105176/>
2. National Geotechnical Engineering Society (NGES): <https://www.ngs.org/>
<https://www.ngs.org/>

COURSE OUTCOMES

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

- CO1:** Understand soil exploration methods (boring, sampling), analyze disturbed/undisturbed samples & techniques
- CO2:** Apply Terzaghi & IS code methods to analyze bearing capacity & settlement.
- CO3:** Understand the type of shallow foundations and proportioning them for structural applications.
- CO4:** Understand the necessity for pile foundation and its types, estimating the load carrying capacity of single pile and group piles and their settlement.
- CO5:** Analyze retaining wall stability using graphical methods (Culmann) and concepts (active/passive pressure).

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1		1	2		1			1	2	2	1
2	3	1	1	2		2		1			1	1	2	1
3	3	2	1		1	2		1			1	2	2	1
4	3	2	1		1	2		1			1	2	2	1
5	3	3	2	1	1	2		2			2	3	3	2

25CZPESCN	ADVANCED STRUCTURAL CONCRETE DESIGN					L	T	P/D	C
						3	-	-	3

COURSE OBJECTIVES

- Design for gravity & lateral loads (wind, seismic) as per IS 456 and IS 1893
- Analyse and design water tanks (circular, rectangular) using IS 3370.
- Understand shell structures (domes, hyperbolic paraboloids) and their behaviour under loads.
- Design grid floors (two-way ribbed slabs) for optimized load distribution.
- Learn folded plate structures for long-span roofs and industrial applications.

UNIT I GRAVITY AND LATERAL LOADS

Analysis and design of concrete Building frames: Gravity and lateral loads (wind or seismic)
 - Substitute frame method for gravity loads - Portal and Cantilever methods for lateral loads
 - Analysis and design of two storied two bay concrete Plane frames under gravity and lateral loads- Reinforcement detailing as per SP34: 1987 and IS 13920: 2016.

UNIT II WATER TANKS

Design of square, rectangular and circular shape water tanks resting on the ground - Design of square, rectangular and circular shape water tanks resting underground (IS 3370 (Part IV): 2009) - Reinforcement detailing as per SP 34 : 1987. Design of Concrete Domes - Reinforcement Detailing as Per SP:34 -1987. Introduction to bridge engineering, Investigation for bridges, IRC loadings, Design of slab culvert; Design of Masonry walls and columns.

UNIT III SHELL STRUCTURE

Elements of Differential Geometry, Classifications of Shells, Shells of revolution loaded symmetrically with respect to their axis, Membrane theory, Edge disturbance, Application to conical shells, Spherical shells, Shells of revolution under unsymmetrical loading.

UNIT IV GRID FLOORS

Design of Grid Floors – Reinforcement detailing as per SP 34:1987.

UNIT V FOLDED PLATES

Introduction to Folded Plates, Beam action, Plate action, Stress distribution, Introduction to Simpson method.

TEXT BOOKS

1. Reinforced Concrete Design by S. Ramakrishnan, Tata McGraw-Hill Education Co, New Delhi, 2018.
2. Limit State Design of Reinforced Concrete, by Varghese PC., Prentice Hall of India Pvt. Ltd., 2017
3. Reinforced Concrete Design, S. Unni krishna Pillai and Devdas menon, Tata McGraw-Hill Education Co, New Delhi, 2008.

REFERENCES

1. Fundamentals of Reinforced Concrete, Sinha N.C., and Roy S.K., S. Chand and Company, New Delhi, 2013.
2. IS: 456 - 2000, Indian Standard Code of Practice for Reinforced Concrete, Bureau of Indian Standards, New Delhi.
3. SP- 16 - 2016, Design Aids for reinforced Concrete (Third Revision), Bureau of Indian Standards, New Delhi.
4. SP-34: 2016, Detailing of Reinforcement in Concrete (Second Revision), Bureau of Indian Standards New Delhi
5. Reinforced Concrete Limit State Design, Ashok K Jain, New Chand Bros, Roorkee, 2012.
6. Reinforced Concrete Design by S.N Sinha, Tata McGraw Hill Publishing Co, New Delhi, 2011.

ONLINE RESOURCES

1. <https://nptel.ac.in/courses/105/105/105105105>

COURSE OUTCOMES

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

- CO1:** Identify the material properties of concrete and steel, evaluate the strength parameters as per LSM and IS 456-2000 for computing member capacity.
- CO2:** Analyze and design the beams for flexure, shear, and torsion.
- CO3:** Design the solid slabs to assess ultimate and serviceability limit states using IS 456 - 2000.
- CO4:** Design the columns for axial load and bending load using SP16 interaction charts as per LSM and IS 456-2000
- CO5:** Analysis and design of footings using IS 456-2000 guidelines

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	3	1	2	2	1	1		1	2	3	2	1
2	3	2	3	2	2	1	1	1		1	2	3	3	2
3	3	1	2			1		1			1	3	2	1
4	3	2	2	1	2	1	1			1	2	3	2	1
5	3		3		1		1				1	3	3	

25CZPESCN	REPAIR & REHABILITATION OF CONCRETE STRUCTURES	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- Identify common causes of structural deterioration and assess damage levels.
- Study modern methods for repairing concrete, steel, and masonry structures.
- Analyse cost-effective solutions to restore structural integrity while adhering to codes.
- Gain proficiency in tools like ultrasonic testing, rebound hammer, and infrared thermography for condition assessment.
- Design retrofitting solutions (e.g., jacketing, post-tensioning) to enhance load capacity and extend service life.

UNIT I MAINTENANCE AND REPAIR STRATEGIES

Maintenance, Repair and Rehabilitation, retrofit and strengthening, need for rehabilitation of structures Facets of Maintenance, importance of Maintenance, routine and preventive maintenance, causes of deterioration. Non-destructive Testing Techniques

UNIT II STRENGTH AND DURABILITY OF CONCRETE

Quality assurance for concrete based on Strength and Durability - Thermal properties, microstructure of concrete – packing density- Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion

UNIT III REPAIR MATERIALS AND SPECIAL CONCRETES

Repair materials-Various repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials, Special mortars and concretes- Polymer Concrete and Mortar, Quick setting compounds, Grouting materials-Gas forming grouts, Sulfoalumate grouts, Polymer grouts, Acrylate and Urethane grouts, Bonding agents-Latex Emulsions, Epoxy bonding agents, Protective coatings-Protective coatings for Concrete and Steel, FRP sheets.

UNIT IV PROTECTION METHODS AND STRUCTURAL HEALTH MONITORING

Concrete protection methods – reinforcement protection methods- self-regulating anode - Corrosion protection techniques – Corrosion inhibitors, concrete coatings-Corrosion resistant steels, Coatings to reinforcement, cathodic protection, Structural health monitoring.

UNIT V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES

Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Overlays, Repair to active cracks, Repair to dormant cracks. Corrosion of embedded steel in concrete, Mechanism, Stages of corrosion damage, Repair of various corrosion damaged of structural elements (slab, beam and columns) Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, Reinforced concrete jacketing, steel jacketing, FRP jacketing, Strengthening, Beam shear strengthening, Flexural strengthening

TEXT BOOKS

1. Maintenance and Repair of Civil Structures, Atul Prakashan, 2023.
2. Concrete Repair, Rehabilitation, and Retrofitting, Zbigniew Zembaty, Springer, 2019.

REFERENCES

1. Structural Rehabilitation of Existing Buildings, M.A. Aziz, Springer, 2023.
2. Guide for Evaluation and Repair of Concrete Surfaces, ACI Committee, 546 American Concrete Institute, 2020.
3. Rehabilitation of Buildings and Infrastructure, Edward Heindl, Wiley, 2019.
4. Repair and Rehabilitation of Reinforced Concrete Structures, Franco Antonucci, CRC Press, 2018.
5. Advanced Materials for Rehabilitation and Retrofit of Structures, Michael C. Forde, Springer, 2018.

ONLINE RESOURCES

1. <https://nptel.ac.in/courses/105/106/105106202/>

COURSE OUTCOMES

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

- CO1:** Understand the concepts of maintenance, repair, rehabilitation, retrofit, and strengthening as applied to structures.
- CO2:** Identify and categorize different types of cracks in concrete, understanding their causes and effects.
- CO3:** Select suitable repair materials for various concrete deterioration scenarios, considering their properties, compatibility, and application techniques.
- CO4:** Understand the principles of Concrete protection methods structural health monitoring and its applications
- CO5:** Analyze different beam strengthening techniques for shear and flexure enhancement.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	1	1	1	1	2		1			1	2	1	1
2	3	1				2		1			1	1	1	1
3	3					2		1			1	1	1	1
4	3	1	1	1	1	2		1			1	1	1	1
5	3	2	2	1	1	2		1			1	3	2	1

25CZPESCN	WATER RESOURCE ENGINEERING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.

UNIT I PRECIPITATION AND ABSTRACTIONS

Hydrological cycle - Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges - Spatial analysis of rainfall data using Thiessen and Isohyet methods - Interception - Evaporation. Horton's equation, pan evaporation measurements and evaporation suppression - Infiltration-Horton's equation - double ring infiltrometer, infiltration indices.

UNIT II RUNOFF

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical – Strange's table and SCS methods – Stage discharge relationships flow measurements- Hydrograph – Unit Hydrograph – IUH

UNIT III FLOOD AND DROUGHT

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)

UNIT IV RESERVOIRS

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve

UNIT V GROUNDWATER AND MANAGEMENT

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas

TEXT BOOKS

1. Engineering hydrology, subramanya .K, tata McGraw Hill, 2010
2. Hydrology, jayarami Reddy .P, tata McGraw Hill, 2008.

REFERENCES

1. Groundwater hydrology, David keith todd, john wiley & sons, inc. 2007
2. Applied hydrology, ven te chow, maidment, d.r. And mays, l.w, McGraw Hill international book company, 1998.
3. Hydrology, Raghunath.h.m, wiley eastern ltd., 1998.
4. Groundwater hydrology, Chahar br, McGraw Hill education (india) pvt ltd, New Delhi,

COURSE OUTCOMES

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

CO1: Define the key drivers on water resources, hydrological processes and their integrated behaviour in catchments

CO2: Apply the knowledge of hydrological models to surface water problems including basin characteristics, runoff and Hydrograph

CO3: Explain the concept of hydrological extremes such as Flood and Drought and management strategies

CO4: Describe the importance of spatial analysis of rainfall and design water storage reservoirs

CO5: Apply the concepts of groundwater for water resources management

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	1				1		1			1	1	2	1
2	3	1	3			1		1			1	1	3	2
3	3	1				1		1			1	1	2	1
4	3	1				1		1			1	1	1	1
5	3	1	3			1		1			1	1	3	1

25CZPESCN	VALUATION OF BUILDING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- Explain the historical evolution and interdisciplinary foundations of valuation.
- Classify assets and apply data collection techniques.
- Utilize income, market, and cost approaches to value diverse assets.
- Adhere to professional standards and ethical guidelines on valuation.
- Prepare valuation reports and analyze real-world case studies.

UNIT I FUNDAMENTALS OF VALUATION SCIENCE

Introduction to Valuation -Need, applications, and implications across fields (finance, law, taxation) -Types of assets: Tangible vs. intangible.

Historical Evolution - Global examples (Dutch Tulip Mania, 2008 Financial Crisis) - Indian context (land valuation in Mughal era, post-liberalization reforms) - Activity: Group discussion on historical valuation failures.

UNIT II ASSET CLASSES AND DATA COLLECTION

Asset Classification - Land & Buildings (L&B), Plant & Machinery (P&M), Securities or Financial Assets (SFA) -Niche assets: Plantations, art, agricultural land, mines, digital assets (NFTs).

Data Generation Techniques - Physical surveys, GIS mapping, financial records, market comparable -Challenges in valuing illiquid assets.

Activity - Fieldwork simulation: Survey a hypothetical asset using GIS tools and collect appropriate data.

UNIT III VALUATION APPROACHES AND MODELING

Core Valuation Approaches - Income Approach: DCF, capitalization methods -Market Approach: Comparable transactions, multiples -Cost Approach: Replacement vs. depreciation.

Cross-Verification & Limitations - Reconciling conflicting values, addressing assumptions (e.g., market stability). Activity: Build a DCF model for a startup valuation.

Interdisciplinary Foundations - Economics, statistics, law, sociology, and engineering.

Applications in Practice - Mergers & acquisitions, litigation, insurance, and taxation - Lending by financial institutions - Compensation offered during infrastructure development and national projects Activity: Group discussion on historical valuation failures.

UNIT IV PROFESSIONAL STANDARDS AND REPORTING

Valuation Standards - IVS (International Valuation Standards), RICS guidelines -Indian standards: Insolvency and Bankruptcy Board of India (IBBI).

Ethics in Valuation - Conflicts of interest, confidentiality, bias mitigation.

Report Writing - Structure, data presentation, legal defensibility.

Activity: Critique a sample report for compliance with IVS.

UNIT V PRACTICAL APPLICATIONS AND CAREER PATHWAYS

Case Studies - Corporate bankruptcy valuation, art appraisal disputes, ESG-driven asset pricing.

Career Pathways - Roles in investment banking, real estate, government, consultancy.

Activity: Present a case study on valuing a commercial structure (shopping mall/cinema theatre/hospital).

TEXTBOOKS

1. Fundamentals of Valuation Science Title: Principles and Practice of Valuation P. S. Gahlaut (2023, Chand & Co.)
2. Valuation Standards and Ethics V. S. Pillai (2020, RICS India)

REFERENCES

1. Property Valuation Handbook – B. Kanagasabapathy (2023, McGraw Hill, India).
2. IVSC Guidelines (International Valuation Standards Council, free downloads).
3. IBBI (Insolvency and Bankruptcy Board of India) syllabus for Registered Valuer exams.
4. NISM-Series-XV: Real Estate Valuation Certification.

COURSE OUTCOMES

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

CO1: Understand the need for valuation and its societal impact. Trace historical milestones in valuation, with a focus on India. Identify interdisciplinary contributions to valuation practices.

CO2: Classify major and niche asset categories. Design surveys and data collection frameworks.

CO3: Apply income, market, and cost approaches. Develop valuation models and validate results.

CO4: Apply global and Indian valuation standards. Draft ethical, compliant valuation reports.

CO5: Analyze case studies across industries. Explore career opportunities in valuation.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	1		1	1	2		1				1	1	1
2	3	1		1	1	2		1				1	1	1
3	3	1		1	1	2		1				1	1	1
4	3	1		1	1	2		1				1	1	1
5	3	2		1	1	2		1				1	1	1

25CZPESCN	COASTAL AND OFFSHORE STRUCTURES	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To learn about the various types of structures and their design principles in the nearshore and offshore regions.

UNIT I WAVE KINEMATICS

Conservation laws: Mass, momentum, and Energy. Types of ocean waves. Wave kinematics. Shallow, intermediate, and deepwater conditions. Transformation of waves, wave reflection, wave refraction, wave diffraction.

UNIT II TYPES OF COASTAL STRUCTURES

Introduction to types of coastal structures: Breakwaters, seawalls, revetments, jetties, Groynes. Design standards, Hudson formula.

UNIT III DESIGN OF OFFSHORE STRUCTURE

Introduction to offshore structures: Jacket structures, FPSOs, Jackup platforms, Semi-submersible, Tension Leg Platforms. Added mass and radiation damping.

UNIT IV FORCES ON OFFSHORE STRUCTURE

Calculation of non-breaking wave forces on the slender and large structures. Morrison, Froude Krylov, and Diffraction theory.

UNIT V CODAL STANDARDS FOR THE DESIGN OF OFFSHORE STRUCTURE

Equation of motion. Estimating natural periods in uncoupled and coupled modes. Design aspects using DNV codes: Deterministic and probabilistic approaches.

TEXTBOOKS

- Water wave mechanics for engineers and scientists (Vol. 2), Dean, R. G., & Dalrymple, R. A. (1991), World scientific publishing company.
- Basic wave mechanics: for coastal and ocean engineers, Sorensen, R. M. (1993), John Wiley & Sons.
- Hydrodynamics of offshore structures, Chakrabarti, S. K. (1987), WIT press.

REFERENCES

- Design of Marine Structures in India Dr. K. M. Sivakholundu 2021, IIT Madras Publications
- Guidelines for Coastal Protection Works Central Water Commission (CWC), Govt. Of India 2019
- IRC: SP-58: Guidelines for Bridges in Coastal Zones, 2022
- IS 4651 (Part 1-3): Planning and Design of Ports and Harbors BIS, 2020

COURSE OUTCOMES

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

- CO1:** Analyze ocean wave behavior using conservation laws, classify wave types, and evaluate wave transformations (reflection, refraction, diffraction) in different water depth conditions.
- CO2:** Classify coastal structures (breakwaters, seawalls, revetments, jetties, groynes), explain their functions, and apply design standards such as the Hudson formula for stability analysis.
- CO3:** Analyze and compare different offshore structures (Jackets, FPSOs, Jackups, Semi-submersibles, TLPs) while considering hydrodynamic effects like added mass and radiation damping in their design.
- CO4:** Compute non-breaking wave forces on slender and large offshore structures using Morrison's equation, Froude-Krylov theory, and diffraction analysis.
- CO5:** Able to apply DNV design codes, evaluate natural periods in uncoupled/coupled modes, and implement deterministic/probabilistic approaches for offshore structural analysis.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	1	1	1	2		1			1	2	1	1
2	3		3	1	1	2		1			1	1	1	2
3	3	3	1	1	1	2		1			1	2	2	1
4	3	2	2	1	1	2		1			1	2	2	1
5	3	2	3	1	1	2		1			1	2	2	1

25CZPESCN	ADVANCED CONCRETE TECHNOLOGY	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To provide in-depth knowledge of advanced concrete materials, mix design, durability, and innovative technologies

UNIT I BASIC STRUCTURE

Cement: Hydration of cement and its basic compound, structure of hydrated cement, C-S-H gel, heat of hydration, gel-space ratio and its significance. Aggregate: types, physical properties and standard methods for their determination.

UNIT II FRESH CONCRETE

Properties of fresh concrete including workability, air content, flow ability, segregation, bleeding and viscosity etc. – Factors affecting methods of determination

UNIT III HARDENED CONCRETE

Properties of hardened concrete such as strength, permeability, creep, shrinkage, factors influencing standard tests on fresh and hardened concrete as per IS code. Aggregate– cement interface, maturity concept.

UNIT IV REBOUND HAMMER

Application and use of rebound hammer, ultrasonic pulse velocity meter, Rebound and cover meter half-cell potential meter, corrosion resistivity meter, core sampling

UNIT V COMPACTION OF CONCRETE

Compaction of concrete methods & equipment's, curing of concrete, various methods, their suitability. Durability of concrete.

TEXTBOOKS

1. Concrete Technology: Theory and Practice, M.S. Shetty, 2022
2. Properties of Concrete, A.M. Neville, 2011

REFERENCES

1. IS 456:2000 – Plain and Reinforced Concrete Code of Practice
2. Concrete Microstructure, Properties, and Materials – P. Kumar Mehta
3. IS 10262 (2019): Concrete Mix Design Guidelines

COURSE OUTCOMES

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

CO1: Composition, hydration process, and microstructure of concrete (cement matrix, aggregates, ITZ).

CO2: Evaluate workability, segregation, bleeding, and setting time using tests (Slump, Flow Table, VEBE).

CO3: Analyze compressive, tensile, and flexural strength

CO4: Conduct rebound hammer tests (IS 13311) to estimate in-situ compressive strength.

CO5: Correlate compaction efficiency with strength and durability.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	1		1		2		1			1	1	1	
2	3	1		1		2		1			1	1	1	1
3	3	1		1		2		1			1	1	2	1
4	3	1		1		2		1			1	1	1	
5	3	1		1		2		1			1	1	1	

25CZPESCN	ENGINEERING SEISMOLOGY	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To gain a thorough understanding of engineering seismology, strong ground motion and hazard assessment - To provide a background for the assessment of design-basis ground motion, both in frequency and time domain.

UNIT I INTRODUCTION TO SESIMIC GEOLOGY

Introduction: Seismic and structural geology, Sources of earthquakes, Seismic instrumentation, Stability and Flexure of tectonic plates.

UNIT II SEISMIC WAVE PROPAGATION

Seismic Wave Propagation: Computational aspects.

UNIT III EARTHQUAKE MECHANICS

Earthquake Source Mechanics: Seismotectonic, Electrodynamics, Fault rupture mechanics, Fault plane solutions (PC based) and source parameters.

UNIT IV EARTHQUAKE RECORDS

Earthquake Catalogs and Recurrence Models: Analysis of previous earthquakes.

UNIT V SEISMIC HAZARD ASSESSMENT

Engineering Seismology and Strong Ground Motion: Computational aspects. Probabilistic Seismic Hazard Assessment (PSHA), Numerical Analysis, Seismic hazard maps for India.

TEXT BOOKS

1. Geotechnical Earthquake Engineering, Kramer, S.L., Pearson, 2003.
2. An Introduction to Seismology, Earthquakes and Earth Structure, Stein, S. and Wysession, M., Blackwell Publishing, 2003.
3. Introduction to Seismology, 2nd Ed., Shearer, P.M., Cambridge University Press, 2009.
4. Geodynamics, 3rd Ed., Turcotte, D.L. and Schubert, G., Cambridge University Press, 2014.
5. Quantitative Seismology, 2nd Ed., AKI, K. And Richards, P.G., University Science Books, 2002.
6. Development of Probabilistic Seismic Hazard Map of India, National Disaster Management Authority report.

REFERENCES

1. Design of Concrete Structures, H. Nilson (2020, 15th Ed.)
2. Advanced Reinforced Concrete Design, P. C. Varghese (2016, 2nd Ed.)
3. Concrete Shells and Spatial Structures, H. C. Howland (1990)

COURSE OUTCOMES

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

CO1: Study how earthquakes relate to Earth's structure, plate tectonics, and fault systems.

CO2: Learn how earthquake waves (P, S, surface) travel through the ground and their effects.

CO3: Understand how faults rupture, energy releases, and how quakes are measured (magnitude/intensity).

CO4: Analyze seismograms and strong-motion data to study quake characteristics.

CO5: Predict earthquake risks for engineering design using hazard models and site effects.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3					1					1	2		1
2	3					1					1	2		1
3	3	1			1	1					1	2		1
4	3	2			1	1					1	2		2
5	3	2			1	1					1	2		1

25CZPESCN	IRRIGATION ENGINEERING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To introduce the students to the concept of soil-plant characteristics and their water requirements and to understand the necessity of planning an irrigation system to provide water at the right time and right place.

UNIT I IRRIGATION PRINCIPLES

Need for irrigation – Advantages and ill effects – Development of irrigation – National Water Policy – Tamil Nadu scenario - Physical properties of soil that influence soil moisture characteristics – Concept of soil water potential and its components: Gravitational and Osmotic pressures- Retention of water in soils - Concept of available water — Movement of water into and within the soils — Measurement of soil moisture content.

UNIT II CROP WATER REQUIREMENT

Necessity and importance– Crop and crop seasons in India –Duty, Delta, Base Period– Factors affecting Duty-Irrigation efficiencies– Consumptive use of water-Irrigation requirements of crops - Standards for irrigation water- Planning and Development of irrigation projects.

UNIT III DIVERSION AND IMPOUNDING STRUCTURES

Head works –Weirs and Barrages –Types of impounding structures - Factors affecting, location of dams -Forces on a dam -Design of Gravity dams; Earth dams, Arch dams — Spillways -Energy dissipaters.

UNIT IV CANAL IRRIGATION

Classification of canals- Alignment of canals – Design of irrigation canals– Regime theories - Canal Head works – Canal regulators - Canal drops – Cross drainage works – Canal Outlets, Escapes – Lining and maintenance of canals – Other methods of Irrigation: Surface, Subsurface – Merits and Demerits.

UNIT V IRRIGATION WATER MANAGEMENT

Modernization techniques — Rehabilitation — Command Area Development - Systems of rice intensification - Water delivery systems - Participatory Irrigation Management — Farmers’ organization and turn over – Water users’ associations - Economic aspects of irrigation.

TEXT BOOKS

1. Irrigation Engineering, Sharma, R.K., and Sharma, T.K., S. Chand and Company, New Delhi, 2008.
2. Irrigation Engineering, Michael, A.M., Vikas Publishers, New Delhi, 2008.
3. Irrigation Engineering, Garg, S.K., Laxmi Publications, New Delhi, 2008.
4. Irrigation, Water Power and Water Resources Engineering, Arora, K.R., Standard Publishers Distributors, New Delhi, 2009.
5. Irrigation Engineering, Basak, N.N., Tata McGraw-Hill Publishing Co, New Delhi, 2008.
6. Irrigation Water Management, Dilip Kumar Majumdar, Prentice-Hall of India, New Delhi, 2008.
7. Irrigation and Water Power Engineering, Punmia, B.C., Laxmi Publishers, New Delhi, 2008.

REFERENCES

1. Irrigation Engineering and Hydraulic Structures, Santosh Kumar Garg
2. Principles of Irrigation Engineering, Frederick Haynes Newell & Daniel William Murphy
3. IS 6966 (1994): Hydraulic Design of Barrages and Weirs
4. Water Resources Engineering, Larry W. Mays

COURSE OUTCOMES

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

CO1: Describe the national water policy structure and soil plant water characteristics

CO2: Describe the basics of requirements and estimation of crop water

CO3: Design the various types of hydraulic structure includes dams, spillways and dissipaters

CO4: Design the components of irrigation canal includes canal drops and cross drainage works

CO5: Apply the concepts to Irrigation water management, water user association for participatory irrigation management

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3		1										2	
2	3	2	3	3								2	2	2
3	3		3	3	2							2	3	1
4	3	2			2							1	2	
5	2		2	2				3					3	

25CZPESCN	URBAN AND RURAL PLANNING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To enable students to develop knowledge on Urban and rural planning.
- To introduce the regulations and laws related to urban planning.
- To educate the importance of zoning in planning.
- To get to know the principals involved in planning public buildings.

UNIT I OBJECTIVES OF TOWN PLANNING

Objectives of town planning–Economic justification–Principles of Town Planning–Necessity of Town Planning–Growth of Towns– Natural and planned growth–stages in Town Development– Distribution of Land use–Forms of planning–Development of Town Planning in Ancient India–Concepts of Modern Town Planning and its stages.

UNIT II IMPORTANCE OF SURVEY AND ZONING

Types of surveys–Collection of Data– Importance of zoning– Classification of Zoning–Use of zoning– Height zoning–Density zoning –Housing–Planning of neighbouring units–Types of Layouts – Classification of housing– Housing problems in India.

UNIT III IMPORTANCE OF PARKS AND PLAYGROUNDS

Parks and Playgrounds–Schools–Public buildings and Town Centres– Industries– Industrial Estates– Communication and Traffic system–Traffic surveys –Traffic congestions– Types of road junctions– Parking facilities –Street lighting.

UNIT IV NECESSITY OF PLANNING

Urban Renewal – Re planning of the existing towns – Objects of replanning–Necessity of Re planning – Advantages of Master plan– Data and Maps–Features of Master plan–Implementation of Master Plan– Planning law and Legislation in India–Building Byelaws– Functions of Local authority–Development – Control Rules for Metropolitan and District Municipalities.

UNIT V CONCEPT OF RURAL PLANNING

Concept of rural planning–Urban and Rural differences– Urbanization –Principles of Rural planning– Village redevelopment–Integral Rural development program–Rural housing–Principles–Design of Rural Housing–Rural Housing schemes –Group housing–Environmental Sanitation in Rural planning– Usage of low-cost materials.

TEXT BOOKS

1. Fundamentals of Town Planning, Hiraskar. K.G., Danpatrai & Sons., New Delhi, 2012
2. Town Planning, Charotar, Rangwala. S.C., Publishing House Pvt. Limited, Gujarat, 2009.

3. Chennai Metropolitan Development Authority, Second Master Plan for Chennai, Government of Tamil Nadu, Chennai, 2008.
4. Tamilnadu Town and Country Planning Act 1971, Government of Tamil Nadu, Chennai.
5. Goel. S.L., Urban Development and Management, Deep and Deep Publications, New Delhi, 2002.
6. Human Settlements —A Planning Guide to Beginners, Thooyavan. K.R., M.A. Publications, Chennai, 2005.

REFERENCES

1. Urban Development in India, K.C. Sivaramakrishnan
2. Rural Development: Principles, Policies, and Management, Katar Singh
3. Urban Planning and Development, S.K. Kulshrestha

ONLINE RESOURCES

1. Ministry of Housing and Urban Affairs (MoHUA) - mohua.gov.in

COURSE OUTCOMES

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

CO1: To enable students to develop knowledge Principles of Town Planning

CO2: To understand the Types of surveys and Importance of zoning

CO3: To introduce the regulations and laws related to urban planning

CO4: To know the principals involved in planning public buildings

CO5: To know about the Planning and Principles of Rural Housing Schemes

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3		1	2	1	2			3	1		1	2	1
2	3	1	3	2	2	1		1	2	1		1	3	2
3	3	2	2	1	1			2	2	1		2	2	1
4	2	2	1	2	1	2		1	1	2		2	2	1
5	3	2	3	1	2	1		2	1	2		2	3	1

25CZPESCN	RAILWAY ENGINEERING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- Design tracks, ballast, and alignments as per IRC/Indian Railways standards.
- Analyse signalling & interlocking systems (CCTV, RFID, Kavach).
- Plan high-speed & metro rail projects (e.g., Bullet Train, RRTS).
- Maintain bridges, tunnels, and rolling stock for safety & efficiency.
- Implement sustainable practices (electrification, solar-powered stations).

UNIT I INTRODUCTION TO RAILWAY ENGINEERING

Introduction, Permanent way, gauges, wheels and Axles, Locomotives and Wagons.

UNIT II RAILWAY TRACK CROSS SECTIONAL DETAILS

Rail section, Rail length, Tests and Failures, sleepers, sleeper density, spacing, type of sleepers, Ballast.

UNIT III TRACK FASTENINGS AND ALINGMENT

Traction and Resistances, Hauling capacity and Tractive effort, Track modulus. Track stresses – vertical, lateral, longitudinal, Stresses in Rails, Sleepers, and Ballast, Formation, Joints in Rails – Types and Requirements. Fastenings for Rail-to-Sleeper, Track Alignment – Need, Requirements, Selection factors.

UNIT IV TRACK GRADIENTS AND SIGNALLING

Speed on track – Safe, Permissible, Equilibrium, can't excess, can't deficiency, Transition curves, Widening at curve, clearances, Gradients. Widening at curve, clearances, Gradients, Vertical curves; Realignment of curves; Turnouts – Types and Design, Crossings - Types and Design. Track Junctions and Design; Signals – Classification and functions, Types of signals, Signal placements; Interlocking of tracks – Standards, Principles, Isolation.

UNIT V TRACK MAINTENANCE

Interlocking on tracks: Key, Mechanical, Route Reply, Electrical, Electronic interlocking; Train Control Systems: Block and non-block systems; Railway stations – Types, Yards, Level crossings. Maintenance of Tracks: Criteria, Mechanical, Measured Shawal Packing, Direct Track maintenance, maintenance equipment; Drainage of Tracks – surface and subsurface, At stations, in yards, High Speed Rails – Technologies and Requirements.

TEXT BOOKS

1. Basic Concepts of Signal Engineering, <https://ecr.indianrailways.gov.in/cris/uploads/files/1603174622179.pdf>
2. Basic of Track Structure and Components, Indian Railways Center for Advanced Maintenance Technologies, IRCAMT, Maharajpur, Gwalior, 2023
3. Basics of Railway Signal Engineering by G V Rao, ITD-2, Indian Railways Institute of Signal Engineering and Telecommunication, IRISSET, Secundrabad

4. Handbook on welding techniques, Indian Railways Center for Advanced maintenance Technologies, IRCAMT, Maharajpur, Gwalior

REFERENCES

1. Indian Railway Track Manual (IRTM), Indian Railways (Ministry of Railways)
2. Railway Track Engineering, J.S. Mundrey
3. Guidelines for Modern Track Maintenance, RDSO (Research Designs & Standards Organisation)

COURSE OUTCOMES

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

CO1: Basics of railways, history, and their role in transport.

CO2: Components like rails, sleepers, ballast, and formation layers.

CO3: Types of rail joints, clips, and proper track positioning.

CO4: How slopes (gradients) and bends (curves) affect train movement. Different signals (semaphore, colour-light) and safety systems.

CO5: Methods to inspect, repair, and keep tracks in good condition.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	2									1	2	
2	3			2									2	2
3	3	2	3									1	3	2
4	3	2	3	3								1	3	3
5	3	1		2								1	3	2

25CZPESCN	DESIGN OF LOAD BEARING STRUCTURES	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- Masonry structures need not always be less strong in comparison to structures constructed with other materials.
- If proper principles of analysis and design are scientifically adopted and innovative approach is followed, masonry structures can be as strong and functional as other structures.
- This course deals with the scientific approach to be followed in the design of masonry structures.

UNIT I INTRODUCTION TO MASONRY CONSTRUCTION

Historical development – Classification of masonry construction – Codes and standards-

Types of masonry walls – Bricks, Mortar, Grout and Steel reinforcement – Characteristics and Requirements-Loads types and intensities – Basic design data.

UNIT II REINFORCED MASONRY DESIGN

Basis of reinforced masonry design — Resistance to axial load, bending, shear — Design of reinforced masonry walls, masonry beams, masonry columns and masonry retaining walls- Detailing of reinforced masonry.

UNIT III PRESTRESSED MASONRY DESIGN

Basis of prestressed masonry design – Basic principles – Design strength – Vertical and Horizontal shear stress – Principal tensile stress – Design of cavity walls, Fin walls, Diaphragm retaining walls and Post – tensioned beams – Detailing of prestressed masonry.

UNIT IV JOINTS AND CONNECTION DESIGN

Connections and joints – Connection resistance – Design considerations – Connection details – Types – Seismic separations – Control joints – Expansion joints.

UNIT V SPECIAL DESIGNS

High-rise masonry – Design factors – Reinforcing details – Floor systems – Construction techniques.

TEXT BOOKS

1. Reinforced Masonry Design, Robert Schneider, R., and Walter Dickey L., Englewood Cliffs, N.J.: Prentice Hall, USA, 1980.
2. Design of Reinforced and Prestressed Masonry, Curtin, W.G., Shaw G., and Beck J.K., Thomas Telford, London, 1988.

REFERENCES

1. An Introduction to Load Bearing Brickwork Design, Hendry, A.W., SinhaB.P, and Davies. R., Chichester, E.Horwood, Halsted Press, Sydney, 1981.
2. Elements of Load Bearing Brick Work Design, David Lenczher, Pergamon Press, London, 1972
3. Brick and Reinforced Brick Structures, Dayaratnam, P,Primlani M,for Oxford & IBHDistributed by South Asia Books, New Delhi, 1987.

COURSE OUTCOMES

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

CO1:To understand the scientific approach to be followed in the design of masonry structures.

CO2:To analyze the application masonry materials and design related to civil engineering problems.

CO3:To know the testing of masonry structures.

CO4:To know where and how to construct the expansion joints in brick masonry structures.

CO5:To design the pre-stressed brick masonry structures.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	3	2	1	2		1			1	2	2	1
2	3	2	3	2	1	2		1			1	2	3	2
3	3	2	1	2	3	2		1			1	2	2	1
4	3	2	1	2		2		1			1	2	2	1
5	3	2	3	2	2	2		1			1	2	3	1

25CZPESCN	PREFABRICATED STRUCTURES	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- Understand Principles of Prefabrication
- Learn Manufacturing & Erection Techniques
- Master Design Principles for Prefab Structures
- Evaluate Joints and Connection Systems
- Design for Abnormal Loads

UNIT I PRINCIPLES OF PREFABRICATION

Types of prefabrication - Advantages and disadvantages of prefabrication-Economy of prefabrication - Modular coordination - Standardization - Prefabrication system and structural schemes - Prefabricated elements - Beams - Columns - Slabs-Roof and floor panels - Wall panels — Staircase.

UNIT II MANUFACTURING AND ERECTION TECHNIQUES

Standard practices and techniques of precast concrete manufacturing and handling - Cycle of precasting - Reinforcement- Preparation of moulds -Preparation and transportation of concrete- Production tolerances -Transportation and erection of prefabricated elements - Equipments for handling precast elements.

UNIT III DESIGN PRINCIPLES

Disuniting of structures-Structural behaviour of precast structures - Handling and erection stresses - Design of cross section based on efficiency of material used- Problems in design because of joint flexibility-Allowance for joint deformation.

UNIT IV JOINTS AND CONNECTIONS

Types of precast element connections - Column to foundation connections -Column to column connections-Beam to column connections-Beam to beam connections-Floor to beam connections- Wall to wall connections- Joints for different structural connections - Dimensioning and detailing of joints for different structural connections - Construction and expansion joints in precast construction.

UNIT V DESIGN PRINCIPLES FOR ABNORMAL LOADS

Code provisions- Equivalent design loads for considering abnormal effects such as earthquakes, cyclones - Progressive collapse -Importance of avoidance of progressive collapse

TEXT BOOKS

1. Precast Concrete Handbook, by PCI Committee on Buildings, 9th Edition, Precast / Prestressed Concrete Institute, Chicago, 2017.
2. Precast Concrete Construction, by Menn, C., Ernst & Sohn, Berlin, 2016.
3. Precast concrete materials, Manufacture properties and usage, by Levit M., Applied Science Publishers, London, 2000.
4. Precast concrete Connection Details, Structural Design Manual, Society for the Studies in the use of Precast Concrete, Netherland Behor Verlag, 2009.
5. Precast Concrete Structures, by Nawy, E.G, John Wiley & Sons, Hoboken, NJ, 2013.

REFERENCES

1. IS 15627:2008 Precast Concrete Blockwork for Load-Bearing Walls, Bureau of Indian Standards (BIS)
2. IS 15916-2010: Indian Standard Code of Practice for Building Design and erection using Prefabricated Concrete, Bureau of Indian Standards, New Delhi.

ONLINE RESOURCES

1. <https://archive.nptel.ac.in/courses/124/105/124105013/>

COURSE OUTCOMES

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

CO1:Evaluate and select appropriate prefabrication systems and elements based on economic, standardization, and structural considerations.

CO2:Plan and manage the precast concrete production process, including reinforcement, mold preparation, concrete handling, transportation, and erection, ensuring quality and safety.

CO3:Design precast concrete structures for efficient material use, considering handling and erection stresses, joint flexibility, and potential deformation issues.

CO4:Develop and detail efficient and structurally sound connections for precast elements, ensuring proper load transfer and stability.

CO5:Analyze robust design solutions for precast structures using relevant code provisions and methods, addressing abnormal loads and ensuring progressive collapse resistance.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3					2					1		2	
2	3		3		2	2					1		2	2
3	3	3			2	2					1		2	1
4	3	3	3		2	2					1		2	2
5	3	3	3		1	2					1		2	2

25CZPESCN	SOLID WASTE MANAGEMENT	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVE

- To make the students conversant with the types, sources, composites, characteristics of uses

UNIT I SOURCES AND CHARACTERISTICS

Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management –Social and Financial aspects — solid waste , rules 2016 — integrated solid waste management-Public awareness; Role of NGO“ s- Public Private participation

UNIT II ON-SITE STORAGE AND PROCESSING

On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and environmental aspects of open storage – waste segregation and storage — case studies under Indian conditions — source reduction of waste — Reduction, Reuse and Recycling of plastic waste –Construction and Demolishing waste.

UNIT III COLLECTION AND TRANSFER

Methods of Residential and commercial waste collection — Collection vehicles — Manpower — Collection routes — Analysis of collection systems; Transfer Stations — Selection of location, operation & maintenance; options under Indian conditions – Field problems- solving.

UNIT IV OFF-SITE PROCESSING

Objectives of waste processing — Physical Processing techniques and Equipment; Resource recovery from solid waste composting and biomethanation; Thermal processing options — case studies under Indian conditions.

UNIT V DISPOSAL

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 capping –Biomining.

TEXT BOOKS

1. Solid and Hazardous Waste Management, Cherry P M, CBS publishers and distributors Pvt Ltd, 2018
2. Solid and hazardous waste management — Rao M.N, Razia Sultana, Sri Harsha Kota,

Science and Engineering, Butterworth-Heinemann, 2016

3. Integrated Solid Waste Management, George Tchobanoglous, Hilary Theisen and Samuel A. Vigil, Mc-Graw Hill India, First edition, 2015
4. Manual on Municipal Solid waste management, CPHEEO, Vol I, II and III, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2016.

REFERENCES

1. Solid Waste Engineering - William A. Worrell, P. Aarne Vesilind, Christian Ludwig, A Global Perspective, 3rd Edition, Cengage Learning, 2017.
2. Environmental Resources Management, Hazardous waste Management, Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and Mc-Graw Hill International edition, New York, 2010.
3. Waste Management Practices, John Pitchtel, CRC Press, Taylor and Francis Group, 2014.
4. Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, Gary C. Young, Wiley, 2010

COURSE OUTCOMES

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

CO1: Understand the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management

CO2: Explains the segregation of solid waste and the onsite storage methods

CO3: Explains the various transfer methods and to know the site condition for the transfer station

CO4: Select appropriate methods for processing and disposal of solid and hazardous wastes, taking into account the impact of the solutions in a sustainability context

CO5: Knowledge about selection of appropriate disposal methods and its handling in an efficient manner

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	3	3	2	2						3	3	2
2	3	2	3		2	1						2	2	2
3	3	3	3	2	2	1						3	2	2
4	2	3	2	2	2	1						3	2	2
5	3	3	3	2	2	1						3	3	2

25CZPESCN	TRAFFIC ENGINEERING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVE

- To give an overview of Traffic engineering, various surveys to be conducted, traffic Regulation, management and traffic safety.

UNIT I TRAFFIC CHARACTERISTICS

Road Characteristics – Classification – Functions and standards – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India.

UNIT II TRAFFIC SURVEYS

Traffic Surveys – Speed, journey time and delay surveys – Vehicle Volume Survey – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – level of service – Concept, application and significance.

UNIT III TRAFFIC ENGINEERING REGULATION AND CONTROL

Capacity of Rotary intersection and Design – Capacity of signalized intersections – Traffic signals, warrants, type – Design and coordination – Intersection channelization – Grade separation - Traffic signs and road markings.

UNIT IV TRAFFIC SAFETY AND ENVIRONMENT

Road accidents – Causes, effect, prevention, and cost – street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, health effects and abatement measures.

UNIT V TRAFFIC MANAGEMENT

Area Traffic Management System — One way street system, exclusive traffic lanes, tidal flow operation, staggering of work hours and road pricing – non-Road pricing options – Parking charges, public transport, Subsidies, Vehicle License fees, Road Building, Permit system, Physical Traffic Management Transport System Management (TSM) and Transport Demand Management (TDM)-

- Introduction to Intelligent Transportation Systems (ITS) - ITS Applications in Traffic Management.

TEXT BOOKS

1. Traffic Engineering and Transport Planning, Kadiyali. L.R. Khanna Publishers, Delhi, 2008.
2. A Highway Engineering, Khanna.K and Justo C.E.G. and Veeraragavan, Nem Chand Bros., Roorkee, Revised 10th Edition, 2014.
3. Introduction to Traffic Engineering, Srinivasa Kumar, Universities Press, 2018
4. Principles of Transportation Engineering, Partha Chakroborty and Animesh Das PHI Learning Pvt. Ltd., 2011.
5. Transportation Engineering and Planning, Papacosta. P. S and Prevedouros.P.D, third edition,
6. Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions, Hargreen Publishing Company, 1998.

REFERENCES

1. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
2. Traffic Simulation for Indian Conditions P. Vedagiri, IIT Bombay, 2020
3. IRC Standards (Indian Road Congress), IRC: 93-1985 – Guidelines for Traffic Rotaries, IRC: SP: 41-1994 – Traffic Impact Assessment, IRC: 106-1990 – Signal Design.
4. Indian Highway Capacity Manual (Indo-HCM) CSIR-CRRI (2017), <https://crridom.gov.in/>

COURSE OUTCOMES

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

CO1: Understand the principles and standards adopted in Planning and Design of Traffic system.

CO2: Apply the knowledge of science and engineering fundamentals in conducting traffic surveys and analyze the problems.

CO3: Designing various types of control and regulatory measures to meet an efficient traffic network

CO4: Select appropriate methods to ensure the safety of the road users and analyze the environmental issues related to traffic network.

CO5: Understand various traffic management measures in addressing the demand, pricing and ITS applications.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1		2		1	2	1		1	2	1
2	3		3	2	1	1			2			1	3	2
3	3	2	1	2	2	1	1		1	1		1	2	1
4	2	2	3	1	2	2	1					1	2	1
5	3	1	3	1	2	2		1	3	3		2	3	2

25CZPESCN	TOWN PLANNING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To enable students to develop knowledge on Urban and rural planning.
- To introduce the regulations and laws related to urban planning.
- To educate the importance of zoning in planning.
- To get to know the principals involved in planning public buildings.

UNIT I INTRODUCTION TO PLANNING - SCOPE AND CONTENT

Planning System in India, Regional Plan, Master Plan, Structure Plan, Detailed Development Plans, City Corporate Plan and Smart City Plan. New Town concepts, case studies in India & U.K.
 - Concept of Region, Types of Regions, Techniques of Regional Analysis, Growth Model, Regional disparities, Resources in Regional development. Multi-level Planning Regional Planning in India, Regional Plan case Studies, USA, U.K., Japan.

UNIT II PLANNING THEORY AND TECHNIQUES

Process of evolution of human settlement planning Principles in Planning Rationality in Planning, Blueprint and Process mode, Disjointed Incremental mode of Planning, Normative versus Functional mode of Planning Type of planning surveys, data identification for various plan preparation. Delphi, Trade off-game, Simulation models, Gravity analysis, Lowry model, Threshold analysis, Multivariate analysis Optimization and economic analysis methods in project formulation and implementation, PBBS - URDPFI Guidelines.

UNIT III URBAN SOCIOLOGY, ECONOMICS, GEOGRAPHY: THEORIES AND APPLICATIONS

Socio-economic groups, structures and Institutions as related to urban and rural communities - Ecological processes and structures in Indian Cities -Social Change & Economic Development - Agglomeration economics-Economics of scale, Multiplier effect concept, scope, limitation - Basic and on-basic activities of economics base, methods of base identification -Land-use determinants, Locational Dynamics of urban Land-use - Spatial organization of Urban settlements - City-region, Urban Sprawl and Fringe -Urbanization in India and Tamil Nadu with reference to settlements and population distribution.

UNIT IV ENVIRONMENTAL ISSUES RELATED TO PLANNING

Components of Environment - Classification of Environmental Resources -Purpose and Objectives in Environmental Protection Institutional and Legal Support in management of the Environment Environmental Policies, and issues -Environmental Impact Assessment Practice in India Types, Conceptual Approach and Phases of EIA Impact Identification Public Participation in the Process of Environmental Decision Making Process Environmental Concepts Sustainable Planning - Eco Cities, Compact Cities, Smart growth, Sponge city, IGBC Rating Systems applicable for Towns.

UNIT V URBAN INFRASTRUCTURE NET WORK PLANNING ISSUES

Obligatory and Discretionary Services, Implication of Urban Form and Size on Services, Norms and Standards, National Building Code, 2016. National and Local guidelines - Demand Strategy, Issues and Tasks, Operation and Management Aspects of each Service -Water Supply, Sewerage /Drainage, Solid Waste Management, Roads and Street Lighting Priority, Placement Network Options, Effective System Analysis - Private and Public partnership and innovative concepts and practices in Infrastructure Development.

TEXTBOOKS

1. Fundamentals of Town Planning, Hiraskar. K.G., Danpatrai & Sons., New Delhi, 2012
2. Town Planning, Rangwala. S.C., Charotar Publishing House Pvt. Limited, Gujarat, 2009.
3. Development and Management, Goel. S.L., Urban Deep and Deep Publications, New Delhi, 2002.
4. Human Settlements —A Planning Guide to Beginners, Thooyavan. K.R., M.A.Publications, Chennai, 2005.

REFERENCES

1. Chennai Metropolitan Development Authority, Second Master Plan for Chennai, Government of Tamilnadu, Chennai, 2008.
2. Tamilnadu Town and Country Planning Act 1971, Government of Tamilnadu, Chennai.
3. Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines Ministry of Urban Development (MoUD), Govt. Of India (2014, updated 2021)
4. National Urban Policy Framework (NUPF) NITI Aayog (2018)

ONLINE RESOURCE

1. Atal Mission for Rejuvenation and Urban Transformation (AMRUT) MoHUA Portal (mohua.gov.in)

COURSE OUTCOMES

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

- CO1:** To enable students to develop knowledge Principles of Town Planning
- CO2:** To understand the Types of surveys and Importance of zoning
- CO3:** To introduce the regulations and laws related to urban planning
- CO4:** To know the principals involved in planning public buildings
- CO5:** To know about the Planning and Principles of Rural Housing Schemes

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3				1	3					1	2		2
2	3				1	3					1	2		2
3	3					3						2		1
4	3					3						2		1
5	3		3			3						2		1

25CZPESCN	REMOTE SENSING AND GIS	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- Learn the fundamentals of remote sensing (spectral signatures, resolutions) and GIS (spatial data models, coordinate systems).
- Analyze techniques (stereo pairs, photogrammetry) for terrain mapping and 3D modeling.
- Explore multispectral, hyperspectral, and LiDAR data for land cover classification.
- Develop skills in spatial analysis (buffering, overlay), database management, and cartography.
- Implement RS & GIS in urban planning, disaster management, agriculture, and environmental monitoring.

UNIT I PRINCIPLES AND CONCEPTS

Definition - Historical Importance of remote sensing - Principles - and methods of remote sensing - Electromagnetic spectrum Electromagnetic Radiation and radiation sources - Interference - Atmospheric effects on remote sensing - Energy interaction with energy surface features.

UNIT II AERIAL PHOTOGRAPHY

Definition - Types of air photographs - Geometry of air photo - Parallax - pair of photos - Height determination - Flight planning - Stereoscopy - Monovision - Binocular vision - Aerial photo interpretation - Basic elements - Techniques of photo interpretation - Application of aerial photo interpretation - photographs versus maps.

UNIT III IMAGERY

Landsat imagery - Digital image processing - Comparison with aerial photographs - Imaging devices- Aerial camera - Panoramic camera – Satellites – Geo Stationery – Sun Synchronous Satellites – Platforms and Sensors – types - Characteristics.

UNIT IV GIS

GIS – Structure of GIS – various components of GIS – vector and raster data – analysis of data – Introduction to various GIS softwares – Introduction to GPS – Principles – list of software.

UNIT V APPLICATIONS OF GIS AND REMOTE SENSING

Application of Remote Sensing and GIS in water resources engineering, land use studies, soil investigations, geology, transportation networks, agriculture, forestry, coastal engineering and military services.

TEXTBOOKS

1. Fundamentals of remote sensing by Bhatia S.C, New Delhi Atlantic Publishers, 2018.
2. Remote Sensing and Image Interpretation by Lillesand, Thomas. M and Ralph W. Kiefer, John Wiley Sons, 2021.
3. Applications of Geographic Information Systems in Civil Engineering, Niraj Kumar Thakur, Springer, 2018.
4. Manual of Remote Sensing: Principles and Applications, Steven M. De Jong, John Wiley & Sons, 2023.
5. GIS and Remote Sensing in Hydrology, Water Resources and Environment, by Biswajeet Pradhan, Springer, 2018.

REFERENCES

1. Handbook of Satellite Remote Sensing by Quac Pham & Jochen A. Schiller, CRC Press, 2019.
2. NRSC/ISRO Technical Reports (Indian National Remote Sensing Centre) Bhuvan Portal (bhuvan.nrsc.gov.in) – Free satellite data (Carto sat, Resource sat).
3. Survey of India Topographic Maps & GIS Standards (2021) Ministry of Science & Technology, Govt. Of India.
4. NRSA Training Modules on RS & GIS Indian Institute of Remote Sensing (IIRS), Dehradun (2022).

ONLINE RESOURCES

1. <https://earthobservatory.nasa.gov/>
2. <https://www.opengeospatial.org/>
3. Bhuvan Geoportal – <https://bhuvan.nrsc.gov.in> (ISRO's GIS platform).
4. SWAYAM-NPTEL Courses on RS & GIS – <https://nptel.ac.in>

COURSE OUTCOMES

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

CO1: Analyze the fundamental principles of remote sensing, including electromagnetic interactions, atmospheric effects, and energy interactions with surface features.

CO2: Interpret aerial photographs using stereoscopic principles and image analysis techniques to extract spatial information and solve real-world problems.

CO3: Compare and contrast various satellite imageries based on their acquisition characteristics, resolutions, and applications.

CO4: Analyze and evaluate the components, data types, and functionalities of GIS to apply them effectively in spatial data analysis and problem-solving.

CO5: Select and integrate geospatial technologies to address real-world problems in various domains.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	2	1						2	2	1
2	3	1	3	2	1	1						2	3	2
3	3				3	1						2	2	1
4	3	2	1	1	1	1						2	1	1
5	3					1						2	1	1

25CZPESCN	PLANNING FOR SUSTAINABLE DEVELOPMENT	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- Learn ecological, economic, and social dimensions of sustainable development.
- Apply GIS, remote sensing, and policy frameworks (e.g., SDGs, NUA) for sustainable urban/rural planning.
- Design low-carbon infrastructure, green energy systems, and disaster-resilient communities.
- Develop participatory approaches for inclusive and equitable development.
- Assess national/international sustainability initiatives (e.g., Smart Cities Mission, Paris Agreement).

UNIT I SUSTAINABLE DEVELOPMENT

Sustainable Development-explains and critically evaluates the concept of sustainable development

UNIT II SUSTAINABLE PRINCIPLES

Environmental degradation and poverty Sustainable development: its main principles, the evolution of ideas about sustainability

UNIT III RESISTANCES, ALTERNATIVES AND CURRENT DEBATES

Strategies for promoting sustainable development, resistances to the concept, and some alternative

approaches. Examine some important current issues and areas of debate in relation to sustainable development.

UNIT IV INNOVATION FOR SUSTAINABLE DEVELOPMENT

Innovation for sustainable development- Environmental management and innovation strategies.

UNIT V SOCIETAL TRANSFORMATIONS FOR SUSTAINABILITY

Societal transformations. Institutional theory, Governance for sustainable development. Policy responses to environmental degradation. Capacity development for innovation. Research methods.

TEXT/REFERENCE BOOKS

1. Basic Principles for Sustainable Development, Harris, J.M., 2004, Global Development and Environment
2. Navigating towards Sustainable Development: A System Dynamics Approach, Hjorth, P. & A. Bagheri, 2006, Futures
3. Struggling with Sustainability - A Comparative Framework for Evaluating Sustainable Development Programs, Mog, J.M., 2004, World Development 32(12): 2139-2160. IISD Commentary on the OECD's Draft Principles for International Investor Participation in Infrastructure
4. Indicators for Environmental Innovation: What and How to Measure, forthcoming in International Handbook on Environment and Technology Management (ETM), Arundel, A., R. Kemp, and S. Parto, 2004, edited by D. Annandale, J. Phillimore and D. Marinova, Cheltenham, Edward Elgar.

COURSE OUTCOMES

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

CO1: Understand Sustainable Development Frameworks

CO2: Apply Sustainable Principles in Planning

CO3: Critique Resistances & Evaluate Alternatives

CO4: Design Innovation-Driven Solutions

CO5: Lead Societal Transformations

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	3	2	3	2						3	3	3
2	3	3	3	2	3	2						3	2	2
3	2	3	3		3	1						3	2	2
4	3	2	2		2	1						2		
5	2	2	2		1	1						2	2	

25CZPESCN	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- Understand EIA Framework – legal/policy frameworks and stages of EIA.
- Master Assessment Tools – Apply methods like baseline studies, predictive modeling (air/water/noise), and GIS mapping.
- Evaluate Mitigation Strategies – Design measures to minimize ecological/social impacts (e.g., afforestation, waste management).
- Stakeholder Engagement – Develop skills for public consultations and conflict resolution in project planning.
- Critique Case Studies – Analyze real-world EIAs (e.g., dams, highways) to identify gaps and best practices.

UNIT I INTRODUCTION

The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, international agreements

UNIT II IDENTIFYING THE KEY ISSUES

Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, Consideration of Alternatives, Process selection Construction Phase, Input Requirements, Wastes and Emissions, Air Emissions, Liquid Effluents, Solid Wastes, Risks to Environment and Human, Health, Socio-Economic Impacts, Ecological Impacts, Global Environmental Issues

UNIT III EIA METHODOLOGIES

Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods. Reviewing the EIA Report

Scope, Baseline Conditions, Site and Process alternatives, public hearing, Construction Stage Impacts, Project Resource Requirements and Related Impacts, Prediction of Environmental Media Quality, Socio-economic Impacts, Ecological Impacts, Occupational Health Impact, Major Hazard Risk Assessment, Impact on Transport System.

UNIT IV REVIEW OF EMP AND MONITORING

Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, what should be monitored? Monitoring Methods, who should monitor? Pre-Appraisal and Appraisal

UNIT V CASE STUDIES

Preparation of EIA for developmental projects Factors to be considered in making assessment decisions, Water Resources Prag Pharmaceutical industry, thermal plant, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Tannery industry.

TEXT BOOKS

1. Environmental Impact Assessment- Theory and Practice, Wathem. P Routledge Publishers, London, 2004.
2. DC, Environmental Impact Assessment, Rau, JG. And Weolm, McGraw Hill Pub. Co, New York, 1996.
3. Environmental Impact Assessment Methodologies, Anjapeyula. Y and Manickam. V, BS. Publications, Hyderabad, 2007
4. Environmental Impact Analysis, Jain, R.K. Urban, L.V, Stracy, G.S, Van Nostrand Reinhold Co., New York, 1991.
5. Environmental Impact Assessment, Barthwal, R. R. New Age International Publishers, 2002

REFERENCES

1. EIA Guidelines for India MoEFCC (Ministry of Environment, Forest & Climate Change, 2022)
2. Environmental Impact Assessment: Theory and Practice Peter Wathern (2013, Routledge)
3. MoEFCC EIA Portal: <https://environmentclearance.nic.in> , Database of Indian EIA reports and notifications.

COURSE OUTCOMES

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

- CO1:** Understand the fundamentals of EIA, including its purpose, legal framework, and significance sustainable development. (Introduction)
- CO2:** Identify key environmental issues and assess the potential impacts of development projects on air, water, soil, biodiversity, and socio-economic conditions. (Identify Key Issues)
- CO3:** Apply EIA methodologies such as screening, scoping, impact prediction, evaluation, and mitigation measures. (EIA Methodology)
- CO4:** Review Environmental Management Plans (EMP) and monitoring techniques to ensure compliance with environmental regulations. (Review of EMP and Monitoring)
- CO5:** Analyse real-world case studies to evaluate the effectiveness of EIA processes and learn from best practices and challenges. (Case Studies)

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	3	2	1	2						3	3	
2	3	3	3	2	2	1						3	3	3
3	3	3	3	2	2	1						3	2	2
4	2	2	2	1	2	1						2	2	2
5	3	2	2	1	1	1						1	3	

25CZPESCN	COMPOSITE MATERIALS FOR CONSTRUCTION	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- Understand Fundamentals – Learn the science behind composites, including fiber-matrix interactions, classifications (PMCs, MMCs, CMCs), and material properties.
- Master Manufacturing Techniques – Explore fabrication methods (hand lay-up, filament winding, 3D printing) and their impact on performance.
- Analyze Mechanical Behaviour – Apply micromechanics & micromechanics theories to predict strength, stiffness, and failure modes (e.g., delamination).
- Design with Composites – Use software tools (ANSYS, ABAQUS) for optimizing lightweight structures (aerospace, automotive).
- Evaluate Applications & Sustainability – Study real-world uses (wind turbine blades, F1 cars) and eco-friendly composites (natural fibers, recyclability).

UNIT I INTRODUCTION

Classifications of Engineering Materials, Concept of composite materials, Matrix materials, Functions of a Matrix, Desired Properties of a Matrix, Polymer Matrix (Thermosets and Thermoplastics), Metal matrix, Ceramic matrix, Carbon Matrix, Glass Matrix etc.

UNIT II TYPES OF REINFORCEMENTS/FIBERS

Role and Selection of reinforcement materials, Types of fibres, Glass fibers, Carbon fibers, Aramid fibers, Metal fibers, Alumina fibers, Boron Fibers, Silicon carbide fibers, Quartz and Silica fibers, Multiphase fibers, Whiskers, Flakes etc., Mechanical properties of fibres. Material properties that can be improved by forming a composite material and its engineering potential

UNIT III VARIOUS TYPES OF COMPOSITES

Classification based on Matrix Material: Organic Matrix composites, Polymer matrix composites (PMC), Carbon matrix Composites or Carbon-Carbon Composites, Metal matrix composites (MMC), Ceramic matrix composites (CMC); Classification based on reinforcements: Fiber Reinforced Composites, Fiber Reinforced Polymer (FRP) Composites, Laminar Composites, Particulate Composites, Comparison with Metals, Advantages & limitations of Composites

UNIT IV FABRICATION METHODS

Processing of Composite Materials: Overall considerations, Autoclave curing, Other Manufacturing Processes like filament winding. Compression molding, resin-transplant method, pultrusion, pre-peg layer, Fiber-only performs, Combined Fiber-Matrix performs, Manufacturing Techniques: Tooling and Specialty materials, Release agents, Peel plies, release films and fabrics, Bleeder and breather plies, bagging films

UNIT V TESTING OF COMPOSITES

Mechanical testing of composites, tensile testing, Compressive testing, Intra-laminar shear testing, Inter-laminar shear testing, Fracture testing.

TEXTBOOKS

1. ASM Handbook, Materials characterization, Vol. 10,
2. Mechanical Metallurgy, G. Dieter, Me-Graw Hill
3. Thermal Analysis of Materials, R.F. Speyer Marcel Decker
4. Engineering Materials: Polymers, Ceramics and Composites, A.K Bhargava Prentice Hall India

REFERENCES

1. Mechanics of Composite Materials, Jones, R.M., (2015), McGraw Hill Co., New Delhi
2. Experimental Mechanics of Fibre Reinforced Composite Materials Prentice Hall, Whitney, Daniel 1. M. And Pipes R. B. (1984), New Jersey
3. Stress Analysis of Fibre Reinforced Composite Materials, Hyer, M.W. (1998), Mc Graw Hill Co., New Delhi
4. Mechanics of Fibrous Composites, Herakovich C. T. (1998), John Wiley Sons Inc.,N. Delhi

COURSE OUTCOMES

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

- CO1:** Understand fundamental knowledge in mechanical analysis
- CO2:** Understand the design of structures made of composite materials.
- CO3:** Propose suitable materials in relation to the project
- CO4:** Understand the different fabrication methods.
- CO5:** Emphasis the importance of testing methods

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	3	2	3	2	1				1	3	2	3
2	3	3	3	2	3	2	1				1	3	3	3
3	3	2	2	2	3	2	1				1	3	2	3
4	3	2	2	2	3	2	1				1	3	2	3
5	3	2	2	2	3	2	1				1	3	2	3

LIST OF OPEN ELECTIVES

25CZOESCN	STRUCTURAL AUDIT	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVE

- Learn the purpose, scope, and legal requirements (e.g., NBC, IS codes) of structural audits for buildings and bridges.
- Gain hands-on skills in using tools like rebound hammer, ultrasonic pulse velocity (UPV), and ground-penetrating radar (GPR) for defect detection.
- Analyze cracks, corrosion, material degradation, and load capacity to classify risk levels (critical, moderate, safe).
- Document findings professionally and recommend repair/retrofitting strategies (e.g., FRP wrapping, jacketing).
- Study real-world audits (e.g., Mumbai building collapses) and adhere to ethical guidelines (avoiding conflicts of interest).

UNIT I INTRODUCTION TO STRUCTURAL AUDIT

Introduction to Structural Audit, Objectives, Bye-laws, Importance, Various Stages involved, Visual inspection: scope, coverage, limitations, Factors to be keenly observed. Aspects of audit of Masonry buildings, RC frame buildings, Steel Structures.

UNIT II DETERIORATION IN STRUCTURES

Causes and types of deterioration in Structures: Permeability of concrete, capillary porosity, air voids, Micro cracks and macro cracks, corrosion of reinforcing bars, sulphate attack, alkali silica reaction. Causes of deterioration in Steel Structures: corrosion, Uniform deterioration, pitting, crevice, galvanic, laminar, Erosion, cavitations, fretting, Exfoliation, Stress, causes of defects in connection

UNIT III STRUCTURAL INTEGRITY AND SOUNDNESS

Elementary aspects of Non-Destructive Testing, Concrete Strength Assessment: Rebound hammer, Ultrasonic Pulse velocity, Penetration resistance, Pull out test, Chemical test: Carbonation test, Chloride test, Corrosion potential assessment, Fire damage assessment: Differential thermal analysis, X ray diffraction, Structural Integrity and soundness assessment: Radiography, Impact echo test, dynamic testing of structure, Interpretation and evaluation of test results.

UNIT IV EVALUATION OF DAMAGE IN RC STRUCTURES

Strength Evaluation of Existing Structures, Reserve strength, identification of critical sections, structural system and its validation, evaluation of damage in RC structures

UNIT V STRUCTURAL AUDITS GUIDELINES

Approach to conduct Structural Audits Guidelines of Statutory Bodies, Legal aspects, Responsibility of calling Structural Audit, Scope of Investigation.

Structural Audit Report, Study of sample Structural audit report for up-gradation of existing building, Audit for continuation of usage of old Buildings, Audit for Buildings damaged due to Earthquakes, Fire

TEXTBOOKS

1. Structural Audit and Rehabilitation of Buildings Dr. V. R. Rangan (2019, I. K. International Publishing)
2. Handbook on Structural Audit for Civil Engineers Prof. S. K. Duggal (2022, McGraw Hill, India)

REFERENCES

1. Indian Standard codes related with nondestructive testing, Government Resolutions related to Structural Audits (BMC Act, etc.)
2. IS 16284:2015 – *Guidelines for Structural Safety Audit* (BIS)

ONLINE RESOURCE

1. IIT Madras NPTEL Lectures on Structural Audit (nptel.ac.in)
2. CPWD Structural Audit Guidelines (cpwd.gov.in)

COURSE OUTCOMES

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

CO1: Gain the knowledge of Byelaws, procedure of Structural audit and study the typical problems in structures.

CO2: Aware of causes and types of deterioration in structures.

CO3: Develop skills for use of various Nondestructive tests required during auditing of structures

CO4: Strength evaluation of existing structures.

CO5: Acquire knowledge of legal procedure to conduct structural audits and to prepare a Structural audit report.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3					1		1			1	2		1
2	3					1		1			1	2		1
3	3		3		1	1		1			1	2	1	1
4	3					1		1			1	2		1
5	3				1	1		1			1	2		1

25CZOESCN	ADVANCED CONSTRUCTION TECHNIQUES	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To introduce the concept of Construction management, use of Construction Techniques for civil engineering activities and the implementation in construction site.
- To study about the project management system for planning, monitoring and controlling of the projects.

UNIT I

Types of foundations and construction methods; Basics of Formwork and Staging: Common building construction methods (conventional walls and slabs; conventional framed structure with block work walls; 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 II

Techniques of Box jacking Pipe Jacking under water construction of diaphragm walls and basement Tunnelling 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 III

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.

UNIT IV

Selection of equipment for earth work Earth moving operations - Types of earthwork equipment Tractors, motor graders, scrapers, front end loaders, earth movers Equipment for foundation and pile driving. Equipment for compaction, batching and mixing and concreting - Equipment for material handling and erection of structures Equipment for dredging, trenching, tunnelling.

UNIT V

Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing, Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities. 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.

TEXT BOOKS

- 1) Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, New Delhi, 1997.
- 2) Varghese P.C. Building Construction, Prentice Hall of India Pvt. Ltd, New Delhi, 2007.

REFERENCE BOOKS

- 1.) Sharma.S.C, Construction Equipments and Management, Khanna Publishers, NewDelhi, 2002.
- 2) Srinath.L.S, PERT and CPM Principles and Applications, East West Press Private Ltd., New Delhi, 1991.
- 3) Modi P.N, PERT and CPM Programming, Tata McGraw Hill Publications, New Delhi, 1990.
- 4) Pert and CPM Programming, Programme Evaluation and review Technique and Critical Path Method, Tata McGraw Hill Publications, New Delhi, 1997.
- 5) Punmia.B.C, et al, Project Planning and Control with PERT and CPM, Tata McGraw Hill Publications, New Delhi, 1991.

COURSE OUTCOMES

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

CO1: To know the fundamentals of the construction of structures from the beginning to the end.

CO2: To understand the project control and construction management.

CO3: To gain knowledge about the CPM and PERT

CO4: To gain the practical knowledge of construction process and techniques.

CO5: To know the various construction techniques involved in the execution of construction.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3					3				1	1	2	2	1
2	3					2				3	1	2	2	1
3	3		1		3	3				3	1	2	3	2
4	3				1	3				2	1	2	1	2
5	3				1	3				2	1	2	3	2

25CZHESCN	CONSTRUCTION TECHNIQUES & EQUIPMENTS	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To introduce the concept of Construction management, use of Construction Techniques for civil engineering activities and the implementation in construction site.
- To study about the project management system for planning, monitoring and controlling of the projects.

UNIT I SPECIALIZED CONSTRUCTION TECHNIQUES

Construction aspects and procedures of specialized construction techniques - Box pushing - Box type retaining walls - Slip form for Chimney and Silo construction - Sheet piling and Diaphragm walls - Well and Caisson - Underpinning - Shotcreting & Guniting - Vacuum dewatering - Finishing & Curing method.

UNIT II UNDERGROUND CONSTRUCTION

Site investigation and Geological studies - Drilling - Pneumatic breakers - Explosives - Blasting. Tunneling technology- Mechanized shield- Micro method- Cut and cover method- Pipe Jacking - Hazards and safety measures in underground construction.

UNIT III OFFSHORE CONSTRUCTION

Underwater construction - Stages of offshore structure, Construction, Facilities and Methods of fabrication- Equipment's- Crane barges- derrick barges - Drilling vessels.

UNIT IV BRIDGE CONSTRUCTION TECHNIQUES

Types of Bridge- Based on span- Material- Type of super structure- Support condition -Position of floor - High flood level- Bridge construction methods - In situ and Precast construction methods- Balanced cantilever methods - Span by span method - Incremental launching method.

UNIT V EARTHWORK AND MATERIAL HANDLING EQUIPMENTS

Importance of construction equipment's their classification, selection and contribution rate of production (Output), Owning and operating cost. Fundamentals of earth work operations - Selection of equipment for earth work- Types of earth work equipment - Tractors, Motor graders, Scrapers, Front end loaders, Earth movers. Material handling equipment - Forklifts and related equipment - conveyors-hauling equipment.

TEXT BOOKS

1. Advanced Construction Technology by M.L. Gambhir, McGraw-Hill Education, 2023.
2. Construction Technology by R.B. Peuri, Wiley Blackwell, 2020.

REFERENCE BOOKS

1. Handbook of Tunnel Construction by Michael S. Mooney, CRC Press, 2023
2. Offshore Structures: Design, Construction and Application by Dongwook Choi and Jin-Yong Kim, Academic Press, 2022. (2nd Edition)

3. Bridge Engineering: Design, Construction, and Analysis by W. F. Chen and J.Y. Zhan, Springer, 2020. (2nd Edition)
4. Earthwork & Its Equipment by B.C. Punmia & Ashok Kumar Jain, Laxmi Publications, 2019. (8th Edition)
5. Construction Equipment Management for Engineers & Managers by William R. Riggs & Namdar Gowrishankar, McGraw-Hill Education, 2018.

COURSE OUTCOMES

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

CO1: Apply appropriate specialized construction techniques like box pushing, diaphragm walls, and shotcreting, considering project conditions and safety requirements.

CO2: Identify safe and efficient underground construction methods like tunneling and pipe jacking, considering geological challenges and hazard mitigation strategies.

CO3: Select suitable offshore construction equipment and methodologies based on the type of structure, fabrication needs, and environmental factors.

CO4: Outline bridge construction methods like balanced cantilever or incremental launching, considering bridge type, site constraints, and economic feasibility.

CO5: Select appropriate earthwork and material handling equipment based on project requirements, cost-effectiveness, and environmental considerations.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3			1	1	2				1		1	2	1
2	3			1	1	2				1		1	3	1
3	3			1	1	2				1		1	2	1
4	3			1	1	2				1		1	2	1
5	3			1	1	2				1		1	3	1

25CZHESCN	BEHAVIOUR OF REINFORCED CONCRETE STRUCTURES	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To describe the behaviour of concrete under uniaxial compression-bending and its codal standards
- To analyse Characteristic loads and strengths under limit state of collapse
- To assess its shear and torsional capacities of concrete beams as per codal standards
- To analyse the behaviour of beams under limit state of serviceability
- To describe the concrete beams behaviour and its reinforcement detailing aspects for beams, slabs and columns as per codal standards

UNIT I

Introduction to Behaviour of concrete under uniaxial compression, Tension and Combined stresses Elastic Modulus of concrete under compression and tension as per IS:456-2000 and ACI codal Standards. Design philosophy— Working Stress Method — Ultimate Load Method — Limit State Method

–Load Resistance Factor Design Method.

UNIT II

Introduction to Characteristic loads and strengths — Limit state of collapse - Behaviour of Beams under flexure at ultimate limit state- Problems related to Modes of failure of beams (Under Reinforced and over reinforced)— Ultimate Limit state Load Combinations as per IS

UNIT III

Behaviour of concrete beams in shear — Shear capacities of Concrete due to aggregate interlock, dowel action, web reinforcements — critical sections for shear- Problems related to Shear Capacity assessment based on Ultimate Limit state as per IS.

Behaviour of concrete in torsion — equilibrium and compatibility torsion — Problems related to Torsion— Ultimate Limit state as per IS.

UNIT IV

Introduction to Limit state of serviceability - Behaviour of Beams under flexure at serviceability limit state- Factors influencing short and long terms deflection—control of deflection—Problems related to Deflection, creep Shrinkage and temperature effects — limits on deflection as per IS.

Bond and anchorage — bond failure mechanisms —anchorage requirements — splicing of reinforcement.

UNIT V

Moment versus curvature relationships— Torsion versus twist relationship for concrete members - Behaviour of concrete beams under sustained loading over a period of time.

Reinforcement Detailing aspects of beams, slabs, columns and frames as per IS specification.

TEXT BOOKS

1. Robert Park & Thomas Paulay, Reinforced Concrete Structures, John Wiley & Sons, 1975
2. S.Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design, Tata McGraw Hill, 1999.

REFERENCE BOOKS

1. Sinha, N.C., and Roy, S.K., “Fundamentals of Reinforced Concrete”, S.Chand and Company, New Delhi, 2013.
2. Sinha, S.N., “Reinforced Concrete Design”, Tata Mc Graw – Hill Publishing Co, Ltd., New Delhi, 2012.
3. MacGregor J.G., “Reinforced Concrete Mechanics and Design”, Prentice Hall, New Jersey, 2011.
4. Varghese, P.C., “Limit State Design of R.C.Structures”, Prentice Hall of India, 2001.
5. Mallick, S.K., and Gupta, A.P., “Reinforced Concrete”, Oxford & IBH Publishing Co., New Delhi, 2012.
6. IS: 456 - 2000 Indian Standard Code of Practice for Reinforced Concrete, Bureau of Indian Standards, New Delhi.
7. SP- 16 – 1980 Design Aids for reinforced Concrete, Bureau of Indian Standards, New Delhi.
8. SP - 34 — 1987, Hand Book on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

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

CO1: To analyze the behaviour of concrete and to specify the design methodologies for Reinforced Concrete members

CO2: To describe the importance and types of limit states for structural design

CO3: To describe the requirements of shear and torsional capacities of concrete beams for practical design problems

CO4: To describe the requirements of limit state of serviceability of concrete beams for practical design problems

CO5: To suggest proper structural reinforcement detailing norms as per codal Standards for beams, slabs, columns and Footings

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	2	2	1							3	2	2
2	3	2	2	2	1							3	2	2
3	3	2	2	2	1							3	2	2
4	3	2	2	2	1							3	2	2
5	3	2	2	2	1							3	2	2

25CZHESCN	GROUND IMPROVEMENT TECHNIQUES	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- This course teaches the advancement in the subsoil stabilization in a modern approach
- The real problem, methods of improvement over such problems and the methodology are dealt.

UNIT I

Introduction - Methods of ground improvement - Geotechnical problems in alluvial, lateritic and Black Cotton soils - Selection of suitable ground improvement methods based on soil conditions.

UNIT II

Drainage and dewatering - Drainage techniques - Vacuum and electro - Osmotic methods – Seepage analysis for 2D flow fully and partially penetrating slots in homogeneous deposits.

UNIT III

In-situ treatment of granular and cohesive soils — In-situ densification of granular soils - consolidation of cohesive soils - Dynamic compaction and consolidation – Vibro-floatation - Sand pile compaction - Preloading with sand drains and fabric drains - Stone columns - Lime piles - Relative merits of various methods and their limitations.

UNIT IV

Earth reinforcement - concept - Types of reinforcing materials - Application of reinforced earth – Geo- textiles in filtration drainage - Separation and road works.

UNIT V

Grouting techniques - Grouting equipments and machinery - Injection methods — Grout monitoring - Stabilization with cement, lime and chemicals - Stabilization of expansive soils.

TEXT BOOKS

1. Robert M Koerner, Construction and Geotechnical Methods in Foundation Engineering, McGraw-Hill, Inc, USA, 1984.
2. Mike Moseley, Klaus Kirsch, Ground Improvement, Taylor & Francis Ltd, Spon Press, London, 2003.

REFERENCE BOOKS

1. Colin J F P Jones, *Earth Reinforcement and Soil Structures*, London; Boston: Butterworths, 1985.
2. Craig R F, *Soil Mechanics*, 7th Edition Taylor & Francis, London, 1992.

COURSE OUTCOMES

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

CO1: To identify the Methods of ground improvement

CO2: To recognize the Drainage techniques

CO3 To be familiar with In-situ treatment of granular and cohesive soils

CO4 To be thorough with Earth reinforcement - concept - Types of reinforcing materials

CO5: To classify and to be aware of the Grouting techniques - Grouting equipments

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	1	1	1		1		3	1			1	2	1
2	3	2	3	2				3	1			1	3	2
3	3	1	1	1				2	1	1		1	2	1
4		2	1	2				3	1			1	1	1
5	3	1	3	1				3	1			1	3	1

25CZHESCN	BRIDGE ENGINEERING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the basics of IRC standards and positioning of loads for maximum effects
- To carryout design of slab and pipe culverts as per IRC standards.
- To analyse and design of box culverts as per IRC standards.
- To carry out the design of pre-stressed concrete girders and detailing as per IRC standards
- To describe the design behaviours of balanced cantilever and segmental type bridges

UNIT I

Introduction IRC Standards- Concept of Moving Track and Wheel loads as per IRC Standards- Assessing Impact factors for quasi static dynamic loads - IRC Track and Wheeled Loading standards with impact factor — Positioning of IRC loads for maximum moment and shear- Analysis of slabs using Pigeaud's curves.

UNIT II

Introduction to Slab and Pipe Culverts- Design of Slab culverts as per IRC: 6-2014 and IRC 21:2000. Detailing aspects as per IRC Standards

UNIT III

Analysis and design of. Box culverts as per IRC: 6-2014 and IRC 21: 2000. Detailing aspects as per IRC Standards

UNIT IV

Introduction to the Design of Pre-stressed Concrete Bridge Girders- Design and Detailing as per IS 1343:1980, IRC: 6-2014 and IRC 21: 2000. Maximum and minimum pre-stressed forces Eccentricity- Dead load and Live load moments and shears - Cable zone in girder - Check for stresses - Diaphragms- End block - Short-term and long-term deflections

UNIT V

Balanced cantilever bridges Bowstring girder bridges - Advantages - Design principles of Segmental bridges - Procedure for launching of bridge girders — Design principles of Bridge bearings.

TEXT BOOKS

- 1.Krishna Raju N, *Design of Bridges*, Oxford & IBH, New Delhi, 2010.
- 2.Ponnuswamy S, *Bridge Engineering*, Tata McGraw-Hill, New Delhi, 1986.

REFERENCE BOOKS

- 1.Johnson Victor D, *Essentials of Bridge Engineering*, Oxford & IBH Pub. Co., New Delhi, 2001.
- 2.Rajagopalan N, *Bridge Super Structure*, Alpha Science International, London, 2006.
- 3.Johnson Victor D., “Essentials of Bridge Engineering” Oxford and IBH Publishing Company, New Delhi, 2003.
- 4.Phatak D.R., “Bridge Engineering”, SatyaPrakashan, New Delhi, 1990
- 5.Ponnuswamy, S., *Bridge Engineering*, Tata McGraw – Hill, New Delhi, 1997.
- 6.N. Rajagopalan, *Bridge Superstructure*, Narosa Publishing House, New Delhi, 2006.
- 7.Jagadeesh. T. R. and Jayaram. M. A., *Design of Bridge Structures*, Prentice Hall of India Pvt.Ltd., 2004.

STANDARDS

- 1.IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
- 2.IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces - Code of Practice
- 3.SP 34: 1987, Handbook on Concrete Reinforcement and Detailing.
- 4.IRC: 6-2014, Standard Specifications and Code of Practice for Road Bridges Section: II (Loads and Stresses).
- 5.IRC 21: 2000, Standard Specifications and Code of Practice for Road Bridges Section: III [Cement Concrete (Plain and Reinforced)].

6.IS 1343:1980, Code of Practice for Pre-stressed Concrete, Bureau of Indian Standards, New Delhi, 2012.

7.IRC: 83(Part I)-1999, Standard Specifications and Code of Practice for Road Bridges Section:IX, Part I (Metallic Bearings).

8.IRC: 83(Part I)-1999, Standard Specifications and Code of Practice for Road Bridges Section:IX, Part II (Elastomeric Bearings).

COURSE OUTCOMES

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

CO1: To study the IRC code standards for carrying out the critical loading conditions for bridge deckslabs

CO2: To describe the importance of pipe and slab culverts and its design standards as per IRC for practical problems

CO3 To describe design requirements of box culverts and its design as per IRC standards for practical problems

CO4 To design the pre-stressed concrete girders and detailing as per IRC standards for practical problems

CO5: To suggest proper design steps for balanced cantilever and segmental type bridges and to explain advanced launching techniques followed by bridge bearing and its merits

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	2	2	1							2	2	1
2	3	2	2	2	1							2	2	1
3	3	2	2	2	1							2	2	1
4	3	2	2	2	1							2	2	1
5	3	2	2	2	1							2	2	1

25CZHESCN	DYNAMICS OF STRUCTURES	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the basics of structural dynamic systems and its various vibration characteristics
- To analyse the Free Vibration characteristics of Single Degree of freedom systems with damping without damping.
- To analyse the Forced Vibration characteristics of idealized structural dynamic systems
- To analyse the dynamic systems for assessing the Force Transmissibility and experimental damping methods to ascertain the viscous damping coefficients
- To analyse the behaviour of building frames as MDOF systems.

UNIT I

Idealization of Building frames for Dynamic analysis- Identification of mass, stiffness and damping elements in a conventional structural systems - Degrees of Freedom, Discrete and continuous systems, Principles of Structural dynamics. Free, Forced, Un-damped, Damped, Linear, Non-linear, Deterministic and Random Vibrations. Vibration analysis. Classification of damping present in the dynamic systems with suitable examples. Formulation of equation of motions using direction equilibrium concept and principle of conservation of energy.

UNIT II

Free Vibration analysis of Single Degree of freedom systems with damping without damping: Equations of motion and solutions- logarithmic decrement — energy dissipation in viscous damping. Free vibration with coulomb damping, Free vibration with hysteretic damping.

UNIT III

Forced vibration analysis of Single Degree of freedom systems with damping without damping under harmonic excitations. Vibrational Problems associated with the SDOF systems

UNIT IV

Forced vibrations due to Non-periodic force —Impulse response functions — Response to an arbitrary Excitation, Impulse length ratio shock spectrum.

Force Transmitted to Base in terms of displacement and force Transmissibility —Practical problems on base isolation. Simple Vibration measuring instruments. Problems related to Forced vibration with coulomb damping and hysteretic damping. Experimental Methods of assessing viscous Damping using logarithmic decrement method and Half power point Methods. Forced vibration response to harmonicbase excitations.

UNIT V

Free vibration analysis of multi Degrees of freedom systems: Formulation of equation of motions. Orthogonally of normal — Modal analysis — Un-damped system —

Damped system using proportional damping – modes. Force vibration analysis of multi Degrees of freedom systems(restricted to two degrees of freedom only) – Formulation of equation of motions – Expressions in matrix form – solution of MDOF systems – Numerical methods for solution of MDOF systems.

TEXT BOOKS

1. Anil k Chopra, Dynamics of Structures, McGraw-Hill International Edition, 1998.
2. Clough, R.W. and Penzien, J., Dynamics of Structures, Second Edition, McGraw-Hill International Edition, 1993.

REFERENCE BOOKS

1. D.J. Inman, Engineering Vibrations, Prentice Hall, 2000.
2. Mario Paz, and William Leigh, Structural Dynamics, CBS, Publishers, 1987.
3. Roy R Craig, Jr., Structural Dynamics, John Wiley and Sons, 1981.
4. Srinivasan Chandrasekaran, Dynamic Analysis and Design of Ocean Structures, Springer, 2015.
5. Humar.L., Dynamics of Structures, Second Edition, McGraw-Hill International Edition, 1989.

COURSE OUTCOMES

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

CO1: To analyze the basics of structural dynamic systems and specify the requirements for building design

CO2: To describe the importance and types of Free Vibration characteristics of Single Degree of freedom systems with damping without damping

CO3: To describe the requirements of Forced Vibration characteristics of idealized structural dynamic systems

CO4: To analyse the dynamic systems for assessing the Force Transmissibility and the viscous damping coefficients

CO5: To suggest proper dynamic MDOF system analysis to model for building frames subjected to dynamic loads

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1	1	2	2		1				2	2	
2	3			1	2	2		1				1	3	2
3	3			1	2	2		1				1	2	1
4	3	2	1	1	2	2		1				2		
5	3	2	1	1	2	2		1				2	3	

25CZHESCN	FINITE ELEMENT METHOD	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To learn the analysis of structures with a versatile technique finite element method which can accommodate variations in material and engineering properties and can tackle multilayered systems and non-linearity with ease.

UNIT I INTRODUCTION

Finite Element Formulation – Steps involved - Advantages and Disadvantages - Applications - Two-Dimensional Elasticity problems - Plane Stress and Plane Strain - Equilibrium equations - Strain-displacement equations - Compatibility equations - Constitutive equations - Boundary conditions.

UNIT II FINITE ELEMENT TYPES

Displacement Function - Natural Coordinates – Shape Functions – Shape functions for truss elements in local and global coordinates - Shape function for beam and frame elements, Triangular elements (CST and LST elements), Rectilinear ISO- parametric elements, Solid elements.

UNIT III FINITE ELEMENT FORMULATION

Element stiffness formulation for truss elements in local and global coordinates, beams, CST elements, Load vectors for gravity, surface and body forces.

UNIT IV AXISYMMETRIC ELEMENTS

Numerical Integration for evaluation of element stiffness – Load vectors- Computation of stresses. Use of Static Condensation Techniques, Axi-symmetric elements, Sub- structuring, Plate bending and shell elements.

UNIT V MODELLING TECHNIQUES

Pre and Post Processing – Modelling techniques – Complete algorithms with flow chart for solving FEM problems - Solution Techniques – Linear Analysis-Non-linear analysis both material and geometric non-linearity Use of Finite element software packages such as ANSYS, SAP 2000N, STAAD Pro, ETABS, ABAQUS, MSC/NASTRAN, etc.

TEXT BOOKS

1. Finite Element Analysis, Seshu P, Prentice Hall of India, New Delhi, 2005.
2. Introduction to Finite Element in Engineering, Chandrupatla, T.R. and Belegundu, A.D, Prentice Hall, Delhi, 2003 161

REFERENCES

1. Finite Element Analysis - Theory and Programming, Krishnamoorthy. C. S, TataMcGraw Hill Publications, New Delhi,1995.
2. Finite Element Analysis in Engineering Design, Rajasekaran.S, S.Chand and Co., New Delhi, 2014.
3. Concepts and Applications of Finite Element Analysis, Cook. R. D, Tata McGraw Hill Publications, New Delhi, 1989.
4. Introduction to the FEM, Desai. C. S & Abel. J. F, Affiliated East West Press, New

Delhi, 1972.

5. The Finite Element Method in Engineering, Rao. S. S, Butters worth-Heinemann Publishing, Burlington, 2000.

6. An Introduction to Finite Element Method, Reddy J.N, International Edition, McGraw Hill, New Delhi, 2006.

ONLINE RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_me43/preview

COURSE OUTCOMES

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

CO1: The knowledge of solving physical problems using finite element software's.

CO2: To develop computer coding for any structural problem and creating software packages.

CO3: The knowledge in solving practical problems by global stiffness matrix approaches for truss, beam, etc.

CO4: The knowledge of modelling techniques of the problems.

CO5: The knowledge of using FEM software's for the practical problems and to find the solution.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	2	1	3	2		1			1	3	2	1
2	3	2	3	2	3	2		1			1	3	3	2
3	3	3	2	2	3	2		1			1	3	2	1
4	3	3	2	1	3	2		1			1	3	2	1
5	3	3	3	3	3	2		1			1	3	3	1

25CZMESCN	CONSTRUCTION ENGINEERING	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To expose the students to construction practice through an understanding of different types of construction materials and their properties.
- To understand the techniques of construction, different finishing works and remedial practices for distressed structures.
- To impart knowledge of modern construction materials and equipments.

UNIT I PROPERTIES OF CONSTRUCTION MATERIALS

Stones (Dressed) – Bricks – Cement – Steel – Sand and Quarry Dust – Timber – FRP (Fibre Reinforced Polymer) – Composite materials – Physical and Chemical Properties – Manufacturing Process – Classification – Test on materials – IS Standards and Specifications for use in construction as per SP 21: 2005

UNIT II SUBSTRUCTURE

Introduction – Types of Soils – Classification of soils as per IS standards – Cohesion and Adhesion of soil – Bearing Capacity of soil – Methods of Assessing Bearing Capacity of Soils – Types of Foundations – Shallow Foundations – Deep Foundations – Special type of Foundations for Shore and Offshore Structures – Foundations with Rock Anchors

UNIT III SUPERSTRUCTURE

Introduction – Masonry – Types of Masonry – Reinforced Cement Concrete (RCC) works like Footings, Columns, Plinth Beams, Lintels, Sill slab, Sunshades, Roof Beams and Roof Slabs – Fabrication of Steel, Bar Bending as per IS Standards (SP 34: 1987), Cover Blocks, Placing of Bars in Form Work – Types of Roofing Systems – Types of Stairs – Types of Doors, Windows and Ventilators – Methods of Termite Proofing – Methods of Damp proofing.

UNIT IV FINISHING OF SUPERSTRUCTURE

Types of Floor finishes - Mud Flooring, Cement flooring, Ceramic Tile Flooring, Marble and Granite Flooring, Wooden Flooring, Flooring with Puffed Panels – Plastering (Interior and Exterior) – Pointing for Walls and Floors using Grouts – White Washing, Colour Washing with different Colour Shades available in the Markets – Painting – Types of Painting for Interior and Exterior application. Form Work (Shuttering or Scaffolding) - Types of Form Work – Use of Shoring and Underpinning.

UNIT V SPECIAL MATERIALS AND REPAIRS

Introduction – Glass – Ceramics – PVC – UPVC – Refractory – Aluminium – Lightweight Concrete Blocks – Poly Carbonate Sheets – Insulated Puffed Sheets – Sealant Joints – Uses in construction. Cracks in Buildings – Causes – Methods of Repairs– Equipments used for Repair works.

TEXT BOOKS

1. Punmia.B.C, Construction Engineering, Laxmi Publishers Private Limited, New Delhi, 2012 Eleventh Edition.
2. Arora S.P. & Bindra S.P, A Text Book of Building Construction, Dhanpat Rai & Sons, New Delhi, 2010.

REFERENCE BOOKS

1. Rangwala.S.C, Building Construction, Charotar Publishing House Pvt. Ltd,Gujarat, 2009.
2. Sharma and Kaul, Building Construction, S.Chand & Company, New Delhi, 2013.
3. Rajput.R.K, Engineering Materials, S.Chand & Company, New Delhi. 2008.

COURSE OUTCOMES

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

CO1: Compare the properties of most common and advanced building materials.

CO2: Understand the typical and potential applications of these materials.

CO3: Acquire knowledge of testing of construction materials and their strength requirements.

CO4: Recognize the functions of different building components.

CO5: Understand the usage of modern building materials and construction equipments and apply techniques to repair buildings.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3		1			3		1			1	1	1	
2	3		1			3		1				1	1	
3	3		1			3		1			1	1	1	
4	3		1			3		1				1	1	
5	3		1		1	3		1			1	1	2	

25CZMESCN	CONSTRUCTION TECHNIQUES & EQUIPMENTS	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To introduce the concept of Construction management, use of Construction Techniques for civil engineering activities and the implementation in construction site.
- To study about the project management system for planning, monitoring and controlling of the projects.

UNIT I SPECIALIZED CONSTRUCTION TECHNIQUES

Construction aspects and procedures of specialized construction techniques - Box pushing - Box type retaining walls - Slip form for Chimney and Silo construction - Sheet piling and Diaphragm walls - Well and Caisson - Underpinning - Shotcreting & Guniting - Vacuum dewatering - Finishing & Curing method.

UNIT II UNDERGROUND CONSTRUCTION

Site investigation and Geological studies - Drilling - Pneumatic breakers - Explosives - Blasting. Tunneling technology- Mechanized shield- Micro method- Cut and cover method- Pipe Jacking - Hazards and safety measures in underground construction.

UNIT III OFFSHORE CONSTRUCTION

Underwater construction - Stages of offshore structure, Construction, Facilities and Methods of fabrication- Equipment's- Crane barges- derrick barges - Drilling vessels.

UNIT IV BRIDGE CONSTRUCTION TECHNIQUES

Types of Bridge- Based on span- Material- Type of super structure- Support condition -Position of floor - High flood level- Bridge construction methods - In situ and Precast construction methods- Balanced cantilever methods - Span by span method - Incremental launching method.

UNIT V EARTHWORK AND MATERIAL HANDLING EQUIPMENTS

Importance of construction equipment's their classification, selection and contribution rate of production (Output), Owning and operating cost. Fundamentals of earth work operations - Selection of equipment for earth work- Types of earth work equipment - Tractors, Motor graders, Scrapers, Front end waders, Earth movers. Material handling equipment - Forklifts and related equipment - conveyors-hauling equipment.

TEXT BOOKS

1. Advanced Construction Technology by M.L. Gambhir, McGraw-Hill Education, 2023.
2. Construction Technology by R.B. Peuri, Wiley Blackwell, 2020.

REFERENCE BOOKS

1. Handbook of Tunnel Construction by Michael S. Mooney, CRC Press, 2023
2. Offshore Structures: Design, Construction and Application by Dongwook Choi and Jin-Yong Kim, Academic Press, 2022. (2nd Edition)

3. Bridge Engineering: Design, Construction, and Analysis by W. F. Chen and J.Y. Zhan, Springer, 2020. (2nd Edition)
4. Earthwork & Its Equipment by B.C. Punmia & Ashok Kumar Jain, Laxmi Publications, 2019. (8th Edition)
5. Construction Equipment Management for Engineers & Managers by William R. Riggs & Namdar Gowrishankar, McGraw-Hill Education, 2018.

COURSE OUTCOMES

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

CO1: Apply appropriate specialized construction techniques like box pushing, diaphragm walls, and shotcreting, considering project conditions and safety requirements.

CO2: Identify safe and efficient underground construction methods like tunneling and pipe jacking, considering geological challenges and hazard mitigation strategies.

CO3: Select suitable offshore construction equipment and methodologies based on the type of structure, fabrication needs, and environmental factors.

CO4: Outline bridge construction methods like balanced cantilever or incremental launching, considering bridge type, site constraints, and economic feasibility.

CO5: Select appropriate earthwork and material handling equipment based on project requirements, cost-effectiveness, and environmental considerations.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3				1	2				1	1	1	2	1
2	3				1	2				1	1	1	2	1
3	3				1	2				1	1	1	2	1
4	3				1	2				1	1	1	2	1
5	3				1	2				1	1	1	3	1

25CZMESCN	SMART MATERIALS & SMART STRUCTURES	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To know the different products of smart materials
- To know the purpose of Piezoelectric Ceramics, Piezo-polymers, Magnetostrictive Materials, Electro active Polymers, Shape Memory Alloys, Electro and Magneto Rheological Fluids, Modelling of smart materials.
- To study about the composite smart materials, Mechanics of smart composite materials, Smart sensors based on high bandwidth low strain smart materials, Low-bandwidth high strain smart actuators, Micro-electro mechanical Smart Systems and Intelligent devices based on smart materials
- To know the applications of Smart Actuators, Active and Hybrid Vibration Control, Active Shape Control, Distributed Sensing and Control of Smart Beams.

UNIT I

Introduction to Smart Materials, Principles of Piezoelectricity, Perovskite Piezoceramic Materials, Single Crystals vs. Polycrystalline Systems, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth Magnetostrictive materials, Giant Magnetostriction and Magneto-resistance Effect, Introduction to Electro- active Materials, Electronic Materials, Electro-active Polymers, Ionic Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Memory Alloys, Shape Memory Polymers, Electro-rheological Fluids, Magneto Rheological Fluids.

UNIT II

Piezoelectric Strain Sensors, In-plane and Out-of Plane Sensing, Shear Sensing, Accelerometers, Effect of Electrode Pattern, Active Fibre Sensing, Magnetostrictive Sensing, Villari Effect, Matteuci Effect and Nagoka-Honda Effect, Magnetic Delay Line Sensing, Application of Smart Sensors for Structural Health Monitoring (SHM), System Identification using Smart Sensors.

UNIT III

Modelling Piezoelectric Actuators, Amplified Piezo Actuation — Internal and External Amplifications, Magnetostrictive Actuation, Joule Effect, Wiedemann Effect, Magnetovolume Effect, Magnetostrictive Mini Actuators, IPMC and Polymeric Actuators, Shape Memory Actuators, Active Vibration Control, Active Shape Control, Passive Vibration Control, Hybrid Vibration Control.

UNIT IV

Review of Composite Materials, Micro and Macro-mechanics, Modelling Laminated Composites based on Classical Laminated Plate Theory, Effect of Shear Deformation, Dynamics of Smart Composite Beam, Governing Equation of Motion, and Finite Element Modelling of Smart Composite Beams.

UNIT V

Self-Sensing Piezoelectric Transducers, Energy Harvesting Materials, Autophagous Materials, Self- Healing Polymers, Intelligent System Design, Emergent System Design.

TEXT BOOKS

1. Brian Culshaw, *Smart Structures and Materials*, Artech House, London, 2000
2. Gauenzi, P, *Smart Structures*, Wiley, New Delhi, 2009

REFERENCE BOOKS

1. Cady, W. G., *Piezoelectricity*, Dover Publication, New York, 1964

COURSE OUTCOMES

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

CO1: To know the different products of smart materials

CO2: To understand the properties of Piezoelectric Ceramics, Piezo-polymers, Magnetostrictive Materials, Electro active Polymers, Shape Memory Alloys, Electro and Magneto Rheological Fluids,

CO3: To understand the Modelling of smart materials.

CO4: To study about the composite smart materials, Mechanics of smart composite materials, Smart sensors based on high bandwidth low strain smart materials, Low bandwidth high strain smart actuators, Micro- electro mechanical Smart Systems and Intelligent devices based on smart materials

CO5: To know the applications of Smart Actuators, Active and Hybrid Vibration Control, Active Shape Control, Distributed Sensing and Control of Smart Beams.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3				1	2				1	1	1	2	1
2	3				1	2				1	1	1	2	1
3	3				1	2				1	1	1	2	1
4	3				1	2				1	1	1	2	1
5	3				1	2				1	1	1	3	1

25CZMESCN	SMART CITIES	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To examine the core challenges relating to the foundation of sustainable smart cities
- To develop knowledge, understanding, and critical thinking related to smart, sustainable urban development.
- To explore issues relating to the development and deployment of new and emerging technologies, that will create a thorough understanding of smart processes and systems of the present and future.

UNIT I INTRODUCTION TO SMART CITIES

Introduction to Smart City - How did the idea evolve - History and Evolution of Smart Cities, worldwide - barriers and benefits of smart cities - Development Perspectives - Definitions and Core Concepts - characteristics and factors of Smart cities

UNIT II INFRASTRUCTURE OF SMART CITIES

Water Supply - Electricity Supply Sanitation, including Solid Waste Management - Efficient Urban Mobility and Public Transport - Affordable housing, especially for the poor - Robust IT connectivity and digitalization.

UNIT III BUILT ENVIRONMENT OF SMART CITIES

Built environment – Energy – Telecommunications – Transportation - Health and human services - Water and wastewater - Public safety and Payments.

UNIT IV SMART CITY ENABLERS

Instrumentation and control — connectivity- interoperability- security and privacy - data management - computing resources and analytics - Process of building a smart cities roadmap

UNIT V DEVELOPMENT OF SMART CITIES IN INDIA

ICT initiatives in Indian Cities - economic development - smart city technologies: inventory and standardization- potential of commercialization and emerging trends - e-democracy and e-governance - Case studies in India : Palava - Dombivalli, Mumbai, Lavasa- Pune.

TEXT BOOKS

1. Chan.D (2016) Defining smart cities seminar: A Guiding Frame work.
2. Goldsmith.S & Crawford.S “the responsive city: engaging communities through data — smart governance”John Wiley & sons, 2014.
3. Mele.N The end of big: How the internet makes david the new Goliath,Macmillan 2013
4. Townsend, A.M., “Smart Cities: Big data, Civic Hackers, and the quest fornew ww norton & company, 2013.

REFERENCE BOOKS

1. Jesse Berst, Liz Enbysk and Christopher Williams Smart Cities Readiness Guide - The planning manual for building tomorrow's cities today, Smart Cities Council, 2014.
2. Aniket Bhagwat, Suparna Bhalla, Sanjay Prakash Ashish Bhalla Destination 100 The Making of Smart Cities in India, Future Institute publishers, 2014,
3. Vinod kumar T. M., Geographic Information Systems for Smart Cities, Copal Publishing, New Delhi, 2014,

COURSE OUTCOMES

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

CO1: Understand the concept and practice of “smart cities” across the globe

CO2: Know the various Infrastructures for smart cities.

CO3: To understand the various other services and public safety in smart cities.

CO4 To understand role of smart data Management

CO5: Initiate the ICT in smart city for economic development of India.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3				1	2				1	1	1	2	1
2	3				1	2				1	1	1	2	1
3	3				1	2				1	1	1	2	1
4	3				1	2				1	1	1	2	1
5	3				1	2				1	1	1	3	1

25CZMESCN	REPAIR & REHABILITATION OF BUILDINGS	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the mechanism of deterioration of concrete, damage assessment, repair materials and rehabilitation techniques.

UNIT I

Introduction – Mechanics of deterioration of concrete – Physical Causes – Freeze and Thaw – Water evaporation – Crystallization of salts in pores – Permeation of water and gases – Chemical Causes – Hydrolysis & Leaching – Sulphate attack – Chloride attack – Salt attack.

UNIT II

Effect of Steel chemistry – Effect of Concrete microstructure – Effect of internal stress levels – Effect of steel bar design – Effect of imposed forces – Effect of environments – Corrosion process in RC structures – Corrosion protection techniques.

UNIT III

Investigations – Visual inspection – Inspection by records – Inspection with instruments: – Surface Hardness Methods – Penetration Techniques (Simbi Hammer, Spit Pins, Windsor Probe, PNR Tester) – Pull Out Tests (Lok Test, TNS Tester, Internal Fracture Test, Epoxy Grouted Bolt) – Core Drilling – Resonant Frequency Method – Ultrasonic Pulse Velocity Method – Pulse Attenuation Method – Pulse Echo Method – Radio Active Method – Nuclear Methods – Magnetic Methods – Electrical Methods – Acoustic Emission Technique – Insitu Permeability Test.

UNIT IV

Introduction - Repair materials – Guniting – Grouting – Cement Grouting – Epoxy Grouting – Polymer Grouting – Epoxy Coating – Epoxy Mortar Coating – Sand Blasting – Grinding – Stitching – Dry Pack – Prepacked Concrete – Resurfacing – Acid etching – Caulking.

UNIT V

Methodology for repair materials - Mortar Replacement – Concrete Replacement – Total Replacement – Preplaced aggregate concrete – Jacketing technique – Plate Bonding technique – Fibre Sheet Bonding Technique

TEXT BOOKS

- Peter H. Emmons, *Concrete Repair and Maintenance*, Galgotia Publishers, New Delhi, 2002.
- Vidivelli.B, *Rehabilitation of Concrete Structures*, Standard Publishers Distributors, New

Delhi, 2015.

REFERENCE BOOKS

- 1.Ted Kay, *Assessment and Renovation of Concrete Structures*, Longman Scientific & Technical, New York, 1992.
- 2.Allen, R.T.L. and S.C. Edwards, *The Repair of Concrete Structures*, Blackie & Son Ltd Glasgow, V.K, 1987.

COURSE OUTCOMES

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

CO1: To understand about the mechanics of deterioration of concrete.

CO2 To estimate and analyze the degree of damage by testing methods.

CO3: To identify the repairs and suitable repair methods and materials.

CO4: To gain the knowledge about rehabilitation and retrofitting of structural members.

CO5: To understand the repair and strengthening of RC structures with reasonable cost.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3				1	2				1	1	1	2	1
2	3				1	2				1	1	1	2	1
3	3				1	2				1	1	1	2	1
4	3				1	2				1	1	1	2	1
5	3				1	2				1	1	1	3	1

25CZMESCN	SERVICES IN HIGH RISE BUILDINGS	L	T	P/D	C
		3	-	-	3

COURSE OBJECTIVES

- High rise buildings are a pleasure to watch, but they are made a pleasure to live in only when the functional requirements are adequately provided through proper ventilation, sanitation and water supply in addition to safety measures during calamities like fire.
- This course covers the principles and practices to be followed in the provision of good service systems.

UNIT I

Planning of building services - Important considerations - Floor loadings -Building cost — Material requirements.

UNIT II

Water supply services - Collection and examination of water samples - Standards - Internal storage and distribution - Bulk water supply - Water treatment - Selection of pumps - Pump rooms and sump.

UNIT III

Sanitation services - Sewerage collection and disposal - Storm water drains - Sewagedisposal - Septic tanks - Solid waste disposal - Refuse disposal systems.

UNIT IV

Lift and Escalators - Types - Selection - Codes and Rules - Structural provisions – Strength considerations - Pits and overheads - Safety precautions.

UNIT IV

Air-conditioning - Provisions in buildings - Systems. Acoustics - Noise in buildings - Noise control - Materials -Methods. Fire fighting services - Classification - Modes of fire - First- aid - Fighting installations — Fire extinguishers - Provisions in building from fire safetyangle - Codes and rules.

TEXT BOOKS

- 1.Jain V.K, Designing and Installation of Services in Building. Complexes & High Rise Buildings, Khanna Publishers, Delhi, 2015.
- 2.Cyril M Harris, Handbook of Utilities and Services for Buildings: Planning, Design, and Installation, McGraw- Hill, New Delhi, 1990.

REFERENCE BOOKS

- 1.Cady, W.G., *Piezoelectricity*, Dover Publications, New York, 1964.

COURSE OUTCOMES

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

CO1: To Identify the Important Consideration involved in planning of building services.

CO2: To understand the examination of water samples required for the construction of buildings and also the internal storage and distribution of water supply along with selection of pumps

CO3: To understand the sanitation services such as sewerage collection and disposal in high rise buildings

CO4: To know the lift and escalator and their structural provisions

CO5: To understand the air conditioning provisions in high rise building and fire fighting services.

COs	POs											PSOs		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3				1	2				1	1	1	2	1
2	3				1	2				1	1	1	2	1
3	3				1	2				1	1	1	2	1
4	3				1	2				1	1	1	2	1
5	3				1	2				1	1	1	3	1