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

2022 Onwards

ANNAMALAI UNIVERSITY
FACULTY OF ENGINEERING AND TECHNOLOGY
B. E. (Four - Year) Degree Programme (FULL - TIME)
Choice Based Credit System (CBCS)
REGULATIONS 2022

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 plus 2 Higher Secondary Course 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/Programme Electives and Open Electives in addition to Seminar & Industrial Training and Project. Each semester curriculum shall normally have a blend of theory, practical and theory cum practical courses. The total credits for the entire degree Programme is **173 (132** 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 173 credits (132 for lateral entry students).

Serve in any one of the Co-curricular activities such as

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

For at least one year. 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, IIChE, 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 are 193. Out of 193 credits (152 credits for lateral entry students), 20 credits must be earned by studying additional course offered by the same or allied Departments (listed in Annexure) in the 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 193 credits, 20 credits must be earned from the courses offered by any one of the Departments (listed in Annexure) 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, second and third 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 173 (132 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 I 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 open elective courses of eighth semester in sixth and seventh semesters one in each to enable them to pursue industrial training/project work in the entire eighth semester period provided they should register those courses in the fifth semester itself. Such students should meet the teachers offering those elective courses themselves for clarifications. No specific slots will be allotted in the time table for such courses.

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 Program

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

- 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 **five** open elective courses of which the student may opt to study either that offered by the Department concerned or from the open elective courses offered by any other Department in the Faculty of Engineering & Technology, with the approval of the Head of the concerned Department and the Head of the Department offering the course. In case the student opts to study an open elective offered by a neighbouring Department in the Faculty, it shall be handled by the faculty of that Department offering the chosen open elective.

A student may be required to choose Intellectual Property Rights (IPR) and Cyber Security as open electives anywhere between fifth and eighth semesters as part of the requirements of the study.

11.3 MOOC (SWAYAM) Courses

The student can be permitted to earn not more than 40 % of his/her total credits (that is 69 credits) by studying Massive Open Online Courses (MOOCs) offered through the SWAYAM Portal of UGC with the approval of the Head of the Department concerned and the Dean of the Faculty. The courses will be considered as equivalent to elective courses from the fifth to the 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 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 Skill Related /Naan Mudhalvan

A student is required to study **Three** open elective courses One each in the fifth, sixth and seventh semester of study as part of acquiring skills in the specified field. The student shall pursue the open electives listed in the Naan Mudhalvan portal against the respective semesters. However alternatively the student shall choose the open electives from the list tabled relating to the respective programmes with the approval of the Head of the Department concerned and Dean of the Faculty.

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

The break-up of Continuous Assessment for the theory course titled Basic Engineering in the II semester that involves two disciplines requires evaluating the performance under the five Course Outcomes, with 3 for one discipline and two for the other, 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.

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

12.3 Theory cum Practical Course

The break-up of Continuous Assessment for the theory cum practical courses necessitates to evaluating the performance as being followed for the theory and practical courses individually and requires the students to clear each component separately. The average of the marks secured by the student in the theory and practical courses and the appropriate grade relating to the average shall be assigned to the student.

12.4 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.

12.5 Industrial Internship

After attending the internship during the semester vacation of II / III year 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/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. 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.

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 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) and 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:

Percentage of marks = (OGPA/CGPA - 0.25) x 10

Where $\boldsymbol{OGPA/CGPA} = \frac{\sum C_i GP_i}{\sum C_i}$

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 193 credits within four years (152 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 173 Credits within four years (132 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 173 credits within ***five*** years (132 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 173 credits within **seven** years (132 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 not related to his/her branch of study at the end of the first year 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 earn an additional 20 credits starting from the third semester in the sense he/she requires 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.

ANNEXURE

S.No.	Branch of Study in B.E	Honours Elective Courses from Same and Allied Departments of	Minor Engineering Courses from Other Departments of
1	Civil Engineering	1. Civil Engineering 2. Civil and Structural Engineering.	1. Mechanical Engineering 2. Electrical Engineering 3. Chemical Engineering 4. Computer Science and Engineering 5. Computer Science and Engineering (Artificial Intelligence and Machine Learning) 6. Computer Science and Engineering(Data Science) 7. Mechanical (Manufacturing) Engineering. 8. Electronics and Instrumentation Engineering. 9. Information Technology 10. Electronics and Communication Engineering.
2	Civil and Structural Engineering		
3	Mechanical Engineering	1. Mechanical Engineering 2. Mechanical (Manufacturing) Engineering.	1. Civil Engineering 2. Civil and Structural Engineering. 3. Electrical Engineering 4. Chemical Engineering 5. Computer Science and Engineering 6. Computer Science and Engineering (Artificial Intelligence and Machine Learning) 7. Computer Science and Engineering (Data Science) 8. Electronics and Instrumentation Engineering. 9. Information Technology 10. Electronics and Communication Engineering.
4	Mechanical (Manufacturing) Engineering.		
5	Electrical and Electronics Engineering	1. Electrical Engineering 2. Electronics and Instrumentation Engineering 3. Electronics and Communication Engineering	1. Civil Engineering 2. Civil and Structural Engineering. 3. Mechanical Engineering 4. Chemical Engineering 5. Mechanical (Manufacturing) Engineering.

6	Electronics and Instrumentation Engineering.		
7	Chemical Engineering	1. Chemical Engineering 2. Pharmacy 3. Electronics and Instrumentation Engineering	1. Civil Engineering 2. Mechanical Engineering 3. Electronics and Instrumentation Engineering. 4. Information Technology 5. Civil and Structural Engineering. 6. Electrical Engineering 7. Electronics and Communication Engineering. 8. Mechanical (Manufacturing) Engineering. 9. Computer Science and Engineering 10. Computer Science and Engineering (Artificial Intelligence and Machine Learning) 11. Computer Science and Engineering(Data Science)
8	Computer Science and Engineering	1. Computer Science and Engineering. 2. Information Technology 3. Electronics and Communication Engineering 4. Computer Science and Engineering(Artificial Intelligence and Machine Learning) 5. Computer Science and Engineering(Data Science)	1. Civil Engineering 2. Mechanical Engineering 3. Mechanical (Manufacturing) Engineering. 4. Civil and Structural Engineering. 5. Chemical Engineering
9	Information Technology		

10	Electronics and Communication Engineering.	1. Electrical Engineering 2. Electronics and Instrumentation Engineering 3. Electronics and Communication Engineering	1. Civil Engineering 2. Civil and Structural Engineering. 3. Mechanical Engineering 4. Chemical Engineering 5. Mechanical (Manufacturing) Engineering.
11	Computer Science and Engineering (Artificial Intelligence and Machine Learning)	1. Computer Science and Engineering. 2. Information Technology 3. Electronics and Communication Engineering 4. Computer Science and Engineering(Artificial Intelligence and Machine Learning) 5. Computer Science and Engineering(Data Science)	1. Civil Engineering 2. Mechanical Engineering 3. Mechanical (Manufacturing) Engineering. 4. Civil and Structural Engineering. 5. Chemical Engineering
12	Computer Science and Engineering (Data Science)		

DETAILS OF COURSE CODE

S. No	Code (3rd and 4th Digits)	Details
1	ET	Common Course for the faculty
2	CE	Civil Engg. Course
3	CZ	Civil and Structural Engg. course
4	ME	Mechanical Engg. Course
5	MM	Mechanical Engg (Manufacturing). Course
6	EE	Electrical and Electronics Engg. Course
7	EI	Electronics and Instrumentation Engg. course
8	CH	Chemical Engg. course
9	CS	Computer Science and Engg. course
10	IT	Information Technology course
11	EC	Electronics and Communication Engg. course
12	AI	Computer Science and Engineering (Artificial Intelligence and Machine Learning)
13	DS	Computer Science and Engineering (Data Science)
14	YY	Code of the Program concerned (S. No 02 to S.No.13)

Code (5th and 6th Digits)	Details
HS	Humanities Theory
HP	Humanities Practical
BS	Basic Science Theory
BP	Basic Science Practical
ES	Engineering Science Theory
SP	Engineering Science Practical
PC	Professional Core Theory
CP	Professional Core Practical
PE	Professional Elective Theory
EP	Professional Elective Practical
IT	Internship /Industrial Training
OE	Open Elective Theory
PV	Project and Viva-voce

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.

ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

B.E (Four Year) Degree Program (FULL-TIME)

Choice Based Credit System (CBCS)

COURSES OF STUDY AND SCHEME OF EXAMINATIONS (REGULATIONS 2022)

Curriculum for B.E 2022-23 onwards

SEMESTER I									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
22ETBS101	**BS-I**	Mathematics-I	3	1	-	25	75	100	4
22ETBS102	**BS-II**	Physics	3	1	-	25	75	100	4
22ETBS103	**BS-III**	Chemistry	3	1	-	25	75	100	4
22ETES104	**ES-I**	Programming for Problem Solving	2	1	-	25	75	100	3
22ETHS105	**HS-I**	Heritage of Tamils தமிழர் மரபு	1	-	-	25	75	100	1
22ETHP106	**HSP-I**	Communication Skills and Language Laboratory	-	-	3	40	60	100	1.5
22ETSP107	**ESP-I**	Engineering Workshop Practices	-	-	3	40	60	100	1.5
22ETSP108	**ESP-II**	Electrical Wiring and Earthing Practice Laboratory	-	-	3	40	60	100	1.5
								Total Credits	**20.5**

SEMESTER II									
Course Code	**Category**	**Course**	**L**	**T**	**P/D**	**CA**	**FE**	**Total**	**Credits**
22ETHS201	**HS-II**	English	3	1	-	25	75	100	4
22ETBS202	**BS-IV**	Mathematics-II	3	1	-	25	75	100	4
22ETES203	**ES-II**	Basic Engineering*	4	-	-	25	75	100	4
22ETHS204	**HS-III**	Tamils and Technology தமிழரும் தொழில்நுட்பமும்	1	-	-	25	75	100	1
22ETBP205	**BSP-I**	Physics Laboratory	-	-	3	40	60	100	1.5
22ETBP206	**BSP-II**	Chemistry Laboratory	-	-	3	40	60	100	1.5
22ETSP207	**ESP-III**	Computer Programming Laboratory	-	-	3	40	60	100	1.5
22ETSP208	**ESP-IV**	Engineering Graphics	2	-	3	40	60	100	3
								Total Credits	**20.5**

*** Basic Civil Engineering (3 Units) & Basic Mechanical Engineering (2 Units) for Circuit Branches**
*** Basic Mechanical Engineering (2 Units) & Basic Electrical and Electronics Engineering (3 Units) for Civil, C&S and Chemical Engineering Branches**
*** Basic Civil Engineering (2 Units) & Basic Electrical and Electronics Engineering (3 Units) for Mechanical & Mechanical (Manufacturing) Engineering Branches**

SEMESTER III									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
22ETBS301	BS-V	Engineering Mathematics III	3	1	-	25	75	100	4
22ETES302	ES-III	Environmental Studies	3	-	-	25	75	100	3
22ETES303	ES-IV	Engineering Mechanics	3	-	-	25	75	100	3
22CZES304	ES-V	Construction Engineering	3	-	-	25	75	100	3
22CZPC305	PC-I	Fluid Mechanics	3	-	-	25	75	100	3
22CZPC306	PC-II	Concrete Technology	3	-	-	25	75	100	3
22CZCP307	PCP-I	Computer Practical I	-	-	3	40	60	100	1.5
22CZCP308	PCP-II	Concrete and Construction Laboratory	-	-	3	40	60	100	1.5
22CZCP309	PCP-III	Fluid Mechanics Laboratory	-	-	3	40	60	100	1.5
			Total Credits						**23.5**

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
22CZBS401	BS-VI	Probability, Random Process andNumerical Methods	3	-	-	25	75	100	3
22CZES402	ES-VI	Solid Mechanics	3	1	-	25	75	100	4
22CZPC403	PC-III	Estimation, Costing & Valuation	3	-	-	25	75	100	3
22CZPC404	PC-IV	Applied Hydraulics Engineering	3	-	-	25	75	100	3
22CZPC405	PC-V	Structural Concrete Design I	3	-	-	25	75	100	3
22CZPC406	PC-VI	Surveying and Geomatics	3	-	-	25	75	100	3
22ETHS407	HS-IV	Universal Human Values	2	1	-	25	75	100	3
22CZCP408	PCP-IV	Structural materials testing laboratory	-	-	3	40	60	100	1.5
22CZCP409	PCP-V	Hydraulics Engineering Laboratory	-	-	3	40	60	100	1.5
22CZCP410	PCP-VI	Surveying and Geomatics Laboratory	-	-	3	40	60	100	1.5
			Total Credits						**26.5**
Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the Forth coming V Semester.									

SEMESTER V									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
22CZPC501	PC-VII	Structural Mechanics I	3	-	-	25	75	100	3
22CZPC502	PC-VIII	Structural Steel Design I	3	-	-	25	75	100	3
22CZPC503	PC-IX	Soil Mechanics	3	-	-	25	75	100	3
22CZPC504	PC-X	Structural Concrete Design II	3	-	-	25	75	100	3
22CZPE505	PE-I	Professional Elective I	3	-	-	25	75	100	3
22CZPE506	PE-II	Professional Elective II	3	-	-	25	75	100	3
22CZOE507	OE-I	Open Elective I	3	-	-	25	75	100	3
22CZCP508	PCP-VII	Computer Practical II	-	-	3	40	60	100	1.5
22CZCP509	PCP-VIII	Structural Reinforcement Detailing Laboratory	-	-	3	40	60	100	1.5
22ETIT510	IT-I	Industrial Training / Rural Internship/Innovation / Entrepreneurship	*Four weeks duringthe summer vacation at the end of IV Semester*				100	100	4.0
								Total Credits	**28.0**

SEMESTER VI									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
22CZPC601	PC-XI	Structural Mechanics II	3	-	-	25	75	100	3
22CZPC602	PC-XII	Disaster Preparedness and Planning	3	-	-	25	75	100	3
22CZPE603	PE-III	Professional Elective III	3	-	-	25	75	100	3
22CZPE604	PE-IV	Professional Elective IV	3	-	-	25	75	100	3
22CZPE605	PE-V	Professional Elective V	3	-	-	25	75	100	3
22CZOE606	OE-II	Open Elective II	3	-	-	25	75	100	3
22CZCP607	PCP-IX	Computer Practical III	-	-	3	40	60	100	1.5
22CZCP608	PCP-X	Geotechnical Engineering Laboratory	-	-	3	40	60	100	1.5
22CZCP609	PCP-XI	Advanced Structural Material Testing Laboratory	-	-	3	40	60	100	1.5
								Total Credits	**22.5**

Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming VII Semester.

SEMESTER VII									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
22ETHS701	HS-V	Professional Practice, Law and Ethics	2	-	-	25	75	100	2
22CZPC702	PC-XIII	Instrumentation and Sensor Technologies for Civil Engineering Applications	3	-	-	25	75	100	3
22CZPE703	PE-VI	Professional Elective VI	3	-	-	25	75	100	3
22CZPE704	PE-VII	Professional Elective VII	3	-	-	25	75	100	3
22CZOE705	OE-III	Open Elective III	3	-	-	25	75	100	3
22CZCP706	PCP-XII	Instrumentation and Sensor Technologies & Earthquake Engineering Laboratory	-	-	3	40	60	100	1.5
22ETIT707	IT-II	Industrial Training / Rural Internship/Innovation / Entrepreneurship	***Four** weeks duringthe summer vacation at the endof VI **Semester***				100	100	**4.0**
								Total Credits	**19.5**

SEMESTER VIII									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
22CZOE801	OE-IV	Open Elective IV	3	-	-	25	75	100	3
22CZOE802	OE-V	Open Elective V	3	-	-	25	75	100	3
22CZPV803	PV-I	Project Work and Viva-Voce	-	PR 10	S 2	40	60	100	6
								Total Credits	**12**

L	No. of Lecture	**TR**	No. of Discussion on Industrial Training
T	No. of Tutorial	**S**	No. of Seminar on Industrial Training / Project
P	No. of Practical	**PR**	No. of Discussion on Project work
CA	Continuous Assessment Marks	**FE**	Final Examination Marks
Credits	Credit points allotted to that course	**Total**	Total Marks

Sl. No.	Course Code	PROFESSIONAL ELECTIVES
1	22CZPE505	Scaffolding and Form Work Design in Construction
2	22CZPE506	Engineering Geology
3	22CZPE603	Structural Steel Design II
4	22CZPE604	Structural Concrete Design III
5	22CZPE605	Environmental Engineering
6	22CZPE703	Prestressed Concrete
7	22CZPE704	Structural Concrete Design IV
8	22CZPESCN	Transportation Engineering
9	22CZPESCN	Advances in Concrete Technology
10	22CZPESCN	Design of Load Bearing Masonry Structures
11	22CZPESCN	Hydrology and Water Resource Engineering
12	22CZPESCN	Tall Buildings

Sl. No.	Course Code	OPEN ELECTIVES
1	22CZOE507	Earthquake Engineering
2	22CZOE606	Foundation Engineering
3	22CZOE705	High Rise Buildings
4	22CZOE801	Design and Construction of Steel Buildings
5	22CZOE802	Repair and Rehabilitation of Concrete Structures
6	22CZOESCN	Finite Element Method
7	22CZOESCN	Services in High Rise Buildings
8	22CZOESCN	Intellectual property rights
9	22CZOESCN	Cyber Security
10	22CZOESCN	Smart Cities
11	22CZOESCN	NCC Studies

Sl. No.	Course Code	HONOURS ELECTIVES
1	22CZHESCN	Behaviour of Reinforced Concrete Structures
2	22CZHESCN	Dynamics of Structures
3	22CZHESCN	Bridge Engineering
4	22CZHESCN	Composites for Construction
5	22CZHESCN	Design of Plates and Shells
6	22CZHESCN	Disaster Resistant Design of Structures

Sl. No.	Course Code	MINOR ENGINEERING ELECTIVES
1	22CZMISCN	Construction Techniques and Management
2	22CZMISCN	Smart Materials and Smart Structures
3	22CZMISCN	Ground Improvement Techniques
4	22CZMISCN	Theory of Elasticity and Plasticity
5	22CZMISCN	Urban and Rural Planning

SEMESTER I

22ETBS101	MATHEMATICS -I	L	T	P/D	C
		3	1	0	4

COURSE OBJECTIVES

- To familiarize definite integrals and its application in finding area and volume.
- To introduce the fundamentals of functions of several variables.
- To make the student to learn infinite series and its nature.
- To impart knowledge about Vector calculus.
- To provide the concept of eigen values and eigen vectors of a real matrix and its properties of great utility in many branches of engineering.

UNIT I: INTEGRAL CALCULUS

Evaluation of definite integrals and their properties - Applications of definite integrals to evaluate surface areas and volumes of revolutions. Improper integral - Beta and Gamma functions and their properties.

UNIT II: FUNCTIONS OF SEVERAL VARIABLES

Rolle's theorem-Mean value theorem. Indeterminate forms - L'Hospital's rule, Functions of two variables: Taylor's and Maclaurin's series expansions - Maxima and minima for functions of two variables.

UNIT III: 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).

UNIT IV: VECTOR CALCULUS (DIFFERENTIATION)

Gradient, divergence and curl - Directional derivative - Unit normal vector - Irrotational and solenoidal vectors - Expansion formulae for operators involving.

UNIT V: MATRICES

Rank of a matrix - Symmetric, skew - Symmetric and orthogonal matrices - Characteristic equation - Eigen values and Eigen vectors - Cayley-Hamilton Theorem - Diagonalization of symmetric matrices by Orthogonal transformation.

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. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th publishers, Reprint,2002.
2. Erwin kreyszig,"Advanced Engineering Mathematics", 9th Edition, JohnWiley &Sons,2006.
3. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi,11th Reprint, 2010.
4. 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 able to

1. Solve improper integrals using Beta and Gamma functions.
2. Evaluate the extreme values for functions of two variables.
3. Analyze the convergence of infinite series.
4. Understand vector differentiation and Recognize solenoidal and irrotational fields.
5. Solve eigen values and eigen vectors of a real matrix and Orthogonal transformation of a matrix.

Mapping of Course Outcomes with Program Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2									
CO2	3	3	2	2								
CO3	3	3	2									
CO4	3	3										
CO5	3	3	3	2	2							

22ETBS102	PHYSICS	L	T	P/D	C
		3	1	0	4

COURSE OBJECTIVES

- To understand the ray of light to undergo the phenomenon of interference diffraction and polarization.
- 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: WAVE OPTICS

Huygens' Principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer and Mach-Zehnder interferometer. Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; diffraction gratings and their resolving power.

UNIT II: LASERS

Introduction - Principles of Laser - Stimulated emission, Properties of laser beams: mono- chromaticity, coherence, directionality and brightness Einstein's theory of, stimulated emission A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO2), solid - State lasers (ruby, Neodymium), dye lasers, laser speckles, applications of lasers in science, engineering and medicine.

UNIT III: CRYSTAL PHYSICS

Introduction to solid Materials - Crystal structure - Geometry of lattice unit cell - Bravais' lattice - Crystal systems, Crystal structures of Materials - (Cordination 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

Heisenberg uncertainty Principle - CDual nature of Matter and radiation - De Broglie's Wave length - Wave Velocity and group velocity. The 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) - Energy quantization - Eigen values and Eigen functions.

UNIT V: ENERGY PHYSICS

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

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

1. Gain knowledge on the construction of different types of interferometer.
2. Description on different types of laser and its application.
3. Analyze the importance of packing factor in different crystal system.
4. Evaluate the quantum mechanical concept of wave velocity and group velocity.
5. Compared the different energy resource and their availability.

Mapping of Course Outcomes with Program Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
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**

22ETBS103	CHEMISTRY	L	T	P/D	C
		3	1	0	4

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 and nano materials.
- To get basic knowledge on refractories, lubricants and spectroscopical techniques.

UNIT I: WATER CHEMISTRY AND SURFACE CHEMISTRY

Hardness of water - Softening of hard water by ion exchange method - Boiler feed water - Boiler troubles - Internal treatment methods - Estimation of hardness by EDTA method - Desalination of brackish water - Reverse Osmosis. Disinfection of water - 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, Cell constant - Types of conductometric titrations. Potentiometry - Principle of acid base titration. Corrosion - Dry and wet corrosion - Galvanic, concentration cell and pitting corrosion - Control of corrosion by Cathodic protection method.

UNIT III: FUELS AND STORAGE DEVICES

Fuels - Classification - Calorific values - HCV and LCV - Analysis of coal - Proximate and ultimate analysis - Refining of petroleum. Cracking - Fixed bed - Synthetic petrol - Fischer -Tropsch process - Flue gas analysis by Orsat apparatus. Batteries - Primary and secondary - Dry cell - Lead acid storage battery - Ni-Cd battery - Lithium battery - H2-O2 fuel cell.

UNIT IV: POLYMERS AND NANO MATERIALS

Polymers -Types of polymerization - Addition, condensation and copolymerisation - Mechanism of addition polymerization (Free radical). Plastics - Thermoplastics and thermosetting plastics -Preparation, properties and uses of polyethylene, polyvinyl chloride, polystyrene, Nylon and bakelite. Nano chemistry -Introduction to nano materials. Synthesis - Precipitation, sol- Gel process, electro deposition and chemical vapour deposition methods. Carbon nano tubes, fullerenes, nano wires and nano rods.

UNIT V: ENGINEERING MATERIALS AND SPECTROSCOPIC TECHNIQUES

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) -Fluorescence and its applications in medicine.

TEXT BOOKS

1. Jain, P.C. and Monica Jain (2010) "Engineering Chemistry" DhanpatRai& 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 McGraw 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 this course work, 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.
3. Understand the properties of fuels and applications of energy storage devices.
4. Synthesis various polymers and understand about nanomaterials.
5. Gain knowledge on refractories, lubricants and understand the concepts of certain spectroscopical techniques

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	2					2			
CO2				2	1							
CO3	3		3									
CO4	3				1							
CO5		2	3	2					2			

22ETES104	PROGRAMMING FOR PROBLEM SOLVING	L	T	P/D	C
		2	1	0	3

COURSE OBJECTIVES

- To understand the fundamentals of C programming
- To provide students with understanding of code organization and functional hierarchical decomposition using complex data types.
- To understand how to break a large problem into smaller parts, writing each part as a module or function
- To effectively utilize structures and pointers in problem solving
- To enable students to take up Systems programming or Advanced C programming course.

UNIT I: FUNDAMENTALS OF PROGRAMMING

Introduction to Programming, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.), Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

UNIT II: EXPRESSIONS AND CONTROL STRUCTURES

Arithmetic Expressions and Precedence, Conditional Branching and Loops, Writing and evaluation of Conditionals and consequent Branching, Iteration and Loops.

UNIT III: ARRAYS

Arrays: Arrays (1-D, 2-D), Character arrays and Strings, Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required).

UNIT IV: FUNCTIONS

Function: Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT V: FILES AND STRUCTURES

Structure: Structures, Defining structures and Array of Structures, Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation). File handling (only if time is available, otherwise should be done as part of the lab).

TEXT BOOKS

1. Byron Gottfried, “Schaum's Outline of Programming with C”,McGraw-Hill.
2. E. Balaguruswamy, “Programming in ANSI C”, TataMcGraw-Hill.

REFERENCE BOOKS

1. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, Prentice Hall ofIndia.

COURSE OUTCOMES

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

1. Formulate algorithms, draw flowcharts and write pseudocode for solving arithmetic and logical problems.
2. Develop C programs using branching and looping statements.
3. Implement searching and sorting algorithms and analyze the order of complexities.
4. Define and call simple functions by value and by reference and also to write recursive functions.
5. Utilize structures, pointers and files in C programming.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2										
CO2	2	2	3	2								
CO3	2	2	3	2								
CO4	1	1										
CO5	2	1	1									

22ETHS105	HERITAGE OF TAMILS தமிழர் மரபு	L	T	P/D	C
		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 சமண 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 V 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, ஒயிலாட்டம், 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 அச்சு வரலாறு.

1. Language and Literature: Language Families in India - Dravidian Languages -Tamil as a Classical Language - Classical Literature in Tamil -Secular Nature of Sangam Literature –Distributive Just icein Sangam Literature –Management Principles inThirukural –Tamil Epics andImpact of Buddhism&Jainismin TamilLand –Bakthi Literature Azhwars and Nayanmars.- Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

2. Heritage - Rock art paintings to modern art - Sculpture: Hero stone to modern sculpture –Bronzeicons – Tribes and their handicrafts-Art of templecar 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.

3. Folk and Martial arts - Therukoothu, Karagattam, VilluPattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

4. Thinai 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.

5. 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

TamilBooks.

TEXT-CUM-REFERENCE BOOKS

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)
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 TamilStudies.
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)(Publishedby: The Author)
11. PorunaiCivilization(JointlyPublishedbyDepartmentofArchaeology&TamilNaduText Bookand Educational Services Corporation, TamilNadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) -Reference Book.

22ETHP106	COMMUNICATION SKILLS AND LANGUAGE LABORATORY	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.

LIST OF TOPICS

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

Suggested Software Package: 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.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		3								3		3
CO2		3								3		3
CO3			2							3		3
CO4		2								3		3
CO5			3							3		3

22ETSP107	ENGINEERING WORKSHOP PRACTICE	L	T	P/D	C
		0	0	3	1.5

COURSE OBJECTIVES

- To provide the students simple hands-on-experience in the basic aspects of production engineering in fitting, carpentry and sheet metal.
- To familiarize the students in the various hand forging operations

CARPENTRY: Use of hand tools - exercises in planning and making joints namely, Lap joint, Lenthhening joint, half lap joint, dovetail joint, mortising and tenoning etc.

FITTING: Use of bench tools, vice, hammers, chisels, files, hacksaw, centre punch, twist drill, taps and dies - Simple exercises in making T, V joint and dovetail joints.

SHEET METAL WORK: Use of hand tools - Simple exercises in making objects like cone, funnel, tray, cylinder.

SMITHY: Demonstration of hand forging and drop forging.

COURSE OUTCOMES

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

1. Use basic tools of fitting, carpentry and sheet metal fabrication.
2. Fabricate simple carpentry joints.
3. Develop skill to make simple fitting joints.
4. Create simple shapes of sheet material.
5. Distinguish hand forging and drop forging operation.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3		2		2		3					3
CO2	3		2		2		3					3
CO3	3		2		2		3					3
CO4	3		2		2		3					3
CO5	3		2		2		3					3

22ETSP108	ELECTRICAL WIRING AND EARTHING PRACTICE LABORATORY	L	T	P/D	C
		0	0	3	1.5

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. Stair case 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 Parameters in a Single-Phase AC Circuit
10. Measurement of Voltage, Current, Power and Power factor in a Resistive Circuit
11. Soldering Practice -Components devices and circuits -using general purpose PCB
12. Corridor Wiring
13. Test the operation and control circuit for LED Flourescent 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 this course work, 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.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3			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

SEMESTER II

22ETHS201	ENGLISH	L	T	P/D	C
		3	1	0	4

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

The concept of Word Formation
Root words from foreign languages and their use in English
Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Count and uncount nouns.
Synonyms, antonyms, and standard abbreviations.
Language development - Wh questions asking and answering yes or no questions.

UNIT II: BASIC WRITING SKILLS

Sentence Structures
Use of phrases and clauses in sentences
Importance of proper punctuation
Creating coherence and Techniques for writing precisely
Organizing principles of paragraphs in writing

UNIT III: NATURE AND STYLE OF SENSIBLE WRITING

Describing and Defining
Classifying and Providing examples or evidence
Writing introduction and conclusion
Comprehension
Precise Writing

UNIT IV: WRITING PRACTICES & ORAL COMMUNICATION

Listening to lectures and making notes
Mechanics of presentation, asking and giving instruction
Essay Writing -Writing analytical essays and issue based essays
Dialogue writing and conversation
Letter writing -Formal and informal

UNIT V: GROUP DISCUSSION AND JOB APPLICATION

Characteristics and practices of group discussion
Job application
Resume preparation
Writing reports -minutes of a meeting, accident, survey E-mail -etiquette

TEXT /REFERENCE BOOKS

1. Michael Swan,“Practical English Usage”, OUP, 1995.
2. F.T. Wood,“Remedial English Grammar”,Macmillan,2007.
3. William Zinsser,“On Writing Well”, Harper Resource Book, 2001,
4. Liz Hamp - Lyons and Ben Heasly,“Study Writing”, Cambridge University Press, 2006.
5. Sanjay Kumar and PushpLata, “Communication Skills” 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 able to

1. Comprehension, writing and speaking skills. Get an exposure of vocabulary and gain a good glossary.
2. Get knowledge regarding use of Grammar in speech and writing.
3. Acquire a knowledge of remembering, understanding, applying, analyzing, evaluating & creating.
4. Determine how to articulate their ideas effectively to a variety of listeners.
5. Acquire ability to speak and write effectively in English.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		2		2						3		3
CO2		2		2						3		3
CO3			3							3		3
CO4			2	3						3		3
CO5			3	2						3		3

22ETBS202	MATHEMATICS -II	L	T	P/D	C
		3	1	0	4

COURSE OBJECTIVES

- To familiarize multiple integrals and its application in finding area and volume.
- To make the student to learn line, surface and volume integrals.
- To solve Second order linear differential equations with constant coefficients.
- To acquaint the student with the techniques in the theory of analytic functions.
- To introduce the fundamentals of complex integrations.

UNIT I: 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.

UNIT II: VECTOR CALCULUS (INTEGRATION)

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 and evaluation of integrals using them.

UNIT III: ORDINARY DIFFERENTIAL EQUATIONS

First order ordinary differential equations (Linear and Bernoulli's differential equations, exact differential equations). Solution of Second order ordinary linear differential equations with constant co-efficient (method of variation of parameters only).Solution of Second order ordinary linear differential equations with variable co-efficient (Euler and Legendre's linear equations).

UNIT IV: COMPLEX VARIABLE (DIFFERENTIATION)

Analytic functions and their properties - Cauchy-Riemann equations - Harmonic functions -harmonic conjugate of elementary analytic functions-Construction of an analytic function. Mobius transformations.

UNIT V: COMPLEX VARIABLE (INTEGRATION)

Cauchy theorem (without proof) - Cauchy Integral formula (without proof) - Cauchy Integral formula for higher derivatives (without proof) -zeros and poles of an analytic functions -singularities. Residues - Cauchy Residue theorem (without proof) - Evaluation of definite integral using them. Taylor's series and Laurent's series.

TEXT BOOKS

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 36thEdition,2010.
2. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley &Sons,2006.

REFERENCE BOOKS

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson,Reprint,2002.
2. W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", 9thEdn., Wiley India, 2009.
3. S. L. Ross, "Differential Equations", 3rd Ed., Wiley India,1984.
4. J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7th Ed., Mc- Graw Hill, 2004.
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. Solve double and triple integrals in finding area and volumes.
2. Apply line, surface and volume integrals in Gauss, Greens and Stoke'stheorems.
3. Solve Second order linear differential equations with constant coefficients.
4. Construct analytic function and analyze conformal mappings.
5. Evaluate the complex integrals and contour integration.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2								
CO2	3	3	2									
CO3	3	3	3	3	3							
CO4	3	3	2									
CO5	3	3	3	2								

22ETES203	BASIC ENGINEERING {Civil (2 Units), Civil (3 Units), Mechanical (2 Units), Electrical and Electronics (3 Units)}	L	T	P/D	C
		4	0	0	4

BASIC CIVIL ENGINEERING (2 Units)

COURSE OBJECTIVES

- To inculcate a knowledge on essentials of Civil Engineering and to expose on the role of significance and contributions
- To satisfying societal needs and illustrate the concepts of various construction techniques

UNIT I

Introduction to Civil Engineering - Various disciplines of Civil Engineering - Introduction to various building materials Stone, Bricks, Steel, Cement, Concrete – its characteristics, types and uses. Surveying - Principles and objectives of surveying; Types, Classifications of surveying, measurement of areas and distances – chain – compass: Introduction to Leveling, Total station, Remote sensing.

UNIT II

Building construction – foundations; Bearing capacity of soil, functions of foundations, Types - Shallow and Deep. Brick masonry – Header, Stretcher, Flemish and English Bond. Columns, Lintels, Roofs – functions, types, roofing materials. Bridges – necessity - selection of site – components of a bridge: Dams – types – selection site - forces acting on a dam – Roads – uses - classification of roads – components of a road.

TEXT BOOKS

1. Ramesh babu. V, A text book of Basic Civil Engineering, Anuradha Agencies, Kumbakonam, 1995.
2. Palanichamy M.S., Basic Civil Engineering, Tata McGraw Hill Publishing Company ltd, 2000.

REFERENCE BOOKS

1. Ramamrutham V, Basic Civil Engineering, DhanpatRai Publishing Co. (P) Ltd., 1999.
2. Natarajan K V, Basic Civil Engineering, Dhanalakshmi Publications, Chennai, 2005.
3. SatheeshGopi, Basic Civil Engineering, Pearson Publications, 2010.

COURSE OUTCOMES

1. Understand the basic knowledge on civil engineering materials
2. Develops the skill to satisfy the social needs and suitable method of construction technique

Mapping of Course Outcomes with Programme Outcomes															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2									2	3	2	2
CO2	3	2	2									2	2	3	2
CO3															
CO4															
CO5															

BASIC CIVIL ENGINEERING (3 Units)

COURSE OBJECTIVES

- To inculcate a knowledge on essentials of Civil Engineering
- To expose the students on the role, significance and contributions of Civil Engineering in satisfying societal needs
- To illustrate the concepts of various construction techniques

UNIT I

Introduction to Civil Engineering - Relevance of Civil Engineering in the overall infrastructural development of the country. Introduction to various building materials -Stone, Bricks, Steel, Cement, Concrete, Timber -its characteristics, types and uses. Various types of buildings as per NBC; Selection of suitable site for buildings, Components of a residential building -its functions, Orientation of a building, simple definitions - Plinth area / built up area, floor area / carpet area -floor space index.

UNIT II

Surveying - Principles and objectives of surveying; Types, Classifications of surveying, measurement of areas and distances - Chain - Compass: Introduction to Leveling, Total station, Remote sensing - Fundamental principles and applications.

Building construction - Foundations; Bearing capacity of soil, functions of foundations, Types - Shallow and Deep. Brick masonry - Header, Stretcher, Flemish and English Bond. Columns, Lintels, Roofs - Functions, types, roofing materials, Floors -functions, types, flooring materials. Decorative finishes - Plastering, interior design.

UNIT III

Bridges - Necessity - Selection of site - Components of a bridge: Dams -Types - Selection of site - Forces acting on a dam - Roads - Uses - Classification of roads - Components of a road; Railways - Basic components of permanent way -Water supply - Per capita requirement - Sources - Need for conservation of water - Rain water harvesting - Basic water treatment - Sewage and its disposal - Basic definitions - Septic tank - Components and functions.

TEXT BOOKS

1. Ramesh babu. V, A text book of Basic Civil Engineering, Anuradha Agencies, Kumbakonam, 1995.
2. Palanichamy M.S., Basic Civil Engineering, Tata McGraw Hill Publishing Company ltd, 2000.

REFERENCE BOOKS

1. Ramamrutham V, Basic Civil Engineering, DhanpatRai Publishing Co. (P) Ltd., 1999.
2. Natarajan K V, Basic Civil Engineering, Dhanalakshmi Publications, Chennai, 2005.
3. SatheeshGopi, Basic Civil Engineering, Pearson Publications, 2010.

COURSE OUTCOMES

1. Understand the basic knowledge on Civil engineering materials
2. Develops the skill to satisfy the social needs
3. Describe the suitable method of construction technique

Mapping of Course Outcomes with Programme Outcomes															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2									2	3	2	2
CO2	3	2	2									2	2	3	2
CO3	3	2	2			2						2	2	2	3
CO4															
CO5															

BASIC MECHANICAL ENGINEERING (2 Units)

COURSE OBJECTIVES

- To familiarize the students the functioning of boilers, turbines and internal combustion engines.
- To provide knowledge about the use of various machine tools and manufacturing processes

UNIT I

Energy Conversion Devices: Boilers - Classification - Description and working of Cochran boiler - Babcock and Wilcox boiler. Steam turbines: Principles and working of Impulse and Reaction turbines. Gas turbines: Principles and working of Open cycle and Closed cycle gas turbines. Internal Combustion Engines: Classification - Principal parts - Two stroke and four stroke cycle engines - Working principle of petrol and diesel engines - Concept of CRDI and MPFI fuel injection systems - Hybrid engines. Battery electric vehicles (BEV) - key components

UNIT II

Formative Manufacturing Processes: Forging - Principle and operations; Rolling - Principle, rolling mill configurations; Extrusion - Direct versus indirect extrusion**.** Metal Casting: Principle - Green sand moulding - Injection moulding. Subtractive Manufacturing: Description of parts and operations performed: Lathe, Shaper, Universal Drilling machine, Universal Milling Machine - CNC Machining Centers. Additive Manufacturing Processes: 3 D Printing: Classification - Steps - Advantages - Disadvantages - Stereo lithography process - Gas welding -principle, Oxy-acetylene welding - Equipment, Arc welding - Principle - Equipment - Brazing: Types - Soldering - Comparison of brazing and soldering.

TEXT BOOKS

1. Prabhu T J, Jaiganesh V and Jebaraj S, Basic Mechanical Engineering, Scitech Publications Pvt. Ltd., Chennai, 2016.

2. Venugopal and Prabhuraj T J, Basic Mechanical Engineering, ARS publishers, Sirkali, 1996.

REFERENCE BOOKS

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

COURSE OUTCOMES

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

1. Demonstrate the working of various energy conversion devices such as boilers, turbines and internal combustion engines
2. Appraise the fundamental concepts of manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (3 Units)

COURSE OBJECTIVES

- To understand the basics of Electrical circuit laws and fundamentals of AC circuits
- To understand the working of DC Machines, transformers and AC machines
- To learn the basics of electronic devices and Communication Systems

UNIT-I BASIC CIRCUITS

Definition of current and voltage - Electrical circuit elements (R, L and C) - Ohm's Law- Kirchhoff's laws - solution for currents and voltages - AC circuits - RMS -Average values - Introduction to 3 phase systems - Advantages

UNIT-II ELECTRICAL MACHINES

Laws of Electromagnetism - Construction of DC Machines - DC Generator - EMF Equation - DC Motor - Principle of operation - Types – Characteristics

Single-phase Transformer: Construction and Working principle - EMF equation - Three-phase transformer - Working principle.

Three-phase induction motor – Construction and working principle - Single-phase induction motor - Alternators - Working principle

UNIT-III BASIC ELECTRONICS

P-N junction - VI Characteristics of PN junction diode, Zener diode - Rectifier circuits- Voltage Regulator using Zener diode - Elements of Communication Systems - Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TEXTBOOKS

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education, 2014.
2. A K Theraja &B L Theraja, A Textbook of Electrical Technology, Vol.2, S. Chand Publishing, 2014.

REFERENCE BOOKS

1. Del Toro, “Electrical Engineering Fundamentals”, Second edition, Pearson Education, New Delhi, 1989.
2. V.K. Mehta, Rohit Mehta, “Basic Electrical Engineering”, S.Chand Publications, 2012.

COURSE OUTCOMES

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

- Understand the concepts related with electrical circuits and AC fundamentals.
- Acquire knowledge on the concepts of DC machines, Transformers and AC machines
- Enhance the knowledge about the basic electronic devices and their applications.
  Gain insight on the various elements of Communication systems.

Mapping of Course Outcomes with Programme Outcomes															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1									2			
CO2	3	2	1									2			
CO3	3	2	1									2			
CO4															
CO5															

22ETHS204	TAMILS AND TECHNOLOGY தமிழரும் தொழில்நுட்பமும்	L	T	P/D	C
		1	0	0	1

1. **Weaving and Ceramic Technology**:Weaving Industry during Sangam Age - Ceramic technology -

அலகு I: நெசவு மற்றும் பானைத் தொழில்நுட்பம்: 3

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் 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 குமுழித் 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

Black and Red Ware Potteries (BRW) - Graffiti on Potteries.

2. **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.
3. **Manufacturing Technology**:Art of Ship Building - Metallurgical studies - Iron industry-Iron smelting, steel - Copper and gold - Coinsassource of history - Minting of Coins - Beads making - Industries Stone beads - Glass beads - Terracotta beads - Shell beads/bone beats - Archeological evidences - Gem stone types described in Silappathikaram.
4. **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 - Conchediving - Ancient Knowledge of Ocean - Knowledge Specific Society.

5. **Scientific Tamil & Tamil Computing**: Development of ScientificTamil - 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)
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 theTamils (Dr.S.V.Subatamanian,Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of theTamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilizationon the bank so friver Vaigai'(Jointly Published by:Department of Archaeology&TamilNadu TextBook and Educational Service Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) Publishedby: 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.

22ETBP205	PHYSICS LABORATORY	L	T	P/D	C
		0	0	3	1.5

COURSE OBJECTIVES

- To access the Rigidity modulus of wire.
- To assess the various properties of light.
- To assess the characterization of Metals.
- To analyses the thickness of microsized objects**.**

LIST OF EXPERIMENTS

1. Air Wedge
2. Newtons's Rings
3. Simple Pendulum
4. Dispersive power of the Prism
5. Diffraction Grating
6. Acoustic diffraction Grating
7. Compound Pendulum
8. Kunt's tube experiment
9. Young's double slit experiment
10. Laser Grating
11. Torsional Pendulum
12. Young's Modulus -Non-uniform Bending
13. Young's Modulus –Uniform Bending.

COURSE OUTCOMES

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

1. Acquired the knowledge of torsional properties of metals wire
2. Determine the radius of curvature of the plano-convex lens.
3. Determine the dispersion power of the prism.
4. Evaluate the important characteristics of simple and compound pendulum
5. Determine the Young's Modulus of uniform and non-uniform bending.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3						2		2	3		3
CO2	3						2		2	3		3
CO3	3						2		2	3		3
CO4	3						2		2	3		3
CO5	3						2		2	3		3

22ETBP206	CHEMISTRY LABORATORY	L	T	P/D	C
		0	0	3	1.5

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 analyse quantitatively the amount of a substance present in a given sample.

LIST OF EXPERIMENTS

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Determination of the rate constant of a reaction
6. Determination of cell constant and conductance of solutions
7. Potentiometry - determination of redox potentials and emfs
8. Saponification/acid value of an oil
9. Determination of the partition coefficient of a substance between two immiscibleliquids
10. Adsorption of acetic acid by charcoal
11. Volumetric analysis

COURSE OUTCOMES

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

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

Mapping of Course Outcomes with Program Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1		1			1					
CO2	2	1				1						
CO3	3	2		1			2					
CO4	3		1									
CO5	2	2										

22ETSP207	COMPUTER PROGRAMMING 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 & 9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems
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 work, 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.

Mapping of Course Outcomes with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
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							

22ETSP208	ENGINEERING GRAPHICS	L	T	P/D	C
		2	0	3	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 Modeling; Solid Modeling; Introduction to Building Information Modeling (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 though 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. BhattN.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.

Mapping of Course Outcomes with Programme Outcomes												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
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

DEPARTMENT OF CIVIL AND STRUCTURAL ENGINEERING

B.E., CIVIL AND STRUCTURAL ENGINEERING

REVISED REGULATIONS & SYLLABI

(Students Admitted From the Academic Year 2022-2023)

VISION

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

MISSION

M1 Provide quality education and knowledge base to the students in structuralengineering.

M2 Prepare the students as nationally competitive and trend setters for the futuregeneration in the realm of technical education.

M3 Assimilate the available theories, explore new frontiers, to propound newtheories 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 provideopportunity to acquire knowledge in state-of-the-art research.

M5 Provide service to the university, engineering profession, and the publicthrough consultancy services.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

PO1	**Engineering Knowledge** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem Analysis** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/Development of Solutions** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct Investigations of Complex Problems** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6	**The Engineer and Society** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and Sustainability** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for Sustainable development.
PO8	**Ethics** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Team Work** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project Management and Finance** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-Long Learning** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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, taking into account 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 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.
PSO2	Students can identify the problem, analyse and design according to the needs of the society and to come up with the environmental friendly sustainable solutions even for the complex problems.
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.
PSO4	Apply the principle of ethics in approaching different projects and problems, communicate with the concerns effectively, proper reports and documentations.

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	3	3	3	3	3

Mapping PO with PEO												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
PEO1	3	1	2	1	1	2	1	2	1	1	1	1
PEO2	3	2	1	1	2	1	1	1	1	1	1	1
PEO3	1	1	1	1	1	3	2	3	2	2	3	1
PEO4	1	2	2	3	3	1	1	1	1	3	1	2

SEMESTER III

		L	T	P	C
22ETBS301	**ENGINEERING MATHEMATICS III**	**3**	**1**	**-**	**4**

COURSE OBJECTIVES

- To learn Partial Differential equations, Fourier Series and Boundary ValueProblems.
- To learn the transforms such as Sine, Cosine, Fourier Transform and ZTransforms.
- To gain the knowledge of the method to find the solutions of different method.

UNIT I Partial Differential Equations

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions - Solution of standard type of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second order with constant coefficients.

UNIT II Fourier Series

Dirichle's conditions - General Fourier series - Odd and Even functions - Half range sine series - Half range cosine series - Complex form of Fourier series – Parseval's identity.

UNIT III Boundary Value Problems

Solutions of one dimensional wave equation – One dimensional heat equation (withoutderivation) – Fourier series solutions in Cartesian co-ordinates.

UNIT IV Fourier Transform

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem - Parseval'sidentity.

UNIT V Z Transform and Difference Equations

Z–Transform – Elementary properties – Inverse Z–Transform – Convolution theorem – Solution of difference equations using Z–Transform.

TEXT BOOKS

1. Kandasamy.P, Tilagavathy.K and Gunavathy.K, *Engineering Mathematics*, 6th Edition,(Vol-I & II), 2007, S.Chand & Co Ltd., New Delhi.
2. Venkataraman.M.K., *Engineering Mathematics*, 2003, The National Publishing Co.,Chennai.

REFERENCES

1. Veerarajan.T, *Engineering Mathematics*, 3rd Edition, 2005, Tata McGraw Hill Publication Co. Ltd., New Delhi.
2. Singaravelu.A, *Engineering Mathematics*, 2004, Meenakshi Publications, Chennai.
3. C.L.Liu, *"Elements of Discrete Mathematics",* Second Edition, 2000, Tata McGraw-Hill.
4. J.L.Hein, "Discrete Structures, Logic, and Computability", 3rd Ed., 2010, Jones andBartlett.
5. K.H.Rosen, "*Discrete Mathematics and its Applications",* sixth Edition, 2007, TataMcGraw-Hill.

COURSE OUTCOMES

At the end of the course the students will be able to acquire knowledge on

1. Be capable of mathematically formulating certain practical problems in terms of partial differential equation. Solve them and physically interpret the results.
2. Have gained a well founded knowledge of Fourier series, their different possible forms and the frequently needed practical Fourier analysis that an engineer may have to make from discrete data.
3. Have obtained capacity to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve and interpret the results.
4. Have grasped the concept of expression of a function under certain conditions as a double integral leading to identification of transform pair, and specialization of Fourier transform pair, their properties, and the possible special cases with attention to their applications.
5. Have learnt the basics of z transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the z transform techniques bringing out the elegance of the procedure involved.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	1	2								1	3	2	2	
CO2	3	3	1	2								1	3	2	2	
CO3	2	3	1	3								1	3	3	3	
CO4	2	3	1	3								1	3	3	3	
CO5	2	3	2	3								1	3	3	3	

22ETES302	ENVIRONMENTAL STUDIES	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

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

UNIT I Introduction

Introduction - 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 andground water, floods, drought, conflicts over water, dams-benefits and problems. Mineralresources: 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 naturalresources- Equitable use of resources for sustainable lifestyles.

UNIT II Ecosystem

Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Foodchains, 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 Diversity

Introduction – Definition: genetic, species and ecosystem diversity - Bio geographicalclassification of India - Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels - Indiaas 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 Pollution

Definition - Cause, effects and control measures of Air pollution - Water pollution - Soilpollution - 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 Social Welfare

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 humanhealth - Case Studies.

FIELD WORK

Visit to a local area to document environmental assets river / forest / grass land / hill /mountains. Visit to a local polluted site – Urban / Rural / Industrial / Agricultural – Study ofcommom 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*, 2001Nidi Publishers Ltd., Bikaner.
2. Bharucha Erach, *The Biodiversity of India*, Mapin Publishing Pvt. Ltd., Ahmedabad.

REFERENCES

1. Brunner R.C., 1994, *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, *EnvironmentalEncyclopaedia*, Jaico Publ. House, Mumbai, 1196p
4. De A.K., *Environmental Chemistry*, Wiley Eastern Ltd.
5. *Down to Earth*, Centre for Science and Environment
6. Gleick, H.P. 1993. *Water in crisis*, Pacific Institute for Studies in Dev., Environment &Security. Stockholm Env. Institute Oxford Univ. Press. 473p
7. Hawkins R.E., *Encyclopaedia of Indian Natural History*, Bombay Natural HistorySociety, Bombay
8. Heywood, V.H &Waston, R.T. 1995. *Global Biodiversity Assessment*. Cambridge Univ.Press 1140p.
9. Jadhav, H & Bhosale, V.M. 1995. *Environmental Protection and Laws*. Himalaya Pub.House, Delhi 284 p.
10. Mckinney, M.L. & School, R.M. 1996. *Environmental Science systems & Solutions*,Web enhanced edition. 639p.
11. Miller T.G. Jr. *Environmental Science*, Wadsworth Publishing Co.
12. Odum, E.P. 1971. *Fundamentals of Ecology*. W.B. Saunders Co. USA, 574p 13.Rao M N. & Datta, A.K. 1987. *Waste Water treatment*. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
14. Sharma B.K., 2001. *Environmental Chemistry*. Geol Publ. House, Meerut 15.Townsend C., Harper J, and Michael Begon, *Essentials of Ecology*, Blackwell Science
16. Trivedi R.K., *Handbook of Environmental Laws, Rules Guidelines, Compliances andStadards*, Vol I and II, Enviro Media (R)
17. Trivedi R. K. and P.K. Goel, *Introduction to air pollution*, Techno-Science Publication18.Wanger K.D., 1998 *Environmental Management*. W.B. Saunders Co. Philadelphia, USA

COURSE OUTCOMES

At the end Students can able to

1. Understand the importance of environment.
2. Analyse the importance of environment in engineering.
3. Apply their own ideas and demonstrate advanced technologies that will be useful toprotect environment.
4. Employ awareness among the society about environmental problems and naturaldisasters.
5. Practice according to the present and future environmental issues.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2						3				2	2	2	1		1
CO2	2	3		2			3				2	2	3	2	2	1
CO3	2		3	2			3				2	2	2	2	2	1
CO4	2					3	3				2	2	2	2		1
CO5	2						3				2	2	2	1		1

22ETES303	ENGINEERING MECHANICS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To provide an introductory treatment of *Engineering Mechanics* with a view to prepare a good foundation for taking up advanced courses.
- To provide knowledge of statics with emphasis on force equilibrium, equilibrium equations, and free body diagrams.
- To understand the basics of kinds of stress, moments and deformation in rigid bodies under different loading conditions and inertia problems.
- To determine the behaviour of wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various loadconditions.

UNIT I Introduction to Engineering Mechanics

Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Bodyequilibrium; 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 CoplanarSystems and Spatial Systems; Static Indeterminacy.

Friction - Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack.

UNIT II Basic Structural Analysis

Equilibrium in three dimensions-Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines.

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

UNIT III Virtual Work and Energy Method

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

UNIT IV Review of Particle Dynamics

Rectilinear motion - Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum(linear, angular); Impact (Direct and oblique).

Introduction to Kinetics of Rigid Bodies - Basic terms, general principles In dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

UNIT V

Mechanical Vibrations

Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.

TEXT BOOKS

1. Irving H. Shames., *"Engineering Mechanics",* Fourth Edition, Prentice Hall, 2006.
2. F. P. Beer and E. R. Johnston, "*Vector Mechanics for Engineers,* Vol I -Statics, Vol II, – Dynamics, Nineth Ed, Tata McGraw Hill., 2011.

REFERENCES

1. R.C. Hibbler, "Engineering Mechanics: Principles of Statics andDynamics", PearsonPress, 2006.
2. Andy Ruina and Rudra Pratap, "Introduction to Statics andDynamics", OxfordUniversity Press, 2011.
3. Shanes and Rao., "Engineering Mechanics", Pearson Education, 2006.
4. Hibler and Gupta "Engineering Mechanics (Statics, Dynamics)",Pearson Education,2010.
5. Reddy Vijaykumar K. and K. Suresh Kumar., "Singer's Engineering Mechanics",2010.
6. Bansal R.K., "A Text Book of Engineering Mechanics", Laxmi Publications, 2010.
7. Khurmi R.S., "Engineering Mechanics", S. Chand & Co., 2010.
8. Tayal A.K., "Engineering Mechanics, Umesh Publications, 2010.

COURSE OUTCOMES

On successful completion of the course the leaner will be able to

1. Use scalar and vector analytical techniques for analysing forces in structures.
2. Apply basic knowledge of maths and physics to solve real world problem.
3. Apply fundamental concepts of kinematics and kinetics of particles tothe analysis ofsimple, practical problems
4. Determine resultants and apply conditions of static equilibrium to plane forcesystems.
5. Calculate the motion characteristics of a body subjected to aforce system and mechanical vibrations.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2		2	1						3	3	2	2	
CO2	3	2	3	3	2	1						3	3	3	3	
CO3	3	2		3	2	1						3	3	2	3	
CO4	3	2		3	2	1						3	3	2	3	
CO5	3	2		3	2	1						3	3	2	3	

22CZES304	CONSTRUCTION ENGINEERING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To expose the students to construction practice through an understanding of differenttypes of construction materials and their properties.
- To understand the techniques of construction, different finishing works and remedialpractices 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 – Cohesionand Adhesion of soil – Bearing Capacity of soil – Methods of Assessing Bearing Capacity ofSoils – Types of Foundations – Shallow Foundations – Deep Foundations – Special type ofFoundations 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 andRoof Slabs – Fabrication of Steel, Bar Bending as per IS Standards (SP 34: 1987), CoverBlocks, Placing of Bars in Form Work – Types of Roofing Systems – Types of Stairs – Typesof 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, Marbleand Granite Flooring, Wooden Flooring, Flooring with Puffed Panels – Plastering (Interior

and Exterior) – Pointing for Walls and Floors using Grouts – White Washing, Colour Washingwith 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 – SealantJoints – 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.

REFERENCES

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.

STANDARDS

1. SP 21: 2005 Handbook on Summaries of Indian Standards for Building Materials,Bureau of Indian Standards, New Delhi.
2. SP 34: 1987, Handbook on Concrete Reinforcement and Detailing, Bureau of IndianStandards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able to

1. Compare the properties of most common and advanced building materials.
2. Understand the typical and potential applications of these materials.
3. Acquire knowledge of testing of construction materials and their strength requirements.
4. Recognize the functions of different building components.
5. Understand the usage of modern building materials and construction equipments andapply techniques to repair buildings.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3			2		2	2	2	1			1	2	3	2	2
CO2	3			2		2	2	2	1		1	1	2	3	2	3
CO3	3	1		2	3	2	2		1				3	3	3	2
CO4	3		1	2		2	1		1		1	2	2	2	2	2
CO5	3		1	2		2	1		1		1	2	2	2	2	2

22CZPC305	FLUID MECHANICS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To introduce the concepts of fluids mechanics thorough understanding of theproperties of the fluids, behavior of fluids under static conditions.
- To learn dynamics of fluids through control volume approach this gives an integratedunderstanding of the transport of mass, momentum and energy.
- To expose to boundary layer theory and a training to analyze engineering problemsinvolving fluid.
- To understand the applications of the conservation laws to (a) flow measurementsand (b) flow through pipes (both laminar and turbulent).

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

Fluid Statics - Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers. Pressure gauges, Hydrostatic pressure and force: 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; Momentum principle; Forces exerted byfluid flow on pipe bend; Vortex Flow – Free and Forced.

UNIT V Dimensional Analysis

Dimensional Analysis and Dynamic Similitude – Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π- Theorem.

TEXT BOOKS

1. C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, "*Fluid Mechanics and Machinery",* Oxford University Press, 2010
2. P M Modi and S M Seth, "*Hydraulics and Fluid Mechanics",* Standard Book House.

REFERENCES

1. K. Subramanya, “Theory and Applications of Fluid Mechanics”, Tata McGraw Hill.
2. R.L. Daugherty, J.B. Franzini and E.J.Finnemore, “Fluid Mechanics with Engineering Applications”, International Student Edition, Mc Graw Hill.

COURSE OUTCOMES

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

1. Understand the broad principles of fluid statics, kinematics and dynamics
2. Understand definitions of the basic terms used in fluid mechanics
3. Understand classifications of fluid flow
4. Apply the continuity, momentum and energy principles
5. Apply dimensional analysis

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	2									3	3	1	
CO2	3					1							3	1		
CO3	3	3											3	2		
CO4	3	3	2	2									3	3	1	
CO5	3	3	2	3									3	3	2	

22CZPC306	CONCRETE TECHNOLOGY	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To develop systematic knowledge about the nature and basic propertiesof the ingredients of concrete.
- To familiarises the testing procedures for properties of fresh and hardened concrete.
- To introduce fundamentals and principles of mix design.

UNIT I Cement

Portland cement– Definition –History–Composition–Hydration of Portland cement – Stiffening and Hardening of cement paste–Specification as per IS 269-2013 Code– Types of Portland cement–Physical and Chemical Properties of cement – Testing of cement

UNIT II Aggregates

Aggregates– Natural and Mineral aggregates – Characteristics of aggregates and their significance– Testing of aggregates properties as per IS:2386 (I to VIII)- 1963 (R 2016) –comparison of properties with IS:383-2016. Importance of aggregates properties in concrete –Water–Testing–Specifications.

UNIT III Concrete

Concrete ingredients – Manufacturing process –Storing - Batching – Mixing – Transporting – Placing – Finishing – Curing- Properties of fresh concrete – Workability measurements - Testing methods – Segregation- Bleeding - Slump loss – Concrete at early age – Setting time – Concrete admixture and its types.

UNIT IV Properties of Concrete

Hardened concrete- Mechanical Properties and their significance- Testing methods as per IS: 516-2021–Compressive strength of concrete and its influencing factors –Short term and long term properties - Drying shrinkage – Creep – Modulus of elasticity – Resistance to dimensional changes - Resistance to weather– Resistance to chemical attack - Durability of concrete. (Special concrete; types and specifications, Fibre reinforced and steel Fibre reinforced concrete, Polymer concrete,Use of admixtures; Deterioration of concrete and its prevention Repair and rehabilitation.

UNIT V Mix Design

Objectives of mix design –Concept of concrete mix proportioning- Methods of mix proportioning as per IS: 10262-2019 and ACI Committee 211.1.91 method – Fly ash based concrete mix design – Effect of replacement materials for binder and filler in mix design- sustainable concrete.

TEXT BOOKS

1. Mehta P.K., and Montero P.J.M., "*Concrete, Microstructure, Propertiesand Materials",* Indian Concrete Institute, Chennai, 2014 - Fourth Edition.
2. Shetty M.S., "*Concrete Technology"*, S.Chand & Co., New Delhi, 2022-Eighth Edition.

REFERENCES

1. Neville A.M., *Properties of Concrete*, Pitman Publishing Limited, London, 2011.
2. Gambhir M.L., *Concrete Technology*, McGraw Hill Education Pvt. Ltd., New Delhi, 2013.
3. Neville A.M., and Brooks J.J., *Concrete Technology*, Pearson Education,Indian reprint,Chennai, 2002.

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 NaturalSources for Concrete, Bureau of Indian Standards, New Delhi.
3. IS 516: 2021, Method of Test for Strength of Concrete (with AmendmentNo.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
5. IS 4031(Part I to X): 1996, Method of Physical Tests for Hydraulic cement,Bureau of Indian Standards, New Delhi.
6. IS 10262: 2019, Recommended Guidelines for Concrete Mix Design, Bureauof Indian Standards, New Delhi.
7. IS 8112 (re-affirmed in 2000), Specification for 43 grade OrdinaryPortland cement, Bureau of Indian Standards, New Delhi.
8. IS 12269-2013, Specification for 53 grade Ordinary Portland cement (with AmendmentNo.3) Bureau of Indian Standards, New Delhi.
9. SP 23:1982 Hand book on Concrete Mixes, Bureau of Indian Standards, New Delhi.
10. ACI Committee 211.1-91 Standard Practice for Selecting Proportions for Normal, Heavy weight and Mass Concrete, American Concrete Institute, Farmington Hill, Michigan, USA,2002

COURSE OUTCOMES

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

1. Compare the properties of most common and advanced building materials.
2. Test the construction materials to determine their properties and strength requirements.
3. Understand the typical and potential applications of these materials.
4. Analyze the properties of concrete and recommend it to the suitable purpose.
5. Calculate the mix ratio of concrete according to the requirements.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	3	1	1							3	3	2	1	
CO2	2	3	3	1	1							3	3	2	1	
CO3	2	3	3	2	1							3	3	3	2	
CO4	2	3	3	2	1							3	3	3	2	
CO5	2	3	3	2	1							3	3	3	2	

22CZCP307	COMPUTER PRACTICAL I (BUILDING DRAWINGS)	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To train the students in developing skills in drawings and detailing of the Building components using AUTOCAD and also develop the skills of using MS office Excel for estimating and costing the Buildings.

LIST OF EXERCISES

Plate 1. Symbols used in Civil Engineering drawings.

Plate 2. Doors, Windows and Ventilators (wooden, glazed and aluminum)Plate 3.

Comprehensive Planning and Drawings of Residential building

Layout, plan, elevation & sectional elevation based on

the NBC standards

a. Single Room RCC roof building
b. Double Room RCC roof building
c. Bungalow/duplex building with sloped tiled Roof
d. 2BHK types Residential building
e. Two storied Residential building

Plate 4. Preparation of Layout plan of different types of commercial building Projects.

a. School building,
b. Office building (Bank, Government office, IT park)
c. Hospital building, and
d. Shopping Mall

Plate 5. Draw the Residential building Layout, plan, elevation & sectional view with all specification and standards of municipal guidelines (Local Bylaws).

MS office – EXCEL

Exercise 1. Practicing of MS office Excel worksheet – file creation – formulas –chart preparation – pivot table

Exercise 2. Preparation of building Estimation of the practiced drawing

REFERENCES

1. Verma B.P, "*Civil Engineering Drawing and housing Planning"*, Khanna Publishers,New Delhi 1992.
2. Balagopal T.S. Prabhu., "*Building drawing and detailing"*, SpadesPublishers, Calicut,2012.
3. National Building Code of India, Bureau of Indian Standards, New Delhi, 2005.
4. Shah & Kale, "*Building Drawing"*, Tata McGraw Hill, New Delhi, 2002.
5. MSOffice Manual.

COURSE OUTCOMES

At the completion of the course students will be able

1. To identify the drawings of detailing and building plans.
2. Draw the building plans and sections using AUTOCAD.
3. To prepare the doors and windows details and other requirements.
4. To draw approval plans with complete requirements of the authorities.
5. To prepare the estimation of buildings in spreadsheets.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3				2	1		1					2	1	1	1
CO2	3				2	1				2			2	1	1	1
CO3	2					1							1	1		
CO4	3					1	2	2		2			2	2		2
CO5	3				2	1		2		2	2	1	2	1	1	3

		L	T	P	C
22CZCP308	**CONCRETE & CONSTRUCTION LABORATORY**	**-**	**-**	**3**	**1.5**

COURSE OBJECTIVES

- To train the students in standard testing procedures for different compositions ofbuilding materials and provides them an opportunity to design a concrete mix.

LIST OF EXPERIMENTS

1. Standard Tests on Cement as per IS Standards
2. Standard test on fine and coarse aggregates as per IS Standards
3. Workability tests on Fresh Concrete
4. Tests on Hardened Concrete, Bricks and Tiles as per IS Standards
5. Concrete Mix design as per IS 10262: 2019
6. Study on Reinforcement Detailing for different Structural Components asper SP34: 1987.

REFERENCES

1. Mehta P.K and Monter P.J.M., *Concrete, Microstructure, Properties and Materials*,Indian Concrete Institute, Chennai, 2014 - Fourth Edition.
2. Shetty M.S., *Concrete Technology*, S. Chand & Co., New Delhi, 2022 - Eighth Edition.
3. Neville A.M., *Properties of Concrete*, Pitman Publishing Limited, London, 2011.
4. Gambhir M.L**.,** *Concrete Technology*, Tata McGraw Hill Co., New Delhi,2004.
5. Neville A.M., and Brooks J.J**.,** *Concrete Technology*, Pearson Education, IndianReprint, Chennai, 2002.

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 forConcrete, 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 ofIndian Standards, New Delhi
5. IS 4031(Part I to X): 1996, Method of Physical Tests for Hydraulic cement, Bureau ofIndian Standards, New Delhi
6. IS 8112-1989 (re-affirmed in 2013), Specification for 43 grade Ordinary Portlandcement, Bureau of Indian Standards, New Delhi.
7. IS 10262: 2019, Recommended Guidelines for Concrete Mix Design, Bureau of IndianStandards, New Delhi.
8. IS 12269-2013, Specification for 53 grade Ordinary Portland cement (with AmendmentNo. 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 IndianStandards, New Delhi

COURSE OUTCOMES

At the completion of the course students will be able

1. Identify the tests for determining concrete properties
2. To test the workability of a concrete for specific purpose depends on requirements.
3. To determine the strength of hardened concrete, bricks, tiles, coarse aggregates, etc.
4. Calculate the mix proportion for concrete
5. Identify the detailing of the structural reinforcements

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3				1	2	1						2	1	1	
CO2	3		2										2	1		
CO3	3				2	1							2	1	1	
CO4	3		2				1						2	2		
CO5	3												2			

22CZCP309	FLUID MECHANICS LABORATORY	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To understand the concepts of flow of fluids under static and dynamic conditions
- To understand the discharge capacities through various notches and channels
- To have a knowledge on dimensional analysis of flow

LIST OF EXPERIMENTS

a. Measurement of viscosity
b. Study of Pressure Measuring Devices
c. Stability of Floating Body
d. Hydrostatics Force on Flat Surfaces/Curved Surfaces
e. Verification of Bernoulli's Theorem
f. Venturimeter
g. Orifice meter
h. Impacts of jets
i. Flow Visualisation -Ideal Flow
j. Length of establishment of flow
k. Velocity distribution in pipes
l. Laminar Flow
    1) Determination of Co-efficient of discharge of **Mouthpiece**
    2) Determination of Co-efficient of discharge of **Venturimeter**
    3) Determination of Co-efficient of Head loss due to **Sudden Change inSection**
    4) Determination of Co-efficient of Head loss due to **Friction in Pipes**
    5) Determination of Co-efficient of discharge of **Rectangular Notch**
    6) Determination of Co-efficient of **Impact of Jet on Vanes**
    7) Determination of **Metacentric Height** of a floating vessel

REFERENCES

1. C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli., "*FluidMechanics andMachinery",* Oxford University Press, 2010.
2. P M Modi and S M Seth., "*Hydraulics and Fluid Mechanics",* Standard Book House
3. K. Subramanya., "*Theory and Applications of Fluid Mechanics",* Tata McGraw Hill
4. R.L. Daugherty, J.B. Franzini and E.J.Finnemore, "*Fluid Mechanics with EngineeringApplications",* International Student Edition, Mc GrawHill.

COURSE OUTCOMES

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

1. Understand the broad principles of fluid statics, kinematics and dynamics
2. Understand definitions of the basic terms used in fluid mechanics
3. Understand classifications of fluid flow
4. Be able to apply the continuity, momentum and energy principles
5. Be able to apply dimensional analysis

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3					2							2	2		
CO2	3					1							2	1		
CO3	3					1							2	1		
CO4	3					1							2	1		
CO5	3					1							2	1		

22CZBS401	PROBABILITY, RANDOM PROCESS AND NUMERICAL METHODS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- Be exposed to probability, random processes, and ststistical methods designed to contribute to the process of making scientific judgements in the face of uncertainty and variation.
- To develop the skills of the students in numerical mathematics – using method of finite difference interpolation, finding numerical solution of algebraic and transcendental equations, and finding numerical solution of ordinary and partial differential equations.

UNIT I Probability and Random Variables

Definition – Types of random variables – probability distribution functioon – probability density function – expectation and moments – moment generating functions – joint probability distribution – marginal probability distribution function – joint probability density function - marginal probability density function – conditional probability density function.

UNIT II Random Processes

Classification of random processes – Methods of description of a random process – Special classes of random processes – Average values of random process – Stationarity – Autocorrelation function and its properties – cross correlation function and its properties.

UNIT III Test of Significance

Hypothesis, testing – Large sampling tests – small sampling test based on t, F and chi-square distributions – interval estimates of mean, standard deviation and proportion.

UNIT IV Interpolation, Numerical Differentiation and Integration

Interpolation: Gregory Newton forward and backward interpolation formula; Stirling's central difference formula; Lagrange's interpolation formula for unequal interval.

Numerical differentiation: Using Newton's forward and backward interpolation formula.

Numerical integration: Trapezoidal rule, Simpson's one-third and three-eight rule.

UNIT V Solution of Algebraic and Transcendental and Ordinary Differential Equations

Solution of algebraic and transcendental equations: Bolzano's bisection method, Regula-falsi method, Newton-Raphson method.

Solution of simultaneous algebraic equation: Gauss elimination method, Crout's method, Gauss-Seidel iteration method.

Solution of ordinary differential equations: Taylor series method, Runge-Kutta fourth order method, Milne's – Predictor corrector method.

TEXT BOOKS

1. Kandasamy,P., Thilagavathy, K., and Gunavathy, K., Probability and Random Processes, S.Chand & Co. Ltd., New delhi.
2. Veerarajan, T., Probability Theory and Random Process, tata McGraw Hill Co., Ltd., New Delhi, 2015.

REFERENCES

1. Venkatraman, M.K., Numerical Method in Science and Engineering, national PublishingCo., Chennai – 2003
2. Lipschutz, S. and Schiller, J., Schaums' Outlines, Introduction to Probability and Statistics, McGraw Hill, New Delhi, 2005.
3. Kandasamy,P., Thilagavathy, K., and Gunavathy, K., Numerical Methods, S.Chand & Co. Ltd., New Delhi, 2006.

COURSE OUTCOMES

The students should be able to

1. Collect data on a problem and describe the data using graphical and descriptive measures; develop a probabilistic model for the problem; perform probability operationsand evaluations;
2. Acquire skills in handling situations involving random variables and random processes Perform statistical analyses of the data and hypotheses testing
3. Perform correlation and regression analyses for fitting a curve or model to data and formulate algorithms to solve problems
4. To solve problems for engineers in using numerical methods.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3							1			3	2		1
CO2	3	3								1			3	1		1
CO3	3				2	1				1			2	1	1	1
CO4		3	2	2					1			1	2	3	1	

22CZES402	SOLID MECHANICS	L	T	P	C
		3	1	-	4

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 Simple Stresses and Strains

Concept of stress and strain – Types of stresses and strains - Elasticity - Hooke's law – stress-strain diagram for mild steel – Working stress – Factor of safety – Poisson's ratio and volumetric strain – Elastic moduli and their relationship –Temperature stresses.

Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications.

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

UNIT II Shear Force and Bending Moment

Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

UNIT III Flexural and Shear Stresses

Flexural stresses - Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

UNIT IV Slope and Deflection & Torsion and Springs

Slope and deflection - Relationship between moment, slope and deflection - Slope & Deflection method - Macaulay's method - Moment area method - Theorem of Three Moments fordeterminate beams.

Torsion - Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion.

UNIT V Thin and Thick Cylinders & Springs

Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

Analysis of open and close coiled springs - helical springs.

TEXT BOOKS

1. Bansal R.K, *Strength of Materials*, Lakshmi Publications, Chennaii, 2018.
2. Rajput R.K, *Strength of Materials*, S.Chand& Co., Delhii, 2015.

REFERENCES

1. Punmia B.C,et al. *Strength of Materials and Theory of Structures - Vol.I,* Lakshmi Publications, Chennai, 2000.
2. Sadhu Singh, *Strength of Materials,* Khanna Publishers, Delhi, 2013.
3. Ramamrutham S, *Strength of Materials,* DhanpatRai Publishing Company, Delhi, 2011.
4. Gambihir M.L, *Fundamentals of Solid Mechanics*,PHI Learning Pvt.Ltd.,New Delhi, 2009.
5. Timoshenko and Gere, *Mechanics of Materials*, Van NosReinbhold, New Delhi, 2004.
6. Bhavikatti S.S, *Solid Mechanics*, Vikas Publishing House Pvt. Ltd., New Delhi, 2010.

COURSE OUTCOMES

On completion of the course, the student will be able to:

1. Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, relative tothe strength and stability of structures and mechanical components;
2. Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures
3. Analyze solid mechanics problems using classical methods and energy methods
4. Analyse various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress; locate the shear center of thin wall beams
5. Calculate the deflection at any point on a beam subjected to a combination of loads; solve for stresses and deflections of beams under unsymmetrical loading; apply various failure criteria for general stress states at points; solve torsion problems in bars and thinwalled members.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	1	2	1		1		1			1	3	2	2	
CO2	3	3	3	3	1		1		1			1	3	3	2	
CO3	3	3	3	3	1		1		1			1	3	3	2	
CO4	3	3	3	3	1		1		1			1	3	3	2	
CO5	3	3	3	2	1		1		1			1	3	3	2	

22CZPC403	ESTIMATION, COSTING & VALUATION	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To equip the students with current practices of estimation.
- To understand the basic principles, economics, cost and material estimates.
- To identify the methods adopted for different structural components.
- To impart knowledge on valuation practices necessary to make the student a completecivil engineer.
- To learn the bidding, contract and tender procedures.

UNIT I ESTIMATION & SPECIFICATION

Introduction of Estimation - Philosophy - Purpose - Measurements for various items - Methods of Estimation - Types of Estimates - Approximate Estimates - Detailed Estimates - Estimation of quantities for various items of works - Specifications - Necessity - Types of Specifications - Writing Technical Specifications for various itemsof work.

UNIT II DETAILED ESTIMATE

Detailed Estimates - Types - Use of relevant Indian Standard Specifications - Taking out quantities from the given requirements of the work - Comparison of different alternatives, Bar bending schedules - Buildings and Structures, Roads and Bridges, Canals and Drainages, Hydraulic Structures, Industrial and Factory Structures - BIM and quantity take-offs

UNIT III EXERCISES FOR DETAILED ESTIMATE

a.Deriving an approximate estimate for a multi-storeyed building by approximatemethods.

a. Ground plus three storied building with load-bearing walls
b. Ground plus three storied RCC Framed structure building with blockwork walls
c. Bridge with minimum 2 spans
d. Fctory building
e. Road work
f. Cross drainage work

UNIT IV RATE ANALYSIS & COSTING

Standard Data - Observed Data - Schedule of Rates - Market Rates - Adding equipment costs and labour costs - Rate analysis; Material survey - Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, and market survey of basic materials - Use of Computers in quantity surveying & Preparation of Abstract - Preparation of valuation report in standard Government form - Assignments on rate analysis and specifications - Preparationof bar bending schedule.

UNIT V TENDERS, CONTRACT & VALUATION

Introduction of Tender - Types of Tenders - Preparation of tender documents,importance of inviting tenders, relative merits, prequalification - TTA Act 2000 - Drafting Model for Tender Notice - e-Tendering - Preparing Bids - Contract - Types of Contract - Formation of contract - Contract conditions - Contract for labour, material, design, construction - Drafting of contract documents based on IBRD / MORTH Standard bidding

documents - Termination of contracts - Contract problems - Arbitration and legal requirements - Definitions – Various types of valuations – Valuation methods – Valuation of land – Buildings – Valuation of plant and machineries - Guide line value - Slavage value - Depreciation - Calculation of Standard rent and fixation - Mortgage – Lease.

TEXT BOOKS

1. Mankiw Gregory N., "*Principles of Economics",* Thompson Asia Publisher, 2016 - Eighth Edition.
2. V. Mote, S. Paul, G. Gupta, "*Managerial Economics",* Tata McGraw Hill Publisher,2004.

REFERENCES

1. Misra, S.K. and Puri, "*Indian Economy",* Himalaya Publisher, 2009.
2. Pareek Saroj., "*Textbook of Business Economics",* Sunrise Publishers, 2003.
3. M Chakravarty, *"Estimating, Costing Specifications & Valuation".*
4. Joy P K, *"Handbook of Construction Management",* Macmillan
5. B.S. Patil, "*Building & Engineering Contracts".*
6. Relevant Indian Standard Specifications.
7. World Bank Approved Contract Documents.
8. FIDIC Contract Conditions.
9. Acts Related to Minimum Wages, Workmen's Compensation, Contract, and Arbitration
10. Typical PWD Rate Analysis documents.
11. UBS Publishers & Distributors, Estimating and Costing in Civil Engineering: Theory andPractice including Specification and Valuations, 2016
12. Dutta, B.N., *"Estimating and Costing in Civil Engineering (Theory & Practice"),* UBSPublishers, 2016.

COURSE OUTCOMES

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

1. Follow the procedures in government for the preparation of quantity estimation.
2. Prepare the detailed estimate for any kind of structures.
3. Carry out and evaluate benefit/cost, life cycle and break even analyses on one or more economic alternatives.
4. Understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.
5. Quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure and how competitive bidding works and how to submit a competitive bid proposal.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2					1	1				2	1	1	1		1
CO2				2		1					1			2	1	1
CO3				1		1					1			1	1	1
CO4						2			1		3			1		2
CO5	2				3	1					2	1	1	1	1	1

22CZPC404	APPLIED HYDRAULICS ENGINEERING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To introduce the students to various hydraulic engineering problems like openchannel flows and their computations.
- To understand the methods of dimensional analysis.
- To impart knowledge on characteristics and working principles of hydraulicmachines.

UNIT I

Types of flow in open channels – geometrical properties of channel sections – velocitydistribution in a channel section – Chezy's formula – Manning's formula – Most economical sections of a channel – rectangular, trapezoidal, triangular and circular sections – uniformflow computations – specific energy and critical depth – critical flow and its computation.

UNIT II

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

Dimensions – Dimensional homogeneity – Methods of dimensional analysis –Rayleigh's method – Buckingham's π-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 ofdynamic similarity to specific model investigations – submerged objects and partially submerged objects.

UNIT IV

Impulse-momentum principle – dynamic force exerted by fluid jet on stationary flat plate: (a) plate normal to jet (b) inclined plate – force on moving flat plate – force on 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, powerand efficiencies – Kaplan turbine: components – force, torque, power and efficiencies – governing of water turbines – selections of turbines.

UNIT V

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 airvessels.

Comparison with reciprocating pumps – principle and operation – different classifications of centrifugal pumps – 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. Jagdish Lal, “Hydraulic machines”, Metro polital Book Co. Pvt. Ltd. Reprint 2011.
2. Subramanya. K., “Flow in open channels”, Tata McGraw Hill, New Delhi 2000.

REFERENCES

1. Ven Te Chow, “Open Channel Hydraulics”, McGraw Hill, New York, 2009.
2. Mays. L. W., “Water Resources Engineering”, John Wiley and Sons (WSE), NewYork, 2005.
3. Jain. A.K., “Fluid Mechanics”, Khanna Publishers, New Delhi. 2010.
4. Srivastava. R., “Flow through open channels”, Oxford University Press, New Delhi,2008.
5. Modi. P.N. and Seth. S.M., “Hydraulics and Fluid Mechanics”, Standard Book House,New Delhi, 2002.

COURSE OUTCOMES

At the end of the course students will be able to

1. Relate the theory and practice of problems in hydraulic engineering.
2. Apply knowledge of fluid mechanics in addressing open channel flow problems.
3. Solve problems in uniform, gradually varied and rapidly varied flows in steady stateconditions.
4. Understand the working principle of pumps.
5. Understand the working principle of turbines.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2											3	1		
CO2	3					1	1						2	1		
CO3	3	2											3	1		
CO4	3								2				2			
CO5	3								2				2			

22CZPC405	STRUCTURAL CONCRETE DESIGN I	L	T	P	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

Objectives of RCC structural design – Structural systems- Structural analysis and Design – Use of Design codes and Hand books – Stress-strain curves of concrete and steel as per IS:456-2000 and ACI 318-14 – Modulus of Elasticity of concrete and steel. Design Philosophies-Working stress method- assumptions- Concept of transformed sections-modular ratio- permissible stresses- Stress block characteristics. Ultimate Load method- assumptions- Stress block characteristics. Limit State method- assumptions- Partial Safety Factors for Materials-Partial Safety Factors for loads- Ultimate limit state – Serviceability limit state - Stress block characteristics. Moment of resistance expressions for balanced, under and over reinforced rectangular sections for rectangular beams using working stress method- Simple problems.

UNIT II

Flexure **:** Analysis and Design of Singly Reinforced rectangular beams, Flanged beams(T& L beams)- Doubly Reinforced rectangular beams – Limit state method – Roof beams, Cantilever beams - Lintel beams- Plinth beams. Reinforcement detailing as per SP 34: 1987and IS 13920: 2016.

UNIT III

Shear**:** Shear stresses distribution in rectangular beams-Shear stresses distribution inflanged beams -Shear stresses distribution in rectangular beams due to torsion - Design shear strength of concrete- Flexural shear-Codal provisions for rectangular and flanged sections- Problems. Bond - Factors affecting bond resistance. As per IS456:2000- Check for development length- Serviceability limit state– Deflection computations-short term and longterm-Check for Crack width. Design of one and two way slabs - Circular slabs – Cantilever slabs- Dog legged staircase as per IS456:2000 standards-Reinforcement detailing as per SP 34: 1987 and IS 13920: 2016. (Design of flat slab – direct method; Circular slab; Slab type staircase, Placement of reinforcement in slabs - voided slab.

UNIT IV

Design of Short and Slender Columns as per IS456:2000 standards – Design of Columns subjected to axial compression and uni-axial bending – Columns subjected to axialcompression and biaxial bending – Axial load verses moment Interaction charts as per SP- 16-1978- Reinforcement detailing as per SP 34: 1987 and IS 13920: 2016.

UNIT V

Design of Isolated rectangular footings with concentric column loads– Design of Isolated rectangular footings with eccentric column loads - Design of Circular footings withconcentric column loads - Design of combined footings- Reinforcement detailing as per SP34: 1987 and IS 13920: 2016.

TEXT BOOKS

1. Unnikrishna Pillai.S and Devdas Menon*, "Reinforced Concrete Design"*, Thirdedition, Tata McGraw Hill Publisher, New Delhi, Reprint 2017.
2. Krishnaraju.N, "*Advanced R.C.Design"*,Third Edition Tata McGraw Hill Publisher, New Delhi.

ReferenceS

1. Shah.V.L& Karve, "*Illustrated R.C. Design"*, Structures Publications, Pune, 2010.
2. Mallick.S.K&Gupta.A.P, "*Reinforced Concrete"*, Oxford I B H, New Delhi, 1987.
3. Ramamrutham.S and Narayan.R, "*Design of R.C. Structures"*, DhanpatRai & Sons,Delhi, 1993.
4. Punmia.B.C, *"R.C Structures*" - Vol.I &II, Lakshmi Publications, Tenth Edition, Chennai 2015.

STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of IndianStandards, New Delhi.
2. IS 13920: 2016, Ductile Detailing of Reinforced Concrete Structures Subjected toSeismic Forces, Bureau of Indian Standards, New Delhi.
3. SP 34: 1987, Handbook on Concrete Reinforcement and Detailing, Bureau of IndianStandards, New Delhi.
4. SP 16: 1978, Design Aids to IS456: 1978, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the end of the course students will be able

1. To understand the behaviour of steel and concrete structures.
2. To develop and strengthen the knowledge on physical, mechanical and inherent properties of concrete and reinforcing materials and to design practical reinforced concrete structural components.
3. To understand the fundamental application of structural loads, stresses and to designthe structural elements using various design philosophies.
4. To acquire the knowledge about the state of the art principles, procedures and current Indian Code requirements for the design of reinforced concrete structural elements.
5. To understand the concept of detailing of reinforced concrete structural elements asper the Indian Codes.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2	1							3	3	3	2	
CO2	3	3	3	2	2							3	3	3	2	
CO3	3	3	3	2	1							3	3	3	2	
CO4	3	3	3	2	1							3	3	3	2	
CO5	3	3	3	2	1							3	3	3	2	

22CZPC406	SURVEYING & 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 toengineering and surveying activities
- To measure horizontal, vertical, and zenith angles with a transit, theodolite, totalstation or survey grade GNSS instruments.
- To calculate azimuths, latitudes and departures, error of closure; adjust latitudes anddepartures and determine coordinates for a closed traverse.

UNIT I Introduction to Surveying

Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, Levelling: Plane table surveying, Principles of levelling- booking and reducing levels; differential, reciprocal levelling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods,uses; areas and volumes.

Triangulation and Trilateration: Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - methods -triangulation - network- Signals. Baseline - choices - instruments and accessories - extension of base lines
-corrections - Satellite station - reduction to centre - Intervisibility of height and distances -Trigonometric levelling - Axis single corrections.

UNIT II Simple and Compound Curves

Elements of simple and compound curves – Method of setting out–Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve -Verticalcurves

UNIT III Modern Field Survey Systems

Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments,Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.

UNIT IV Photogrammetry Surveying

Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tiltdisplacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereoplotting instruments, mosaics, map substitutes.

UNIT V Remote Sensing

Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation withthe atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.

TEXT BOOKS

1. Madhu, N, Sathikumar, R and Satheesh Gobi, *"Advanced Surveying: Total Station, GISand 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. Chandra, A.M., *"Higher Surveying",* Third Edition, New Age International (P) Limited,2002.
3. Anji Reddy, M., *"Remote sensing and Geographical information system",* B.S.Publications, 2001.
4. Arora, K.R., *"Surveying, Vol-I, II and III",* Standard Book House Publishing, 2015.

COURSE OUTCOMES

The course will enable the students to

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline toengineering and surveying activities.
2. Translate the knowledge gained for the implementation of Civil infrastructure facilities
3. Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.
4. 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.
5. Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station orsurvey grade GNSS instruments

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3				2				2				2		1	
CO2	3				2				2				2		1	
CO3	3				3				2				2		2	
CO4	3				2				2				2		1	
CO5	3				3				2				2		2	

22ETHS407	UNIVERSAL HUMAN VALUES	L	T	P	C
		2	1	-	3

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (humanbeing), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.
- Strengthening of self-reflection.
- Development of commitment and courage to act.

UNIT-I Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Purpose and motivation for the course, recapitulation from Universal Human Values-I. Self-Exploration–what is it? - Its content and process; „Natural Acceptance" and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels. 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!

Understanding human being as a co-existence of the sentient „I" and the material „Body". Understanding the needs of Self („I") and „Body" - happiness and physical facility. Understanding the Body as an instrument of „I" (I being the doer, seer and enjoyer).

Understanding the characteristics and activities of „I" and harmony in „I". Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. 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

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.

Understanding the meaning of Trust; Difference between intention and competence.

Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.

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 examples, 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 asCoexistence

Understanding the harmony in the Nature.
Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature.
Understanding Existence as Co-existence of mutually interacting units in all-pervasivespace.
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

Natural acceptance of human values.
Definitiveness of Ethical Human Conduct.
Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
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.
Case studies of typical holistic technologies, management models and production systems.
Strategy for transition from the present state to Universal Human Order:
a. At the level ofindividual: as socially and ecologically responsible engineers, technologists and managers
b. At the level of society: as mutually enriching institutions and organizations.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 BOOK

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

REFERENCE BOOKS

1 Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2 Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3 The Story of Stuff(Book).
4 The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5 Small is Beautiful - E. F Schumacher.
6 Slow is Beautiful - Cecile Andrews
7 Economy of Permanence - J CKumarappa
8 Bharat Mein Angreji Raj - PanditSunderlal
9 Rediscovering India - by Dharampal
10 Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi11 India Wins Freedom - Maulana Abdul Kalam Azad
12 Vivekananda - Romain Rolland (English)13 Gandhi - Romain Rolland (English)

COURSE OUTCOMES:

By the end of the course,

CO1: students are expected to become more aware of themselves, and their surroundings (family, society, nature);
CO2: students would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO3: students would have better critical ability.
CO4: students would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO5: students would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

This is only an introductory foundational input. It would be desirable to follow it up by
a)faculty-student or mentor-mentee programs throughout their time with the institution Higher level courses on human values in every aspect of living. E.g. as a professional

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1																
CO2		3	3													
CO3				2												
CO4						3			2							
CO5																

22CZCP408	STRUCTURAL MATERIALS TESTING LABORATORY	L	T	P	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. Deflection test on Steel and Wooden beams
4. Compression test on wooden specimen
5. Impact tests
6. Hardness tests on different metals
7. Test on Helical springs
8. Torsion Test.

REFERENCES

1. Bansal.R.K, "*Strength of Materials"*, Lakshmi Publications, New Delhi, December2005.
2. Rajput.R.K, "*Strength of Materials"*, S.Chand& Co., New Delhi, September 2000.
3. Punmia.B.C, et al **, "***Strength of Materials and Theory of Structures" - Vol.I,* Laxmi Publications, Chennai, 2000.
4. Sadhu Singh, "*Strength of Materials",* Khanna Publishers, Delhi, 2016.
5. Ramamrutham.S, "*Strength of Materials", Twentyth Edtion Dhanpat Rai Son,* New Delhi, 2020.
6. Hiraskar.G.K**, "***Strength of Materials"*, Khanna, Delhi, 1984*.*

COURSE OUTCOMES

At the end of the course students will be able

1. To find out the material properties.
2. To find out the stress, strain, young's modulus, Poisson's ratio, etc. for different materials.
3. To understand the materials behaviour by their properties.
4. To determine the hardness of materials
5. To determine the stiffness of the springs.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3				1								2		1	
CO2	3				1								2		1	
CO3	3				1								2		1	
CO4	3				1								2		1	
CO5	3				1								2		1	

22CZCP409	HYDRAULICS ENGINEERING LABORATORY	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To apply their knowledge of fluid mechanics in addressing problems in open channels, will possess the skills to solve problems in uniform, gradually and rapidly varied flows insteady state conditions.

LIST OF EXPERIMENTS

1. Flow Visualization
2. Studies in Wind Tunnel
3. Boundary Layer
4. Flow around an Aerofoil / circular cylinder
5. Uniform Flow
6. Velocity Distribution in Open channel flow
7. Venturi Flume
8. Standing Wave Flume
9. Gradually Varied Flow
10. Hydraulic Jump
11. Flow under Sluice Gate
12. Flow through pipes
13. Turbulent flow through pipes
14. Flow visualization
15. Laminar flow through pipes
16. Major losses / Minor losses in pipe

REFERENCES

1. P.M. Modi and S.M. Seth, *"Hydraulics and Fluid Mechanics",* Standard Book House.
2. K. Subramanya, "*Theory and Applications of Fluid Mechanics",* Tata McGraw Hill.
3. K. Subramanya, *"Open channel Flow",* Tata McGraw Hill.
4. Ven Te Chow, *"Open Channel Hydraulics",* Tata McGraw Hill.
5. Burnside, C.D., "*Electromagnetic Distance Measurement*," Beekman Publishers, 1971.

COURSE OUTCOMES

1. The students will be able to apply their knowledge of fluid mechanics in addressing problems in open channels.
2. They will possess the skills to solve problems in uniform, gradually and rapidly variedflows in steady state conditions.
3. They will have knowledge in hydraulic machineries (pumps and turbines).
4. They will be able to identify the flow properties under various conditions.
5. They will be able to calculate the losses in flow.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	1		1									3	1	1	
CO2	3	1		1			1						3	2	2	
CO3	3				1				1				2		1	
CO4	3	1											3	1		
CO5	3	1											3	1		

22CZCP410	SURVEYING & GEOMATICS LABORATORY	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To conduct experiments on surveying and leveling.
- 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

REFERENCES

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

GEOMATICS LAB (FROM NET)

- Pacing and taping
- Differential levelling
- Familiarization with TS
- Closed traverse
- Construction lab
- Horizontal curve
- GPS
- GIS and auto-cadd
- Plant and profile

COURSE OUTCOMES

At the completion of the course students will be able to

1. Do chain surveying, compass surveying, plane table surveying and leveling.
2. Carry out Theodolite survey and Tachometric survey.
3. Handle the survey instruments, their care and adjustments and the principles of chain surveying
4. Understand the concepts of total station.
5. Carry out the contouring.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3			1					2	1			2	1	1	1
CO2	3				1				2	1			2		1	1
CO3	3								1	1			2			1
CO4	3				2				1	1			2		1	1
CO5	3								1	1			2			1

22CZPC501	STRUCTURAL MECHANICS I	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the complex analysis of structures with different end conditions.
- To learn the concepts of analysis in arches and cables.
- To have knowledge in the various classical methods of analysis of structures.

UNIT I Indeterminate Structures

Linear elastic Analysis - Degree of Redundancy - Degree of Freedom - Static and Kinematic Indeterminacies – Maxwell's Theorem-Betti's law- Method of consistent deformation- sign convention- Clapeyron's theorem of three moments equation method –Problems with concentrated loads, partial or and full UDL, concentrated moments - ProppedCantilever Beams, Fixed Beams and Continuous Beams (restricted to two spans) - Additional problems with flexural hinges, elastic supports and support settlements. All problems shall end with elastic curve, Shear Force Diagrams (SFD) and Bending MomentDiagrams (BMD).

UNIT II Indeterminate Structures

Degree of Redundancy - Static and Kinematic Indeterminacies - Plane frames – Virtual work method (Unit Load Method) – Castigliano's Theorems – Simple frames (restricted to three members with two redundancies) - Simple trusses (restricted to five members with two redundancies)- Additional problems with flexural hinges, elastic supports and support settlements. All problems shall end with elastic curve, Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD).

UNIT III Influence Lines

Analysis for moving loads - Influence Line Diagram (ILD) – Muller Breslau Principle forInfluence Lines- ILD for simply supported beams - ILD for overhanging beams - ILD for Propped cantilever beams with flexural hinges- simply supported beams with floor girders –

Problems with single concentrated loads, two loads, train of loads, UDL longer than span and shorter than span – Maximum SFD and BMDs –Absolute maximum bending moment- ILD for Simple Plane truss. ILD for continuous beams and rigid frames (no problems) - Indirect model analysis for indeterminate structures.

UNIT IV Arches

Arch action – Types of Arches - Analysis of Three-hinged and Two-hinged arches witheffect of temperature change, rib shortening - Yielding of supports - Influence lines - Parabolic and Circular arches – Settlement effects.

UNIT V Cables and Suspension Bridges

Cables and Suspension bridges – Cable Theorem – Cable under uniformly distributed loads (Cable Equation) - Horizontal thrust on the cable -Tension in the cable - Length of the cable - Effect of temperature on the cable - Stiffening girders in suspension bridges - Analysis of three-hinged and two-hinged stiffening girders with different support levels. ILD for moving loads over suspension bridges. Analysis of Beams Curved in Plan – Analysis of Space trusses using tension coefficient method.

TEXT BOOKS

1. Punmia.B.C, et al, "*Theory of Structures- Vol.I& II"*, Lakshmi Publications, New Delhi,2004
2. Ramamrutham.S & Narayan.R, "*Theory of Structures"* 9th Edition, DhanpatRai and Sons,Delhi, 2014.

REFERENCES

1. Devdas Menon, "*Structural Analysis"*, Narosa Publishing House, New Delhi, 2009.
2. Reddy.C.S, "*Basic Structural Analysis"*, Third Edition, Tata McGraw Hill Book Co., New Delhi, 2018.
3. Wang.C.K, "*Intermediate Structural Analysis",* Tata McGrawHillBook Co., NewDelhi,1984.
4. Vazirani and Ratwani, "*Analysis of Structures - Vol.I.& II" Third Edition ,* Khanna Publishers,Delhi,1999.
5. Viadyanathan. R and Perumal. P, "*Comprehensive Structural AnalysisVol. I & II"*, LaxmiPublications, New Delhi,2003.
6. Negi.L.SandJangid.R.S, "*Structural Analysis"*, Tata McGraw Hill BookCo., New Delhi,2003.
7. Gambhir, M.L., "*Fundamentals of Structural Mechanics and Analysis"*,PHI Learning Pvt.Ltd., New Delhi,2011.
8. Bhavikatti.S.S, "*Structural Analysis,Vol. I and II",* Vikas PublishingHouse Pvt. Ltd., New Delhi, 2008.

COURSE OUTCOMES

At the completion of the course students will be able

1. To analyze the indeterminate structures like beams and frameswith different end conditions.
2. To analyze the indeterminate structures like beams and frames withdifferent loading conditions.
3. To analyse the arch structures and suspension cable bridges.
4. To solve the structural problems with influence line methods of analysis.
5. To analyse the problems in the various classical methods of analysis of structures

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	3	3	3	2	3				2	3	3	3	2
CO2	3	3	3	3	3	3	2	3				2	3	3	3	2
CO3	3	3	3	3	3	3	2	3				2	3	3	3	2
CO4	3	3	3	3	3	3	2	3				2	3	3	3	2
CO5	3	3	3	3	3	3	2	3				2	3	3	3	2

22CZPC502	STRUCTURAL STEEL DESIGN I	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

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

UNIT I

Limit State Design – Basic for Design – Ductility – Partial safety factors for loads – Partial Safety Factors for Materials – Deflection Limits. Bolted connections – Location detailsof Fasteners – Bearing and Friction Grip type bolts – Long joints – Shear capacity – Tension capacity – Bearing Capacity – Bolts subjected to combined shear and tension – Slip resistance – Tension resistance – Prying force and Tension – In plane loading – Design ofconnections as per IS 800 – 2007 provisions. Welded connections – Butt joint – Lap joint –Size of weld – Throat thickness – Weld symbols – Weld types – Long joints – Weld subjectedto combination of normal and shear stress – combination of bearing bending and shear – Inplane loading – Out of Plane loading – Design of connections as per IS 800 – 2007 provisions.

UNIT II

Tension members – Types – Design strength due to yielding of cross section – Rupture of critical section – Plates – Threaded rod single Angles – Other sections – Block shear – Bolted and welded connection of Tension members – Design of Tension members as per IS800 – 2007 provisions.

UNIT III

Compression members – Effective lengths – Slenderness ratios – Imperfection factor – Stress reduction factor – Bucking class of cross sections – Design details – Column BasesAngle Struts – Laced Columns – Battened columns – Design of compression members asper IS 800 – 2007 provisions.

UNIT IV

Beams – Effective span of Beams – Design strength in Bending Torsional Buckling – Effective Length for simply supported beams – Shear – Beams of unsymmetrical sections –Design of beams as per IS 800 – 2007 provisions.

UNIT V

Welded Plate girders – Components of plate girder – Design of web – Design of flanges – Connections – End bearing stiffness – Intermediate stiffness – Web splices – Flange splices – Design of Welded plate girders as per SP: 6 (2)- 1962 and IS 800 – 2007provisions.

TEXT BOOKS

1. Subramanian N, "*Design of Steel Structures"*, Oxford University Press, New Delhi, 2018.
2. Bhavikatti S.S, "*Design of Steel Structures"*, I.K. International Publishing House Pvt. Ltd.,New Delhi, 2012.

REFERENCES

1. Duggal S.K, "*Limit state Design of Steel Structures"*, Tata McGraw Hill EducationPrivate Ltd, New Delhi, 2000.
2. Sairam K.S, "*Design of Steel Structures"*, Pearson Publications, London 2013.
3. Shiyekar, "*Limit state Design of Steel Structures"*, Phi Learning Pvt. Ltd, Delhi, 2010.

STANDARDS

1. IS 800: 2007, General Construction in Steel, Bureau of Indian Standards, New Delhi.
2. IS 813: 1986, Scheme of symbols for welding, Bureau of Indian Standards, New Delhi.
3. SP: 6(2):1972, Hand book for Structural Engineers, Bureau of Indian Standards, NewDelhi.

COURSE OUTCOMES

At the completion of the course students will be able

1. To understand the different types of Steel sections available in the market.
2. To design the connections and different types of members subjected to various loadingconditions.
3. To understand the Codal provisions for designing the members.
4. To design the compression and tension members as per the requirements
5. To design the plate girders inclusive of the design of flanges and web and theirconnections.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		3	3				2			1			2	3		1
CO2		3	2										2	3		
CO3		3	2										2	3		
CO4		3	2										2	3		
CO5		3	2										2	3		

22CZPC503	SOIL MECHANICS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the nature, properties and behavioral response of soils is essential for asafe and stable design of foundations.
- To understand the principles involved in the understanding of the behavior of soils as asupporting medium for structures.

UNIT I

Physical & Index properties of soil: Weight- Volume Relationships, In-situ Density, Moisture Content, Specific Gravity, Relative Density, Atterberg's Limits, Soil Indices, consistency of soil, Particle Size Distribution of soil: Sieving, Sedimentation Analysis. Identification & Classification of soil: Field identification of soil, Soil Classification: as per Unified Classification System, IS Code Recommendation as per SP 36 – 1 (1987).

UNIT II

Flow through soil: Darcy's Law, Coefficient of permeability, laboratory and field determination of coefficient of permeability, Permeability for Stratified Deposits, Laplace's Equations, Flow nets, Flow Through Earthen Dam, Estimation of Seepage, Uplift due to seepage. Effective Stress Principles: Effective Stress, Effective pressure due to different conditions, Seepage force, Critical hydraulic gradient, Quick sand condition, Design of filters,Capillarity in soil.

UNIT-III

Stress Distribution In Soil: Normal and shear stresses, Stress due to point loads, Stressbeneath Line, strip & uniformly loaded circular area & rectangular area, pressure bulbs, Newmark's charts- Use for determination of stress due to arbitrarily loaded areas.

UNIT-IV

Compaction of soil: Principles of Compaction, Compaction Test, Field Compaction, Various methods of field compaction and control. Compressibility & Consolidation of Soil:Terzaghi's theory of one dimensional consolidation, Compressibility characteristics of soils: Compression index, Coefficient of compressibility & volume change, Coefficient of consolidation, Degree & rate of consolidation, Laboratory method of one dimensional consolidation test, Determination of consolidation parameters, Secondary consolidation.

UNIT-V

Shear Strength of Soil: Basic concepts, Mohr- Columb's Theory, Laboratory Determination of soil shear parameter- Direct Shear, Tri-axial Test, Unconfined Compression, Vane Shear Test, Sensitivity & thixotropy of clay as per SP 36 – 1 (1987).Slope failure mechanisms - total stress analysis for saturated clays - friction circle method, tension cracks - use of stability number.

TEXT BOOKS

1. Punmia B.C, "*Soil Mechanics & Foundation Engineering",* Lakshmi Publications, NewDelhi, 2005.
2. Moorthy V.N.S., "*Soil Mechanics & Foundation Engineering", CRS Press,* Taylor & FrancisBooks India Pvt. Ltd, New Delhi, *2002.*

REFERENCES

1. Shamsher Prakash, "*Problems in Soil Mechanics", Asia Publishing House,* Hyderabad,1976.
2. Terzaghi, K. and Peck.R.B, "*Soil Mechanics in Engineering Practice", JohnWiley & Sons,Navi Mumbai, 1996.*
3. Venkatramaiah. C, *Geotechnical Engineering", New Age International Publishers,* NewDelhi, 2006.
4. Arora, "*Soil Mechanics & Foundation Engineering", Standard Publishers Distributors,* New Delhi, 2005.

STANDARDS

1. SP 36 – 1:1987 Compendium of Indian Standards on Soil Engineering: Part-1Laboratory Testing of Soils for Civil. Bureau ofIndian Standards, New Delhi

COURSE OUTCOMES

At the end of the course students will be able

1. To understand the soil characters such as shear strength and stress distribution.
2. To determine the soil properties.
3. To demonstrate the experiments on different soils.
4. To understand the stress distribution under the soils.
5. To understand the shear strength and uplift due to seepage.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2												1			
CO2	2	3											3	1		
CO3			3											1		
CO4	1	3											2	1		
CO5	1	3	2		3								2	2	1	

22CZPC504	STRUCTURAL CONCRETE DESIGN II	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

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

UNIT I

Analysis and design of concrete Building frames: load combinations for 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 : 1987and IS 13920: 2016.

UNIT II

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

UNIT III

Design of Under-reamed piles with two bulbs(IS : 2911 (part III) – 1980), Designof Bored Pile foundations with Pile cap for two column loads, three column loads, four columnloads IS: 2911 (Part 1/Sec 2)- 2010 – Reinforcement detailing as per SP 34 : 1987.**UNIT IV**

Design of square, rectangular and circular shape water tanks resting on 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 andcolumns.

UNIT V

Design of cantilever type retaining walls without surcharge - Design of cantilever type retaining walls with surcharge and traffic loads - Design of counter-fort type retaining walls without surcharge - Design of counter-fort type retaining walls with surcharge and traffic loads - 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 Delhi1995.

REFERENCES

1. Ramamrutham.S and Narayan.R, "*Design of R.C. Structures",* Dhanpat Rai andSons, Delhi, 1992
2. Dayaratnam P, "*Design of RC Structures"*, OXFORD & IBH Publishing Co, NewDelhi, 2000.
3. Punmia.B.C, "*R.C.Structures – Vol. II"*, Standard Publishers, New Delhi, 1991.

4. Mallick.S.K & Gupta.A.P, "*Reinforced Concrete"*, Oxford I B H, New Delhi, 1987.
5. Park and Paulay. T, "*R.C.Structures"*, Tata McGraw Hill Publications, New Delhi,1975.

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 toSeismic 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 RaftFoundations, Bureau of Indian Standards, New Delhi.
5. IS 1904: 1986, Code of Practice for Design and Construction of Foundations in Soils : General Requirements, Bureau of Indian Standards, New Delhi.
6. IS: 2911 (Part 1/Sec 1)- 2010, Design and Construction of Pile Foundations - Code of Practice, Bureau of Indian Standards, New Delhi.
7. IS 2911 (Part III): 1980, Code of Practice for Design and Construction of PileFoundations (Under-reamed piles), Bureau of Indian Standards, New Delhi.
8. IS 3370 (Part IV) :2009, Code Of Practice For Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

1. The students will have the knowledge of analysis and design of multi-storeyed frameswith lateral loads
2. The students will have the knowledge of analysis and design of the pile foundation.
3. The students will have the knowledge of analysis and design of the strap footings andraft foundation.
4. The students will have the knowledge of analysis and design of the water tanks of different sizes for various staging conditions.
5. The students will have the knowledge of analysis and design of the retaining walls of different types.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	1	2							3	3	2	2	
CO2	3	2	3	1	2							3	3	3	2	
CO3	3	2		1	2							3	3	2	2	
CO4	3	2	3	1	2							3	3	3	2	
CO5	3	2	3	1	2							3	3	3	2	

22CZCP508	COMPUTER PRACTICAL II (Structural Design Drawings)	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To train the students in the use of latest software's available to solve structuralengineering problems and documentations procedures.

LIST OF EXERCISES

Plate 1. Draw cross section, longitudinal sections of Concrete Beams withreinforcement details as per SP 34: 1987, IS 13920: 2016.

a. Singly and Doubly Reinforced Concrete Beams
b. Flanged beam: T and L shaped Reinforced Concrete Beams
c. Rectangular Continuous Beams

Plate 2. d. Lintel Beams with sunshade
e. Plinth Beams

Plate 3 f. One way and two way slabs.
g. Continuous slabs

Plate 4. Draw cross section, longitudinal sections of Concrete staircase withreinforcement details as per SP 34: 1987, IS 13920: 2016.

- Dog legged staircase

Plate 5. Draw cross section, longitudinal sections of Column with Footings andreinforcement details as per SP 34: 1987, IS 13920: 2016.

a. Rectangular Column with Isolated Footings
b. Circular Column with Circular Isolated Footings

Plate 6 & 7. Draw cross section, longitudinal sections and reinforcement details for thefollowings

a. Strap footing
b. Raft foundation (IS: 2950 (Part I) -1981).

Plate 8, 9 & 10. Draw cross section, longitudinal section and 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)

REFERENCES

1. ACAD Manuals.
2. Krishnaraju.N, "*Structural Design and Drawing",* Oscar Publications, Delhi, 2005.
3. Punmia, B.C, "*Reinforced Concrete Structure Vol. I"*, Standard PublishersDistributors, New Delhi, 2007.

STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of IndianStandards, New Delhi
2. IS 13920: 2016, Ductile Detailing of Reinforced Concrete Structures Subjected toSeismic Forces - Code of Practice, Bureau of Indian Standards, New Delhi
3. SP 34 : 1987, Handbook On Concrete Reinforcement And Detailing, Bureau of IndianStandards, New Delhi.
4. IS: 2950 (Part I) -1981, Code of Practice for Design and Construction of RaftFoundations, Bureau of Indian Standards, New Delhi
5. IS 1904: 1986, Code of Practice for Design and Construction of Foundations in Soils:General Requirements, Bureau of Indian Standards, New Delhi
6. IS: 2911 (Part 1/Sec 1)- 2010, Design and Construction of Pile Foundations - Code ofPractice, Bureau of Indian Standards, New Delhi.
7. IS 2911 (Part III): 1980, Code of Practice for Design and Construction of Pile Foundation(Under-reamed piles),Bureau of Indian Standards, New Delhi,
8. IS 3370 (Part IV): 2009, Code Of Practice For Concrete Structures for the Storage ofLiquids, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be

1. Having the knowledge of how to represent the detailing in the form of drawings forpractical applications.
2. Draw the detailed drawings showing reinforcement details.
3. Able to gain experience/ practice on Modern Software in Civil Engineering field.
4. Able to give the reinforcement detailing for the structures like foundations, water tanks,retaining walls, etc.
5. Able to understand the codal provisions for detailing of reinforcements and how toimplement in the drawings.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3		2				2	1		2			2	2		1
CO2	3		2				2	1		2			2	2		1
CO3	2				3								1		2	
CO4	3		3		2		2	1		1			2	2	1	1
CO5	3				2							2	2		1	

22CZCP509	STRUCTURAL REINFORCEMENT DETAILING LABORATORY	L	T	P	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: a) T Beams
   b) 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. Staircase
8. Isolated Footings: a) Rectangular Column
   b) Circular Column

Reinforcement details as per IS: 2911 (Part 1/Sec 1) - 2010, IS 2911 (Part III): 1980 andSP 34: 1987.

i. Pile with Pile cap (Two pile group)
ii. Pile with Pile cap (Three pile group)
iii. Pile with Pile cap (Four pile group)

Reinforcement details as per SP 34: 1987.

i. Cantilever Type Retaining Wall
ii. Counter fort Type Retaining Wall

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 SeismicForces -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 1904: 1986, Code of Practice for Design and Construction of Foundations in Soils: General Requirements, Bureau of Indian Standards, New Delhi
6. IS: 2911 (Part 1/Sec 1)- 2010, Design and Construction of Pile Foundations - Code ofPractice, Bureau of Indian Standards, New Delhi.
7. IS 2911 (Part III): 1980, Code of Practice for Design and Construction of Pile Foundation

(Under-reamed piles),Bureau of Indian Standards, New Delhi,
8. 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 completion of the course students will be

1. Having the knowledge of how to represent the detailing in the form of drawings for practicalapplications.
2. Draw the detailed drawings showing reinforcement details.
3. Able to give the reinforcement detailing for the structures like beams, columns, footings,foundations, water tanks, retaining walls, etc.
4. Able to understand the codal provisions for detailing of reinforcements and how to implementin the drawings.
5. Able to check the bar bending and reinforcement fittings for different structural elements.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2							1	1		3	2		1
CO2	3	1	3	2									2	2	1	
CO3	3				3								2		2	
CO4	3	1	3	2									2	2	1	
CO5	3		2							2			2	1		1

22ETIT510	INDUSTRIAL TRAINING / RURAL INTERNSHIP / INNOVATION / ENTREPRENEURSHIP	L	TR	S	C
		-	-	-	4

COURSE OBJECTIVES

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

METHOD OF EVALUATIONS

1. During the seminar session each student is expected to prepare and present the topic onthe relevant engineering project topics for duration ofabout 8 to 10 minutes.
2. In a session of 3 periods per week, 15 students are expected to present the seminar.
3. Each student is expected to present at least twice during the semesterand the student isevaluated based on that.
4. At the end of the semester, he/she can submit a report on his/her topicof seminar andmarks are given based on the reports.
5. A faculty guide is to be allotted and he/she will guide and monitor theprogress of thestudent and maintain attendance also.
6. Evaluation is 100% Internal.

COURSE OUTCOMES

1. The students know the advanced engineering developments.
2. Able to Prepare and present technical reports.
3. Able to use various teaching aids such as over head projectors, powerpoint presentationand demonstrative models.
4. Able to present infront of the experts about a topic or technical matters.
5. Able to adapt themselves in the situation needed.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1				1	3	3		1		3		2
CO2	3	3	3	3		2			3	3	2	1	1	2	2	3
CO3	3	3	3		2	1	2		3	3	1		3	3	2	2
CO4							3	3	3	2				1		2
CO5	3	2	1						3	3	1	1	1	2	3	3

SEMESTER VI

		L	T	P	C
22CZPC601	**STRUCTURAL MECHANICS II**	**3**	**-**	**-**	**3**

COURSE OBJECTIVES

- To understand the complex analysis of indeterminate structures with different endconditions. Through various classical methods of analysis of indeterminate structures.
- To provide advanced and modern methods of structural analysis of simple andcomplicated structures and structural systems.
- To learn the concept of force method and displacement method of analysis using matrixapproach.
- To have the knowledge of plastic analysis of concrete structures.

UNIT I Slope Deflection Method

Slope deflection equations- sign convention - Continuous beams (two spans only) – Simple Plane frames with and without sway (three members only) - Problems with flexuralhinges, elastic supports support settlements and non prismatic fixed beams- Problems usingSymmetry and Anti-symmetry concepts.

UNIT II Moment Distribution Method

Moment Distribution method (Prof. Hardy Cross Method) – Joint stiffness- Distribution factors- Carry over factors - Analysis of continuous beams – simple Plane frames with and without sways – Problems with flexural hinges, elastic supports and support settlements.

UNIT III Flexibility Method

Flexibility or Force equation - Member flexibility – Flexibility coefficients – Equivalent Joint Loads- Choice of Redundant force restricted to two - Analysis of continuous beams, frames (two redundant forces), Analysis of simple plane truss, Problems with temperature changes, pre-strains and support settlements.

UNIT IV Stiffness Method

Stiffness or Displacement equation - Member stiffness – Stiffness coefficients – Element and Global stiffness matrices - Transformations of stiffness matrices, load vectors and displacements vectors- Choice of displacements restricted to two - Analysis of continuous beams, frames, Analysis of simple plane truss, Problems with temperature changes, pre-strains and support settlements

UNIT V Approximate Method

Approximate methods: substitute frame method for gravity loads – Portal and cantilever methods for lateral loads. Simple frames used for water tanks, industrial bents, bunkers andsilos staging.

TEXT BOOKS

1. DevdasMenon, "*Structural Analysis"*, Narosa Publishing House, New Delhi, 2009.
2. Bhavikatti.S.S, "*Structural Analysis Vol. I and II",* Vikas Publishing HousePvt.Ltd.,New Delhi, 2008.

REFERENCES

1. Punmia.B.C, et al, "*Theory of Structures- Vol.I& II"*, Lakshmi Publications, NewDelhi,2004.
2. Wang.C.K, "*Intermediate Structural Analysis",* Tata McGraw Hill Book Co, NewDelhi,1984.
3. Negi.L.S and Jangid.R.S, "*Structural Analysis"*, Tata McGraw Hill Book Co,NewDelhi, 2003.
4. Gambhir, M.L., "*Fundamentals of Structural Mechanics and Analysis"*, PHILearningPvt. Ltd., New Delhi, 2011.
5. William Weaver Jr.&James M.Gere, "*Matrix Analysis of framed structures"*,CBSPublishers and Distributors, New Delhi, 2004.
6. Viadyanathan. R and Perumal. P, "*Comprehensive Structural Analysis Vol. I &II"*,Laxmi Publications, New Delhi, 2003.
7. Pandit, G.S. & Gupta, S.P. "*Structural Analysis-A Matrix Approach"*, TataMcGrawHill, New Delhi, 2004.

COURSE OUTCOMES

At the completion of the course students will be able

1. To analyze the indeterminate structures like beams and frames with differentend conditions through various advanced and modern methods.
2. To solve the structural problems with matrix approach.
3. To do the plastic analysis for concrete structures.
4. To analyse the problems with approximate methods and compare the results.
5. To have a sound knowledge on the application of these methods in topractical problems.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	1		3	3	3		2		2	3	3	1	3
CO2	3	3	3	1		3	3	3		2		2	3	3	1	3
CO3	3	3	3	1	2	3	3	3		2		2	3	3	2	3
CO4	3	3	3	1	2	3	3	3		2		2	3	3	2	3
CO5	3	3	3	1		3	3	3		2		2	3	3	1	3

22CZPC602	DISASTER PREPAREDNESS & PLANNING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

The objectives of the course are

- To understand basic concepts in Disaster Management.
- To Understand Definitions and Terminologies used in Disaster Management.
- To Understand Types and Categories of Disasters.
- To Understand the Challenges posed by Disasters.
- To understand Impacts of Disasters Key Skills.

UNIT I

Introduction-Concepts and definitions: disaster, hazard, vulnerability, risks- severity, frequency and details, capacity, impact, prevention, mitigation.

UNIT II

Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); man-made disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT III

Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change andurban disasters.

UNIT IV

Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction,DRR programmes in India and the activities of National Disaster Management Authority.

UNIT V

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

TEXT BOOKS

1. Pradeep Sahni, "*Disaster Risk Reduction in South Asia",* Prentice Hall Publisher, 2004.
2. Singh B.K., *"Handbook of Disaster Management: Techniques & Guidelines",* RajatPublication, 2008.

REFERENCES

1. Ghosh G.K., *"Disaster Management",* APH Publishing Corporation, 2006.
2. Disaster Medical Systems Guidelines. Emergency Medical ServicesAuthority, State ofCalifornia, EMSA no.214, June 2003.
3. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines onMental Healthand Psychosocial Support in Emergency Settings. Geneva: IASC
4. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
5. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministryof HomeAffairs)

COURSE OUTCOMES

The student will develop competencies in

1. The application of disaster concepts to management
2. Analyzing relationship between development and disasters.
3. Ability to understand categories of disasters and
4. Realization of the responsibilities to society
5. Mitigate the people and make awareness during disasters.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2					2	2					1	1	2		
CO2	2					2	2						1	2		
CO3						1	2					1		1		
CO4						3	1							2		
CO5						2			2			1		1		

22CZCP607	COMPUTER PRACTICAL III	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- This course enables the students in studying and understanding structural drawings by training them in doing the structural drawings themselves for various structural elementsand systems.

LIST OF EXERCISES

Draw cross section, longitudinal sections and reinforcement details as per SP34: 1987.

Plate 1 & 2 a. Cantilever Type Retaining Wall
b. Counterfort Type Retaining Wall

Plate 3 & 4. Draw cross section, longitudinal sections and reinforcement of water tanks resting on ground details as per IS 3370 (Part IV): 1967 and SP:34-1987.
a. Square or Rectangular
b. Circular

Plate 5 & 6. Draw cross section, longitudinal sections of Underground water tanks andreinforcement details as per IS 3370 (Part IV): 1967 and SP:34- 1987.
a. Square or Rectangular
b. Circular

Plate 7 & 8. Draw cross section, longitudinal section and reinforcement details of Elevated water tanks as per IS 3370 (Part IV): 1967and SP: 34- 1987.
a. Rectangular
b. Circular

Plate 9 & 10. Draw cross section, longitudinal section and reinforcement detailing of a RC grid floor and flat slabs as per IS 456: 2000.

Plate 11. Draw cross section and longitudinal sections of a steel roof truss with
connection details as per SP: 38–1987.

Plate 12. Draw cross section and longitudinal section of a welded plate girder as perSP: 6 (2) - 1962.

TEXT BOOKS

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2. Krishnaraju.N, "*Advanced R.C.Design"*, Tata McGraw Hill Publications, New Delhi, 1995.

REFERENCES

1. Shah.V.L&Karve, "*Illustrated R.C. Design"*, Structures Publications, Pune, 1996.
2. Mallick.S.K&Gupta.A.P*, "Reinforced Concrete"*, Oxford and IBM Publishing, New Delhi,1987.
3. Punmia.B.C, et al, "*R.C. Structures* - Vol.1 &II", Laxmi Publications (P) LTD, New Delhi, 1992.
4. Ramamrutham.S and Narayan.R, "*Design of R.C. Structures"*, Dhanpat Rai & Sons, NewDelhi, 1993.

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, 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 1904: 1986, Code of Practice for Design and Construction of Foundations in Soils: General Requirements. Bureau of Indian Standards, New Delhi.
6. IS: 2911 (Part 1/Sec 1)- 2010, Design and Construction of Pile Foundations, Bureau of Indian Standards, New Delhi.
7. IS 2911 (Part III): 1980, Code of Practice for Design and Construction of Pile Foundations (Under-reamed piles).Bureau of Indian Standards, New Delhi.
8. IS 3370 (Part IV): 1967, Code Of Practice for Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.
9. IS 4995 (Part I): 1974, Criteria for Design of Reinforced Concrete Bins for the Storage of Granular and Powdery Materials (General Requirements and Assessment of Bin Loads), Bureau of Indian Standards, New Delhi.
10. IS 4995 (Part II) :1974, Criteria for Design of Reinforced Concrete Bins for Storage of Granular ad Powdery Materials (Design Criteria),Bureau of Indian Standards, New Delhi.
11. IS 9178 (Part II):1979, Criteria for Design of Steel Bins for Storage of Bulk Materials (Design Criteria), Bureau of Indian Standards, New Delhi.
12. IS 5503 (Part I):1969, General Requirements for Silos for grain storage (Construction requirements), Bureau of Indian Standards, New Delhi.
13. SP: 6 (2) - 1962 Steel beams and plate girders. Bureau of Indian Standards, New Delhi.
14. IS 3370 (Part IV): 1967, Code Of Practice For Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be

1. Having the knowledge on the detailed codal standards for structural detailing of various structural elements.
2. Able to draw all drawings using ACAD with all basic drafting commands.
3. Able to practice the structural detailing of truss components and welded plate girder as per codel standards through ACAD software.
4. Able to understand and practice the structural detailing of RC grid floor system, bunkers, silos, water tanks resting on ground and elevated water tanks as per codel standards through ACAD software.
5. Having a knowledge in reading the practical drawings available for execution.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	1		1		2	2						2	1	1	1	
CO2	1		2		2	2						2	1	1	1	
CO3	1		3		2	2						2	1	2	1	
CO4	1		3		2	2						2	1	2	1	
CO5	1		3		2	2		2				2	1	2	1	1

22CZCP608	GEOTECHNICAL ENGINEERING LABORATORY	L	T	P	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 successfulgeotechnical 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. Field identification of Fine Grained soils.
5. Specific gravity of Soils.
6. Grain size distribution by Sieve Analysis.
7. Grain size distribution by Hydrometer Analysis.
8. Consistency limits by Liquid limit
9. Consistency limits by Plastic limit
10. Consistency limits by Shrinkage limit.
11. Permeability test using Constant-head test method.
12. Permeability test using Falling-head method.
13. Compaction test: Standard Proctor test.
14. Compaction test: Modified Proctor test.
15. Relative density.
16. Consolidation Test.
17. Triaxial Test (UU)
18. Vane shear test
19. Direct Shear Test
20. Unconfined Compression Strength Test.

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 GeotechnicalEngineering",* 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: BasicGeotechnics"
7. Karl Terzaghi, Ralph B. Peck, and Gholamreza, "Soil Mechanics in EngineeringPractice" Mesri.
8. V.N.S. Murthy, "Geotechnical Engineering: Principles and Practices of SoilMechanics and Foundation Engineering (Civil and Environmental Engineering)".

COURSE OUTCOMES

At the completion of the course students will be able

1. To understand the soil properties.
2. To gain knowledge about the soil characteristics.
3. To conduct the different experiments according to the soil typesfor finding their properties.
4. To classify the soils by its sizes and type.
5. To know the consistency limits of soils and consolidation process forthe usefulness of practical applications.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3											2	1		
CO2		3	2										2	3		
CO3		1	2	3									1	1	2	
CO4		1	3	1									1	2	1	
CO5			3	2										1	1	

22CZCP609	ADVANCED STRUCTURAL MATERIALS TESTING LABORATORY	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- To demonstrate the model analysis to understand the structural elements behaviour and to verify the Mullers Breslaus Principle.
- To determine the material properties and to observe the behaviour of materials of different cross sections, steel reinforcements, concrete, etc.

LIST OF EXPERIMENTS

1. Model analysis of Continuous Beam
2. Model Analysis of Portal Frame
3. Flexure test on beams of various cross sections
4. Flexure test on Continuous beam
5. Test on Curved Beams
6. Sand heap analogy
7. Modulus of Elasticity of concrete
8. Modulus of Elasticity of Steel by Ewing's Extensometer
9. Modulus of Elasticity of Steel by Whitemore's Strain Gauge
10. Modulus of Elasticity of Steel by Electrical Strain Gauge
11. Unsymmetrical bending

REFERENCES

1. Sadhu Singh, "*Experimental Stress Analysis",* Khanna Publishers, New Delhi, 2009.
2. Srinath.L.S, "*Experimental Stress Analysis",* Tata McGraw Hill Publications, New Delhi, 1984.
3. Ray.T.K, "*Experimental Stress Analysis",* Tata McGraw Hill Publications, New Delhi.
4. Sadhu Singh, "*Applied Stress Analysis",* Tata McGraw Hill Publications, New Delhi, 1983.
5. Dally & Riley, "*Experimental Stress Analysis",* Tata McGraw Hill Publications, New Delhi, 1980.
6. Vazrani & Chandola, "*Experimental Stress Analysis",* Tata McGraw Hill Publications, New Delhi, 1980.
7. Durelli A.J, "A*pplied Stress Analysis",* Prentice Hall of India, Delhi, 1970.
8. Mehta P.K., and Monteiro, P.J.M., "*Concrete, Microstructure, Properties and Materials"Fourth Edition*,Indian Concrete Institute, Chennai, 2014.
9. Shetty M.S., "*Concrete Technology" 8th Edition*, S.Chand & Co., New Delhi, 2022.

COURSE OUTCOMES

At the completion of the course students will be able

2. To understand the behaviour of steel elements for practical application.
3. To get experience in Modal analysis.
4. To understand the development of concrete for durability studies.
5. To determine the material property concrete and steel.
6. To determine the properties of the curved beam.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	2	3	2								3	3	3	
CO2	3		3	3	3								3	3	3	
CO3	2	2		2	2								2	2	3	
CO4																
CO5	3												2			

SEMESTER VII

22ETHS701	PROFESSIONAL PRACTICE, LAW AND ETHICS	L	T	P	C
		2	-	-	2

COURSE OBJECTIVES

- To make the students understand the types of roles they are expected to play in thesociety as
- practitioners of the civil engineering profession
- To develop some ideas of the legal and practical aspects of their profession

UNIT I Professional Practice and Ethics

Professional Practice – Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Actsand Standards).

Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing,protected disclosures.

UNIT II General Principles of Contracts Management

General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and subcontracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /"Red Flag" conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bidfixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public- Private Partnerships; International Commercial Terms.

UNIT III Arbitration, Conciliation and ADR

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

Appeal and Revision; Enforcement of foreign awards – New York and Geneva ConventionAwards; Distinction between conciliation, negotiation, mediation and arbitration,confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

UNIT IV Engagement of Labour and Labour & other Construction related Laws

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

UNIT V Law relating to Intellectual Property

Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies.

TEXT BOOKS

1. B.S. Patil, *"Legal Aspects of Building and Engineering Contracts",* 1974.
2. The National Building Code, BIS, 2017

REFERENCES

1. RERA Act, 2017
2. Meena Rao, *"Fundamental concepts in Law of Contract",* Third Edition, ProfessionalOffset, 2006.
3. Neelima Chandiramani., *"The Law of Contract: An Outline",* Second Edition, AvinashPublications, Mumbai, 2000.
4. Avtarsingh ., *"Law of Contract",* Eastern Book Co. 2002.
5. Dutt., *"Indian Contract Act",* Eastern Law House. 1994.
6. Anson W.R. *"Law of Contract",* Oxford University Press, 1979.
7. Kwatra G.K., *"The Arbitration & Conciliation of Law in India with case law onUNCITRAL Model Law on Arbitration",* Indian Council of Arbitration, 2005.
8. Wadhera (2004), *"Intellectual Property Rights",* Universal Law Publishing Co.
9. T. Ramappa (2010), *"Intellectual Property Rights Law in India",* Asia Law House
10. Bare text, *"Right to Information Act",* 2005.
11. O.P. Malhotra, *"Law of Industrial Disputes",* N.M. Tripathi Publishers.
12. K.M. Desai, The Industrial Employment (Standing Orders) Act, 1946.
13. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House
14. Vee, Charles & Skitmore, Martin (2003) Professional Ethics in the Construction Industry,
15. Engineering Construction and Architectural management, V.10,pp 117-127, MCBUPLtd
16. American Society of Civil Engineers (2011) ASCE Code of Ethics – PrinciplesStudyand
17. Application
18. Ethics in Engineering- M.W.Martin& R.Schinzinger, McGraw-Hill
19. Engineering Ethics, National Institute for Engineering Ethics, USA
20. www.ieindia.org
21. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins
22. CONSTRUCTION CONTRACTS, http://www.jnormanstark.com/contract.htm
23. Internet and Business Handbook, Chap 4, CONTRACTS LAW,
24. http://www.laderapress.com/laderapress/contractslaw1.html
25. Contract & Agreements
26. http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm
27. Contracts, http://206.127.69.152/jgretch/crj/211/ch7.ppt
28. Business & Personal Law. Chapter 7. "How Contracts Arise",

29. http://yucaipahigh.com/schristensen/lawweb/lawch7.ppt
30. Types of Contracts, http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt
31. IV. TYPES OF CONTRACTS AND IMPORTANT PROVISIONS,
32. http://www.worldbank.org/html/opr/consult/guidetxt/types.html
33. Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02),
34. http://www.sandia.gov/policy/14g.pdf

COURSE OUTCOMES

1. To familiarise the students to what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession
2. To give a good insight into contracts and contracts management in civil engineering, dispute, resolution mechanisms; laws governing engagement of labour
3. To give an understanding of Intellectual Property Rights, Patents.
4. To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
5. To develop good ideas of the legal and practical aspects of their profession

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3					2		3				1		2		2
CO2	3					1		3		2	3		1	2		3
CO3	3					2		3						1		2
CO4	3					3	1	3					1	2		2
CO5	3					2		3				2		1		2

22CZPC702	INSTRUMENTATION & SENSOR TECHNOLOGIES FOR CIVIL ENGINEERING APPLICATIONS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

The objective of this Course is

- To understand instrumentation, sensor theory and technology, data acquisition, digital signal processing, damage detection algorithm, life time analysis and decisionmaking.
- To understand the theoretical and practical principles of design of sensor systems.
- To Provide principle knowledge, practical training and measurementbest practice for a range of temperature, pressure, electrical, velocity, acceleration and vibration systems

UNIT I Fundamentals of Measurement, Sensing and Instrumentation Definition of measurement and instrumentation, physical variables, common types ofsensors; - LVDT - Describe the function of these sensors; Use appropriate terminology todiscuss sensor applications; andqualitatively interpret signals from a known sensor type,types of instrumentation, Sensor Specifics, Permanent installations, Temporary installations.

UNIT II Strain Gauges and Rosettes

Strain Gauges – Principle, types, performance and uses – Calibration – Temperature compensation – Strain Rosette analysis – Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements – Strain indicators.

UNIT III Sensor Installation and Operation

i) Predict the response of sensors to various inputs; ii) Construct a conceptual instrumentation and monitoring program; iii) Describe the order and methodology for sensor installation; and iv) Differentiate between types of sensors and their modes of operation and measurement and v) Approach to Planning Monitoring Programs, Define target, Sensor selection, Sensor siting, Sensor Installation & Configuration, Advanced topic, Sensor design,Measurement uncertainty

UNIT IV Data Analysis and Interpretation

a) Fundamental statistical concepts, b) Data reduction and interpretation,
c) Piezometer,Inclinometer, Strain gauge, etc. d) Time domain signal processing, e) Discrete signals,Signals and noise and f) a few examples ofstatistical information to calculate are: Averagevalue (mean), On average, how much each measurement deviates from the mean (standarddeviation), Midpoint between the lowest and highest value of the set (median), Mostfrequently occurring value (mode), Span of values over which your data set occurs (range)

UNIT V Frequency Domain Signal Processing and Analysis

Explain the need for frequency domain analysis and its principles; Draw conclusions about physical processes based on analysis of sensor data; Combine signals in a meaningful way to gain deeper insight into physical phenomena, Basic concepts in frequency domain signal processing and analysis, Fourier Transform, FFT (Fast Fourier Transform), Example problems: Noise reduction with filters, Leakage, Frequency resolution

TEXT BOOKS

1.Alan S Morris (2001), Measurement and InstrumentationPrinciples, 3rd/e,Butterworth Hienemann
2.David A. Bell (2007), Electronic Instrumentation andMeasurements 2nd/e, OxfordPress

REFERENCES

1. S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis
2. Ilya Gertsbakh (2010), Measurement Theory for Engineers, Springer

COURSE OUTCOMES

1. To analyze the errors during measurements, specify the requirements in the calibration of sensors and instruments and to describe the noise added during measurements and transmission
2. To describe the measurement of electrical variables
3. To describe the requirements during the transmission of measured signals
4. To construct Instrumentation/Computer Networks
5. To suggest proper sensor technologies for specific applications and todesign and set up measurement systems and do the studies

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3		2	2								3	2	2	
CO2	2	3	2	3	3								3	3	3	
CO3	2	3	2	3	3								3	3	3	
CO4	3	2	2	3	3								3	3	3	
CO5	3	3	3	3	3								3	3	3	

22CZCP706	INSTRUMENTATION & SENSOR TECHNOLOGIES AND EARTHQUAKE ENGINEERING LABORATORY	L	T	P	C
		-	-	3	1.5

COURSE OBJECTIVES

- This course aims at providing practical training in understanding the behaviour of thebuilding elements subjected to earthquake.

LIST OF EXPERIMENTS

A) INSTRUMENTATION AND SENSOR TECHNOLOGIES FOR CIVIL ENGINEERING APPLICATIONS

1. Instrumentation of typical civil engineering members/structures/structural elements
2. Use of different sensors, strain gauges, inclinometers,
3. Performance characteristics
4. Errors during the measurement process
5. Calibration of measuring sensors and instruments
6. Measurement, noise and signal processing
7. Analog Signal processing
8. Digital Signal Processing
9. Demonstration & use of sensor technologies

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

1. To analyze the errors during measurements, specify the requirements in the calibration of sensors and instruments and to describe the noise added during measurements and transmission
2. To construct Instrumentation/Computer Networks
3. To understand the dynamic properties.
4. To gain knowledge about the earthquake occurrence and resistance.
5. To analyse the structure under free and forced vibrations.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	3	3	3								3	3	3	
CO2	3	2	2	2	3								3	2	3	
CO3	3	3	2	3	3								3	3	3	
CO4	2	2	3	3	3								2	3	3	
CO5	2	2	2	3	3								2	3	3	

22ETIT707	INDUSTRIAL TRAINING/ RURAL INTERNSHIP/ INNOVATION/ ENTERPRENEURSHIP	L	T	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 over head projectors,power point presentation and demonstrative models.

METHOD OF EVALUATIONS

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

COURSE OUTCOMES

1. The students know the advanced engineering developments.
2. Able to Prepare and present technical reports.
3. Able to use various teaching aids such as over head projectors, power point presentationand demonstrative models.
4. Able to present infront of the experts about a topic or technical matters.
5. Able to adapt themselves in the situation needed.

Mapping of COs with POs													Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1				1	3	3		1		3		2
CO2	3	3	3	3		2			3	3	2	1	1	2	2	3
CO3	3	3	3		2	1	2		3	3	1		3	3	2	2
CO4							3	3	3	2				1		2
CO5	3	2	1						3	3	1	1	1	2	3	3

22CZPV803	PROJECT WORK AND VIVA-VOCE	L	PR	S	C
		-	10	2	6

COURSE OBJECTIVES

- To develop the ability to solve a specific problem right from its identification and literaturereview till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voceexamination.

COURSE OUTCOMES

On Completion of the project work students will be in a position

1. To take up any challenging practical problems and find solution by formulating propermethodology
2. To Carry out any experimental works on concrete and steel or any other constructionmaterial to know the behavior and properties
3. Understand the modelling, analysis and design concepts by taking up a structure.
4. Carryout a different projects like stadium, theatre, multiplex malls, etc for the analysisand design.
5. Carry out water retaining structures, dams and bridges for the analysis and design.

Mapping of COs with POs													Mapping with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1							3				2			1		1
CO2						2			3					1		
CO3			1					2						1		1
CO4							3			2		1		1		1
CO5							3	2						1		1

22CZPE505	SCAFFOLDING AND FORMWORK DESIGN IN CONSTRUCTION	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To study and understand the overall and detailed planning of formwork, plant andsite equipment.
- To understand the Design and erection of forms for various elements such as slabs,beams, columns, walls, shells and tunnels.
- To know the latest methods of form construction.

UNIT I

Definition – Economy of formwork and scaffolding – Care of formwork material – Typeof form work materials - Allowable stresses in formwork materials – Factors affecting selection of scaffolding and formwork systems – Equipments -.General objectives of formwork building - Planning for safety - Planning for maximum reuse- Scaffold frames.

UNIT II

Qualities of formwork and scaffolding – Types of formwork – Types of scaffolding: Putlog and independent scaffold -Single pole scaffolds - Truss suspended - Gantry and system scaffolds - Stages in formwork and scaffold – Formwork and Scaffold details for different structural members - Maintenance and Cost of formwork, scaffolding– Advantages of formwork and scaffold – Loads on formwork and scaffolds - Forms for foundations, columns, beams walls etc - Formwork hours- Formwork accessories - Formwork elements.

UNIT III

Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability - Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Slenderness ratio - Allowable load vs. length behaviour in forms - Forms for Footings
- Wall footings - Column footings - Sloped footing forms - Strap footing - Stepped footing - Allowable withdrawal load and lateral load -. Various causes of failures - ACI – Design anddeficiencies.

UNIT IV

Pressure of concrete on formwork and scaffolding – Lateral pressure of concrete onformwork and scaffolding – Failures of formwork and scaffolding in different structural members- Pressures on formwork - Examples - Vertical loads for design of slab forms - Laterals loads on slabs and walls.

UNIT V

Hemispherical, Parabolic, Translational shells - Forms for Thin Shell roof slabs designconsiderations - Building the forms - Placing concrete - Form removed -Strength requirements -Tunnel forming components - Curb forms invert forms - Arch forms - Concrete placement methods - Cut and cover construction - Bulk head method - Pressures on tunnels
- Continuous Advancing Slope method - Form construction – Shafts - Slip Forms - Principles
-Types - advantages - Functions of various components - Planning -Desirable characteristicsof concrete - Common problems faced - Safety in slip forms special structures built with slipform Technique.

TEXT BOOKS

1. Robert. Peurifoy and garold D. Oberlender *Form work for concrete structures;* McGraw -Hill , New Delhi, 1996.
2. *Safety requirements for scaffolding,* American National standards Institute;Broadway; New York.

REFERENCES

1. Awad S. Hanna ; *Concrete formwork systems* ; Prentice Hall Inc., New Jersy USA 2003.
2. Stewart champion ; *Access scaffolding* ; Iliffe, London, 2007.
3. Austin, C.K., *Formwork for Concrete*, Cleaver -Hume Press Ltd., London, 1996.

COURSE OUTCOMES

At the end of the course students will be able

1. To know the detailed planning of framework, design of forms and erection of form work.
2. To select the timbers and wooden planks with quality.
3. To have an idea of scaffolding fabrication for different works.
4. To check the formworks and scaffolding works and to check the stability beforeconcreting.
5. To design the formwork and scaffolding works for different shapes to make paraboloid,shell and cylindrical structures.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3				2								2			
CO2	3			2	2	1	1						2	1	1	
CO3	2					2	2						1	2		
CO4	2				1	1							1	1		
CO5	2				3								1			

22CZPE506	ENGINEERING GEOLOGY	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the site characterization and geologic hazard identification andmitigation.
- To know the engineering properties of rock and unconsolidated materials in the characterization of geologic sites for civil work projects.
- To learn the quantification of processes such as rock slides, soil-slope stability,settlement, and liquefaction.
- To know the collection, analysis, and interpretation of geological data and informationrequired for the safe development of civil works.

UNIT I

Introduction-Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Department dealing with this subject in India andtheir scope of work- GSI, Granite Dimension Stone Cell, NIRM. Mineralogy- Mineral, Origin and composition. Physical properties of minerals, susceptibility of minerals to alteration, basic of optical mineralogy, SEM, XRD., Rock forming minerals, megascopic identification ofcommon primary & secondary minerals.

UNIT II

Petrology-Rock forming processes. Specific gravity of rocks. Ternary diagram. Igneous petrology-Volcanic Phenomenon and different materials ejected by volcanoes. Types of volcanic eruption. Concept of Hot spring and Geysers. Characteristics of different types ofmagma. Division of rock on the basis of depth of formation, and their characteristics. Chemical and Mineralogical Composition. Texture and its types. Various forms of rocks. IUGS Classification of phaneritic and volcanic rock.. Field Classification chart. Structures. Classification of Igneous rocks on the basis of Chemical composition. Detailed study of Acidic Igneous rocks like Granite, Rhyolite or Tuff, Felsite, Pegmatite, Hornfels. Metamorphic Aureole, Kaolinization. Landform as Tors. Engineering aspect to granite. Basic Igneous rocks Like Gabbro, Dolerite, Basalt. Engineering aspect to Basalt. Sedimentary petrology- mode of formation, Mineralogical Composition. Texture and its types, Structures, Gradation of Clastic rocks. Classification of sedimentary rocks and their characteristics. Detailed study of Conglomerate, Breccia, Sandstone, Mudstone and Shale, Limestone Metamorphic petrology- Agents and types of metamorphism, metamorphic grades, Mineralogical composition, structures & textures in metamorphic rocks. Important Distinguishing features ofrocks as Rock cleavage, Schistosity, Foliation. Classification. Detailed study of Gneiss, Schist, Slate with engineering consideration.

UNIT III

Physical Geology- Weathering. Erosion and Denudation. Factors affecting weatheringand product of weathering. Engineering consideration. Superficial deposits and its geotechnical importance: Water fall and Gorges, River meandering, Alluvium, Glacial deposits, Laterite (engineering aspects), Desert Landform, Loess, Residual deposits of Claywith flints, Solifluction deposits, mudflows, Coastal deposits. Strength Behavior of Rocks- Stress and Strain in rocks. Concept of Rock Deformation & Tectonics. Dip and Strike.

Outcrop and width of outcrop. Inliers and Outliers. Main types of discontinuities according to size. Fold-Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field, effects on outcrops. Joints & Unconformity; Types, Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding, Earthquake and Subsidence. Strength of Igneous rock structures.

UNIT IV

Geological Hazards-Rock Instability and Slope movement: Concept of sliding blocks. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. Types of landslide. Prevention by surface drainage, slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Case study on black clay. Ground water: Factorscontrolling water bearing capacity of rock. Pervious & impervious rocks and ground water. Lowering of water table and Subsidence. Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence in Himalayan region in India.Seismic Zone in India.

UNIT V

Rock masses as construction material: Definition of Rock masses. Main features constituting rock mass. Main features that affects the quality of rock engineering and design. Basic element and structures of rock those are relevant in civil engineering areas. Main types of works connected to rocks and rock masses. Important variables influencing rock properties and behaviour such as Fresh rock Influence from some minerals. Effect of alteration and weathering. Measurement of velocity of sound in rock. Classification of Rock material strength. Core logging .Rock Quality Designation. Rock mass description. Geology of dam and reservoir site- Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures. Rock Mechanics- Sub surface 9nvestigations in rocks and engineering characteristics or rocks masses; Structural geology of rocks. Classification of rocks, Field & laboratory tests on rocks, Stress deformation of rocks, Failure theories and sheer strength ofrocks, Bearing capacity of rocks.

TEXT BOOKS

1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.
2. Text Book of Engineering Geology, N. Chenna Kesavulu, 2nd Edition (2009), Macmillan Publishers India.

REFERENCES

1. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).

COURSE OUTCOMES

At the completion of the course students will understand

1. Site characterization and how to collect, analyze, and report geologic datausingstandards in engineering practice
2. The fundamentals of the engineering properties of Earth materials and fluids.
3. Rock mass characterization and the mechanics of planar rock slides and topples.
4. Soil characterization and the Unified Soil Classification System.
5. The mechanics of soils and fluids and their influence on settlement, liquefaction,and soilslope stability.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2			2			1		3		2	3	1	1	1	1
CO2	1	2				2			3			3	2	2		
CO3	2		3					1				2	1	1		1
CO4	2			2	2	3	2			2		3	1	2	2	1
CO5	2	2				3		3	2			2	2	2		2

22CZPE603	STRUCTURAL STEEL DESIGN II	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To make the students conversant with the design procedures and practices of complexsteel structures like industrial structures and Gantry girders as per IS 800 – 2007 procedures.

UNIT I

Wind on Industrial Buildings - Design wind speed and pressure – Internal and externalwind pressure coefficients from codes(IS: 875(Part-3) &SP 64: 2001) – Wind forces on members with height - Wind forces on Cladding, Louvers, hoarding structures, Microwave Towers –Wind motion due to Vortex Shedding, dynamic response factor for along wind andacross wind. Design of purlins, Rafters, Sag rods and Girds.

UNIT II

Industrial buildings – Types – Elements of an industrial building – Loads on industrialbuildings – Roof trusses – Components of a roof truss – Loads on roofs – Analysis and Design of roof truss. Pre-Engineered Buildings– Advantages of PEB over Conventional roof trusses- Tubular Trusses, joint details and tubular scaffoldings. Analysis and design of hoarding structures under dead, live and wind loads condition as per IS 875 (Part3) & SP 64:2001.

UNIT III

Design of gantry girder – Gantry supporting columns - Columns with battened plate –column with cap plate details –– Stepped columns – Moment Resistant Connections - Beamand column connections – Beam to Beam connections – Braced industrial buildings – Un-braced industrial frames–Base plate with anchor bolt details - Detailing as per IS 800 : 2007.

UNIT IV

Plastic analysis and design – Advantages and disadvantages – Plastic neutral axis –Plastic modulus – Plastic moment of resistance – Shape factor – Load factor – Plastic hinge– Collapse mechanisms – Theorems of plastic analysis – Analysis and Design of beams andsimple frames – Limitations – Plastic design Versus Elastic design. Design of castellatedbeam for bending and shear.

UNIT V

Cold Form light gauge sections - Type of cross section, stiffened, multiple stiffened and un-stiffened element, Design of light gauge compression, tension and flexural members asper IS 802(Part 1 to 3):1995**.**

TEXT BOOKS

1. Duggal.S.K , "*Limit State Design of Steel Structures"*, Tata McGraw Hill EducationPrivate Ltd, New Delhi, 2000.
2. Sairam.K.S, "*Design of Steel Structures"*, Pearson Publications, Chennai, 2013.

REFERENCES

1. Subramanian.N, "*Design of Steel Structures",* Oxford University Press, New Delhi, 2008
2. Bhavikatti.S.S, *"Design of Steel Structures",* I.K. International Publishing House Pvt. Ltd,New Delhi, 2012.
3. Shiyekar, "*Limit State Design of Steel Structures"*, Phi Learning Pvt. Ltd., Delhi, 2010

STANDARDS

1. IS800:2007, General Construction in Steel – Code of Practice, Bureau of IndianStandards, New Delhi.
2. IS 875 (Part3)-2015: Wind Loads on Buildings and Structures, Bureau of Indian Standards,New Delhi.
3. Teaching resource materials by INSDAG, Kolkata.
4. IS: 802(Part 1 to 3): 1995 Code of practice for use of cold formed light gauge steel structural members in general building construction, Bureau of Indian Standards, New Delhi.
5. IS 806:1968 (R2002) Code of practice for use of steel tubes in general building construction, Bureau of Indian Standards, New Delhi.
6. IS 4014 (Part I and II): 1967 Code of practice for steel tubular scaffolding, Bureau of Indian Standards, New Delhi.
7. SP: 6 (2) – 1962, Hand book for structural Engineers, Steel beams and plate girders, Bureau of Indian Standards, New Delhi.
8. SP: 6 (5) – 1980, Hand book for Structural Engineers, Structural use of light gauge steel, Bureau of Indian Standards, New Delhi.
9. IS codes for Aluminium Structures, IS:3908, 3909, 3921, 5384, 6445, 6476, 6475, 6449, 8147, Bureau of Indian Standards, New Delhi.
10. SP 64 (2001): Explanatory Handbook on Indian Standard Code of Practice for Design Loads (other than Earthquake), Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able

1. To identify the different types of Steel sections available in the market.
2. To design of Connections and Different types of members which are subjected to various loads.
3. To do the plastic analysis and estimate its effects.
4. To design the PEB and Gantry girders.
5. To understand the cold form gauge sections and its applications.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1			3			2				1				2		1
CO2		3	3			2				1			2	3		1
CO3			3							1				1		1
CO4	2		3	2		2				1			1	2	1	1
CO5		3	2			2		1					2	3		1

22CZPE604	STRUCTURAL CONCRETE DESIGN III	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To make the students to expose with the design practices of elevated water tanks, deepbeams, grid floors, flat slabs, concrete walls.
- To understand the force flow at the joints and design of joints.

UNIT I Water Tanks

Design of Elevated square, rectangular and circular shape water tanks with staging –Design includes cover slab; side wall, base slab, columns with staging as per IS 11992: 1995, Reinforcement detailing as per SP 34: 1987.

UNIT II Corbels and Deep Beams

Design of concrete Corbels for crane loads, Design of Deep beams using Strut and tie concept - Reinforcement detailing as per SP 34: 1987.

UNIT III Grid Floors

Design of Ribbed (Voided Slabs), Design of Grid floors - Reinforcement detailing as perSP 34: 1987.

UNIT IV Flat Slabs

Design of Flat Slabs using Direct Design Method - Equivalent Frame Method - Reinforcement detailing as per SP 34: 1987.

UNIT V Shear Wall and B-C Joints

Design of Concrete Shear Walls - Design of concrete joints - Interior and exterior column beam joints - 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, et al, "*R.C. Structures- Vol.I & II",* Laxmi Publications (P) Ltd., Chennai,1995.

REFERENCES

1. Mallick.S.K&Gupta.A.P, "*Reinforced Concrete"*, Oxford & IBH Publishing, New Delhi,1987.
2. Park and Paulay. T, "*R.C. Structures"*, Tata McGraw Hill Publications, New Delhi, 1975.
3. Ramamrutham.S and Narayan. R, "*Design of R.C. Structures",* Dhanpat Rai and Sons,Delhi, 1992.
4. Dayaratnam P, "*Design of RC Structures"*, OXFORD & IBH Publishing, New Delhi, 2000.
5. Punmia.B.C, "*R.C. Structures– Vol. II"*, Standard Publishers, New Delhi, 1991.

STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureauof Indian Standards, New Delhi.
2. IS 13920: 2016, Ductile Detailing of Reinforced Concrete Structures Subjectedto Seismic Force, Bureau of Indian Standards, New Delhi.
3. SP 34: 1987, Handbook on Concrete Reinforcement And Detailing, Bureauof Indian Standards, New Delhi.
4. IS 3370 (Part IV): 2009, Code Of Practice for Concrete Structures for theStorage of Liquids, Bureau of Indian Standards, New Delhi
5. IS 11992: 1995, Criteria for Design of RCC Staging for Overhead Water Tanks,Bureau of Indian Standards, Codal recommendations.

COURSE OUTCOMES

At the completion of the course students will be able

1. To design the special structural elements as per relevant IS standards.
2. To design the grid floor and flat slabs as per codal recommendations.
3. To design the corbels and deep beams
4. To understand the concept of force flow at the joints and design of joints
5. To design the shear walls and its benefits

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3			2		3		1		1	3	3		2
CO2	3	3	3			2		3		1		1	3	3		2
CO3	3	3	3			2		3		1		1	3	3		2
CO4	3	3	3			2		3		1		1	3	3		2
CO5	3	3	3			2		3		1		1	3	3		2

22CZPE605	ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To make the students conversant with basic principles of water supply engineering.
- To know quantification of water, analysis, sources, conveyance, treatment anddistribution of water.

UNIT I Water

Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, Need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distributionsystem, Various valves used in W/S systems, service reservoirs and design. Water Treatment*:* aeration, sedimentation, coagulation flocculation, filtration, disinfection, advancedtreatments like adsorption, ion exchange, membrane processes

UNIT II Sewage

Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage-Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans, Wastewatertreatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes.

UNIT III Air

Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution automobile pollution, Chemistry of combustion, Automobile engines, quality of fuel, operating conditions and interrelationship. Air quality standards, Control measures for Air pollution, construction and limitations. *Noise*- Basic concept, measurement and various control methods.

UNIT IV Solid Waste Management

Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. SpecialMSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes, Effects of solid waste on environment: effects on air, soil, water surface and ground health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle. Disposal methods- Integrated solid waste management. Hazardous waste: Types and nature of hazardous waste as per the HW Schedules of regulating authorities.

UNIT V Building Plumbing

Introduction to various types of home plumbing systems for water supply and waste water disposal, high rise building plumbing, Pressure reducing valves, Break pressure tanks, Storage tanks, Building drainage for high rise buildings, various kinds of fixtures and fittings used. Government authorities and their roles in water supply, sewerage disposal. Solid waste management and monitoring/control of environmental pollution.

TEXT BOOKS

1. Gilbert Masters, *"Introduction to Environmental Engineering and Science",* Prentice Hall,New Jersey.
2. P.Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; *"Introduction toEnvironmental Engineering*", Second Edition., 2008.

REFERENCES

1. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. "*Environmental Engineering"*, Mc-Graw –HillInternational Editions, New York, 1985.
2. MetCalf and Eddy. "*Wastewater Engineering, Treatment, Disposal and Reuse"*, TataMcGraw- Hill, New Delhi.
3. Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.
4. S.M. Patil, "*Plumbing Engineering. Theory, Design and Practice",* 1999. Tchobanoglous,Theissen & Vigil, *"Integrated Solid Waste Management",* McGraw Hill Publication.
5. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central PublicHealth and Environmental Engineering Organization, Ministry of Urban Development.

COURSE OUTCOMES

After successfully studying this course, students will:

1. Understand the impact of humans on environment and environment on humans
2. Be able to identify and value the effect of the pollutants on the environment: atmosphere,water and soil.
3. Be able to plan strategies to control, reduce and monitor pollution.
4. Be able to select the most appropriate technique for the treatment of water, wastewatersolid waste and contaminated air.
5. Be conversant with basic environmental legislation.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2					2	2						2	2		
CO2	2					3	3						2	3		
CO3	2					3	3						2	3		
CO4	2			2									2			
CO5	2					1	2						2	1		

22CZPE703	PRESTRESSED CONCRETE	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

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

UNIT I

Prestress basic concepts – Advantages – Tendons, strands, concrete, end anchorages – Systems and methods of pre-stressing- Analysis of sections – Stress concept – Strengthconcept – Load balancing concept - Effect of loading on the tensile stresses in tendons –Losses of Prestress - Total losses for pre and post tensioning systems**.**

UNIT II

Flexural strength – Simplified procedures as per codes – Strain compatibility method –Basic concepts in selection of cross section for bending - Design of sections as per code forpre-tensioned and post-tensioned rectangular beams – Check for strength limit based on IS:1343-2012 – Design for shear based on IS:1343-2012. Design of anchorage zone reinforcement (end block)

UNIT III

Composite Sections – Types – Advantages - Analysis of stresses for composite sections – Analysis and Design – Flexural and shear strength of composite members – Shear key.

UNIT IV

Factors influencing deflections – Effect of tendon profile on deflections –Calculation of deflections – Short term deflections of un-cracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit state of deflection and crack width. Continuous beams**-**Method of achieving continuity-Analysis-Concordant cable and lineartransformation

UNIT V

Design of concrete pipes - Circular tanks - poles - Rail way sleepers – Partial Prestressing – Applications.

TEXT BOOKS

1. Krishna Raju N, "*Prestressed concrete"*, Fifth Edition, Tata McGraw Hill Company, NewDelhi, 2012.
2. Pandit.G.S. and Gupta.S.P., "*Prestressed Concrete"*, CBS Publishers and DistributersPvt. Ltd, New Delhi, 2012.

REFERENCES

1. Rajagopalan.N, "*Pre-stressed Concrete"*, Narosa Publishing House, New Delhi, 2002.
2. Dayaratnam.P., "*Pre-stressed Concrete Structures"*, Oxford and IBH, New Delhi, 2013.
3. Lin T.Y. and Ned.H.Burns, *"Design of prestressed Concrete Structures",* Third Edition,Wiley India Pvt. Ltd., New Delhi, 2013.
4. IS1343:2012, Code of Practice for Pre-stressed Concrete, Bureau ofIndian Standards,New Delhi, 2012.
5. IS 3370-1:2009 Concrete structures for storage of Liquids. Bureau ofIndian Standards,New Delhi, 2012.

COURSE OUTCOMES

At the completion of the course students will be able to

1. Gain knowledge on methods of pre-stressing.
2. Design various Pre-stressed concrete structural elements.
3. Understand the deflection criteria and its Codal recommendations.
4. Understand the concepts of composite section and its analysis.
5. Design the cables and tendons profile for prestressing and also todesign the concrete pipes, circular tanks, railway sleepers, etc.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3					2	2	1	1			1	2	1		1
CO2	3	2	2	2	2	1	1	1		1		1	3	3	2	2
CO3	3	2	2	2	1	1	1	1		1		1	3	3	2	2
CO4	2	2		1		1	2	1					3	2	1	1
CO5	3	2	2		2		1	1				1	3	3	1	1

22CZPE704	STRUCTURAL CONCRETE DESIGN IV	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the concepts of designing bridges deck slab, concrete Pipes, bunkersand silos and chimneys with relevant codal standards.

UNIT I

IRC loadings standards, Bridge deck slab design using Pigeaud's curves – Design ofSolid slab bridges as per IRC: 6-2014 and IRC 21: 2000 - Reinforcement detailing as per SP:34-1987.

UNIT II

Machine Foundations - Types - General Requirements - Design Parameters - Design Criteria and Codal Provisions for Reciprocating and Rotary Type Machines as per IS 2974(Part I to IV).

UNIT III

Design of prestressed bridges for Buried Concrete Pipes to Carry Water and Gas as perrelevant codes – Design of Post tensioned Concrete slabs - Design of Post tensionedConcrete T section Girders as per IS 1343:2012.

UNIT IV

Design of Concrete Bunkers and Silos as per IS 4995 (Part I, II): 1974, IS 5503 (Part I):1969 – Reinforcement Detailing as per SP:34 -1987.

UNIT V

Design of concrete Chimneys as per IS 4998(Part I):1992 - Stresses in chimneys - Reinforcement detailing as per relevant codes.

TEXT BOOKS

1. Krishnaraju.N, *Advanced R.C. Design*, CBS Publishers & Distributors Pvt. Ltd, NewDelhi, 2012.
2. Punmia.B.C, et al, *R.C. Structures- Vol.I& II,* Laxmi Publications (P) Ltd. Chennai,1995.

REFERENCES

1. Ramamrutham.Sand Narayan.R, *Design of R.C. Structures,* Dhanpat Rai and Sons,Delhi, 1992.
2. Dayaratnam P, *Design of RC Structures*, OXFORD & IBH Publishing, New Delhi, 2000.
3. Mallick.S.K&Gupta.A.P, *Reinforced Concrete*, Oxford I B H, New Delhi, 1987.
4. Park and Paulay. T, *R.C. Structures*, Tata McGraw Hill Publications, New Delhi, 1975.
5. Punmia.B.C, *R.C. Structures– Vol. II*, Standard Publishers, New Delhi, 1991.

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. IRC: 6-2014, Standard Specifications and Code of Practice for Road Bridges Section: II (Loads And

Stresses), *Indian Roads Congress* , New Delhi.
5. IRC 21: 2000, Standard Specifications and Code of Practice for Road Bridges Section: III [Cement Concrete (Plain And Reinforced)], *Indian Roads Congress* , New Delhi
6. IS 1343:2012, Code of Practice for Pre-stressed Concrete, Bureau of Indian Standards,New Delhi, 2012.
7. IS 2974 (Part I) :1982, Code of Practice for Design and Construction of Machine Foundations (Foundation for Reciprocating Type Machines), Bureau of Indian Standards, New Delhi
8. IS 2974 (Part II) :1980, Code of Practice for Design and Construction of Machine Foundations [Foundations For Impact Type Machines (Hammer Foundations)], Bureau of Indian Standards, New Delhi
9. IS 2974 (Part 3) : 1992, Design and Construction of Machine Foundations - Code of Practice [Foundations for Rotary Type Machines (Medium and High Frequency)], Bureau of Indian Standards, New Delhi
10. IS 2974 (Part IV) :1979, Code of Practice for Design and Construction of Machine Foundations (Foundations for Rotary Type Machines of Low Frequency), Bureau ofIndian Standards, New Delhi
11. IS 4995 (Part I): 1974, Criteria for Design of Reinforced Concrete Bins for the Storage of Granular and Powdery Materials (General Requirements and Assessment of Bin Loads), Bureau of Indian Standards, New Delhi
12. IS 4995 (Part II) :1974, Criteria for Design of Reinforced Concrete Bins for Storage of Granular and Powdery Materials (Design Criteria), Bureau of Indian Standards, NewDelhi
13. IS 9178 (Part II) :1979, Criteria for Design of Steel Bins for Storage of Bulk Materials (Design Criteria), Bureau of Indian Standards, New Delhi
14. IS 5503 (Part I) :1969, General Requirements for Silos for grain storage (Construction requirements), Bureau of Indian Standards, New Delhi
15. IS 4998 (Part I): 1992, Criteria for Design of Reinforced (Assessment of Loads), Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the end of the course students will be able

1. To design the bridges deck slab as per Indian Standards.
2. To design concrete Pipes as per the codal provisions.
3. To design bunkers, silos and chimneys with relevant IS standards.
4. To provide the detailing of reinforcements as per Codal recommendations.
5. To design the machine foundation and its detailing.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	2		2						1	3	3	1	
CO2	3	2	2	2		2						1	3	3	1	
CO3	3	2	2	2		2						1	3	3	1	
CO4	3	2	2	2		2						1	3	3	1	
CO5	3	2	2	2		2						1	3	3	1	

22CZPESCN	TRANSPORTATION ENGINEERING	L	T	P	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-Classification of roads, road development in India,Current road projects in India; highway alignment and project preparation.

UNIT II

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 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- 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- 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 concretepavements as per IRC; problems

TEXT BOOKS

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, *'Highway Engineering',* Revised TenthEdition, Nem Chand & Bros, 2017.
2. Kadiyalai, L.R., *"Traffic Engineering and Transport Plannin"',* Khanna Publishers.

REFERENCES

1. Partha Chakraborty, *" Principles Of Transportation Engineering",* PHI Learning,
2. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, *"Principles of Highway*
3. *Engineering and Traffic Analysis"',* Fourth Edition, John Wiley publisher.
4. Srinivasa Kumar, R, "*Textbook of Highway Engineering",* Universities Press, 2011.
5. Paul H. Wright and Karen K. Dixon, *"Highway Engineering",* Seventh Edition, WileyStudent Edition, 2009.

COURSE OUTCOMES

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

1. Carry out surveys involved in planning and highway alignment
2. Design the geometric elements of highways and expressways
3. Carry out traffic studies and implement traffic regulation and control measures andintersection design
4. Characterize pavement materials and
5. Design flexible and rigid pavements as per IRC

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3		2					3				2	2	1	
CO2			3			2								2		
CO3		3	3		2				2				1	3	1	
CO4			3			1	2		1					3		
CO5																

22CZPESCN	ADVANCES IN CONCRETE TECHNOLOGY	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To develop furtherance of knowledge about advances in concrete technology.
- To introduce concept of mix design for special concretes.
- To develop the principles of special concreting techniques and non destructivetesting procedures for concrete structures.

UNIT I

Admixtures – Chemical – Mineral – SCMs and CRMs - Pozzolanic classification in concrete – use of fly ash, GGBS, silica fume, metakaolin in concrete –Concept of mix design for HPC, HSC, SCC – special concrete –Types – Classification – Properties – Applications –Pumped concrete – RMC

UNIT II

Definition - Fibre reinforced concrete – Properties of fibres and matrices – Mix proportioning– Properties of fresh and hardened fibre reinforced concrete – Durability – applications– SIFCON – SIMCON – Properties – Applications – Composite manufacturing.

UNIT III

Ferro-cement – Historical development – Constituent materials – Construction procedures – mechanical and durability properties – Design of Ferro-cement product – Applications.

UNIT IV

Special concrete: Light weight concrete – No fine concrete – High density concrete–polymer concrete composite – Classification – Application –Grouts and Grouting –Gunitingand shortcreting – Geopolymer concrete – Properties –Application – Special concreting techniques – Hot weather concreting – Cold weather concreting – Slipform.

UNIT V

Scanning Electron Microscopy (SEM) and X-ray microanalysis to examine cement, mortar concrete - Techniques of SEM and X-ray microanalysis- Simple imaging of fracture surfaces -Advanced techniques using X-ray microanalysis and digital image analysis on polished sections. X-ray spectra of cement clinker minerals and cement hydration products. Identify deleterious process in concrete, including alkali-silica reaction and sulphate attack-Interpretation of example images and X-ray spectra of the principal causes of damage toconcrete.

TEXT BOOKS

1. Mehta P.K., and Monteiro, P.J.M., Concrete, Microstructure, Properties and Materials,Indian Concrete Institute, Chennai, 2013.
2. Shetty M.S., *Concrete Technology*, S.Chand&Co. New Delhi, 2007.

REFERENCES

1. Neville A.M., *Properties of concrete*, Marshfield, Mass, Pitman Publishing LimitedLondon,1981.
2. Johnnewman and Ban Seng Choo, *Advanced concrete Technology,* (Vol.I to VI)Elsevier, London, 2003.
3. Gambhir. M.L,*Concrete Technology*, Tata McGraw-Hill Education (India) Privatelimited. New Delhi, 2009.
4. Santhakumar.A.R, *Concrete Technology*, Oxford University Press, New Delhi, 2007.

COURSE OUTCOMES

At the completion of the course students will be able

1. To understand about various types of special concretes and testing techniques.
2. To understand the principles of special concreting techniques and non destructivetesting procedures for concrete structures.
3. To prepare and recommending special concrete using admixtures.
4. To understand the behaviour of microstructure of concrete.
5. To understand the concepts of SEM analysis and X-ray micro analysis.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	2		2	1					1	3	3	1	
CO2	3	2	2	2		2	1						3	3	1	
CO3	3	2	2	2		2	1					1	3	3	1	
CO4	3	2	2	2		2	1						3	3	1	
CO5	3	2	2	2		2	1						3	3	1	

22CZPESCN	DESIGN OF LOAD BEARING MASONRY STRUCTURES	L	T	P	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 otherstructures.
- This course deals with the scientific approach to be followed in the design of masonry structures.

UNIT I

Historical development – Classification of masonry construction – Codes and standards – Types of masonry walls – Bricks, Mortar, Grout and Steel reinforcement – Characteristicsand Requirements – Loads types and intensities – Basic design data.

UNIT II

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

Basis of prestressed masonry design – Basic principles – Design strength –Vertical andHorizontal shear stress – Principal tensile stress – Design of cavity walls, Fin walls, Diaphragm retaining walls and Post – tensioned beams – Detailing of prestressed masonry.

UNIT IV

Connections and joints – Connection resistance – Design considerations – Connectiondetails – Types – Seismic separations – Control joints – Expansion joints.

UNIT V

High-rise masonry – Design factors – Reinforcing details – Floor systems – Construction techniques.

TEXT BOOKS

1. RobertSchneider, R., and Walter DickeyL., "*Reinforced Masonry Design*", EnglewoodCliffs, N.J.: Prentice Hall, USA, 1980.
2. Curtin, W.G., ShawG., and Beck J.K., Design of Reinforced and Prestressed Masonry,Thomas Telford, London, 1988.

REFERENCES

1. Hendry, A.W., SinhaB.P., and DaviesS.R.,"*An Introduction to Load Bearing Brickwork Design*",Chichester, E.Horwood, Halsted Press, Sydney, 1981.
2. David Lenczher, "Elements of Load Bearing Brick Work Design", Pergamon Press,London, 1972
3. Dayaratnam, P., "*Brick and Reinforced Brick Structures*", Primlani M,for Oxford & IBHDistributed by South Asia Books, New Delhi, 1987.

COURSE OUTCOMES

At the end of the course students will be able

1. To understand the scientific approach to be followed in the design of masonrystructures.
2. To analyse the application masonry materials and design related to civil engineeringproblems.
3. To know the testing of masonry structures.
4. To know where and how to construct the expansion joints in brick masonry structures.
5. To design the prestressed brick masonry structures.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3					1							2	1		
CO2	3					1							2	1		
CO3	3					1							2	1		
CO4	3					1	1						2	1		
CO5	3	1	2	1		1	1					1	2	2	1	

22CZPESCN	HYDROLOGY & WATER RESOURCE ENGINEERING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the interaction among various processes in the hydrologic cycle; application of fluid mechanics and use of computers in solving problems in hydraulic engineering
- To study types and classes of hydrologic simulation models and design procedures forsafe and effective passage of flood flows for design of hydraulic structures
- To understand the basic aquifer parameters and estimate groundwater resources for different hydro-geological boundary conditions
- To understand application of systems concept, advanced optimization techniques to cover the socio-technical aspects in the field of water resources
- To apply the principles and applications of remote sensing, GPS and GIS in the context to hydrological extreme flood and drought events in water resources engineering.

UNIT I

Introduction - hydrologic cycle, water-budget equation, history of hydrology, world water balance, applications in engineering, sources of data. *Precipitation* - forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth-area duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India. Abstractions from precipitation - evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapo-transpiration, measurement of evapo-transpiration, evapo-transpiration equations, potential evapo-transpiration over India, actual evapo-transpiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.

UNIT II

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

UNIT III

Water withdrawals and uses – water for energy production, water for agriculture, wateror hydroelectric generation; flood control. Analysis of surface water supply, Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water tothe fields: surface, sub-surface, sprinkler and trickle / drip irrigation.

UNIT IV

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

UNIT V

Dams and spillways - embankment dams: Classification, design considerations, estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Arch and buttress dams. Spillways: components of spillways, types of gates for spillway crests; Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic heightof dam, selection of suitable site.

TEXT BOOKS

1. K Subramanya, *"Engineering Hydrology",* Mc-Graw Hill.
2. K N Muthreja, "*Applied Hydrology",* Tata Mc-Graw Hill.

REFERENCES

1. K Subramanya, *"Water Resources Engineering Objective Questions*", Tata Mc-Graw Hill.
2. G L Asawa, "*Irrigation Engineering",* Wiley Eastern.
3. L W Mays, *"Water Resources Engineering",* Wiley.
4. J D Zimmerman, *"Irrigation",* John Wiley & Sons
5. C S P Ojha, R Berndtsson and P Bhunya, *"Engineering Hydrology",* Oxford.

COURSE OUTCOMES

At the end of the course, students must be in a position to:

1. Understand the interaction among various processes in the hydrologic cycle; Apply the application of fluid mechanics and use of computers in solving a host of problems in hydraulic engineering
2. Study types and classes of hydrologic simulation models and design procedures for safe and effective passage of flood flows for design of hydraulic structures
3. Understand the basic aquifer parameters and estimate groundwater resources for different hydro-geological boundary conditions
4. Understand application of systems concept, advanced optimization techniques to cover the socio-technical aspects in the field of water resources
5. Apply the principles and applications of remote sensing, GPS and GIS in the context to hydrological extreme flood and drought events in water resources engineering.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3				2								2			
CO2	3			2	2	1	1						2	1	1	
CO3	2					2	2						1	2		
CO4	2				1	1							1	1		
CO5	2				3								1			

22CZPESCN	TALL BUILDINGS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the concept of different structural systems used for tall structures.
- To understand the types and principles of analysis and design of tall structures.

UNIT I

General – Factors affecting growth, height and Structural systems – Design philosophy – Loads: Gravity and lateral (Wind and Earthquake) – Load combinations – Strength and serviceability criteria – Stability and Drift limitations – Human comfort criteria – Creep, temperature, Fire and Foundation settlement effects – Effects of Soil Structure interaction.

Structural and non-structural systems – Structural system idealisations - Floor slab systems (wall supported slab system, Beam supported slab system, Ribbed slab system, Flat slab system). Vertical framing system (Columns, concrete walls, transfer girders, Suspenders) – Composite floor systems Modelling for gravity and lateral loads – Assumptions – Modelling for approximate analyses – Modelling for accurate analysis.

UNIT II

Lateral load resisting systems – Behaviour of Rigid frames, Behaviour of Braced Rigid frames, Behaviour of shear wall with Rigid frames, Behaviour of framed-tubes, Behaviour of tube in tube, Behaviour of bundled tubes – Behaviour of In-filled frame structures

UNIT III

Analysis and design concepts of Rigid frames, Rigid frames with bracings, Rigid frames with shear walls, framed-tubes, tube in tube and bundled tubes.

UNIT IV

Stability of tall buildings – Overall buckling analysis of frames (Rigid frames, Rigid frames with bracings, Rigid frames with shear walls, framed-tubes, tube in tube and bundled tubes) using approximate methods — Second order effects– Torsional instability – Effects of foundation settlements – Pounding effects – Temperature effects.

UNIT V

Importance of dynamic analysis as per IS 875(Part 3) and IS 1893(Part 1): 2002 – Methods of analyses as per code –How to minimise dynamic effect – Response to along and across wind effects as per SP:64-2001 - Response to earthquake motions – Response to ground accelerations – Response spectrum analysis –Estimation of natural frequencies and damping.

TEXT BOOKS

1. Bryan Stafford Smith, Alexcoull, Tall Building Structures, analysis and Design, JohnWiley and Sons, Inc., New Delhi, 1991.
2. Taranath B.S., *Structural Analysis and Design of Tall Buildings*, McGraw Hill, NewDelhi, 2011.

REFERENCES

1. Lin.T.Y,StotesBurry.D, Structural Concepts and systems for Architects and *Engineers*,JohnWiley, Inc.,Navi Mumbai,1988.
2. Lynn S.Beedle, *Advances in Tall Buildings*, CBS Publishers and Distributors, Delhi,1986.
3. Wolfgang Schueller, *High Rise Building Structures*, John Wiley and Sons, New York,1977.

STANDARDS

1. IS 875 (Part 3): 2015 Design loads – Wind load for Buildings and Structures, Bureauof Indian Standards, New Delhi
2. IS 1893 (Part 1): 2002, Criteria for Earthquake Resistant Design of Structures,Bureau of Indian Standards, New Delhi
3. SP:64 (S&T)-2001 Design Loads (other than earthquake) for Buildings andStructures, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able to

1. Gain the knowledge about the behaviour of tall buildings subjected to lateral loadsand their stability.
2. Design the tall buildings as per the existing codes.
3. Check the stability of the structures under the present and expected loadingconditions.
4. Do the dynamic analysis of a structure to withstand the present and expectedloadings.
5. Estimate the natural frequencies and damping of a structure.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2		2		2							3	3	1	
CO2	3	2	2			2							3	3		
CO3	3	2	2		1	2							3	3	1	
CO4	3	2	2	1	1	2	1						3	3	1	
CO5	3	2			1	2							3	2	1	

OPEN ELECTIVES

22CZOE507	EARTHQUAKE ENGINEERING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To make the students to understand Earthquake and Wind excitations are two majordynamic 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

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, Ritcher scale, MM scale, Earthquake recording instruments, and Seismic resistant designguidelines

UNIT II

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 bandwidth method, and simple problems.

UNIT III

Forced Vibration Analysis (Harmonic loading) of Single Degree of freedom systemswith and without damping under harmonic excitations, Forced vibration response to harmonicbase excitation. Formulation of Response Spectrum, Design Response spectrum as per IS:1893, simple problems using the above response spectrums. Forced vibration analysis of

multi Degrees of freedom systems (restricted to two degrees of freedom only) using modalsuperposition technique.

UNIT IV

Analysis of building frames, Equivalent static method as per IS: 1893- 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

Philosophy and Principles of Earthquake Resistance design- Strength and Stiffness,Ductility Design and Detailing (IS 13920: 1993), Concept of Energy Absorbing Devices, Concepts of Seismic Base isolation technique and Seismic Active control methods. Lessonslearnt from the Past Earthquakes - Case studies of important Indian Earthquakes, Major world Earthquakes.

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 MasonryBuildings",* John Wiley & Sons, Inc., New York, 1992.

REFERENCES

1. Anil k Chopra, "*Dynamics of Structures",* McGraw-Hill International Edition, NewDelhi, 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 ofCalifornia, 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 ofTokyo Press, Tokyo, 1985.
6. Paz, M. and Leigh.W. "*Structural Dynamics – Theory & Computation"*, 4th Edition,CBS Publishers & Distributors, New Delhi, 2006.

STANDARDS

1. IS 1893:2016 Criteria for Earthquake Design of Structures, Bureau of Indian Standards,New Delhi.
2. IS 4236:1976 Code of Practice for Earthquake Resistant Design and Construction ofBuildings, Bureau of Indian Standards, New Delhi.
3. IS 13920: 1993 Ductile Detailing of Reinforced Concrete Structures Subjected to
4. Seismic Forces Code of Practice, Bureau of Indian Standards, New Delhi.
5. SP: 22- 1982 Explanatory Handbook on Codes for Earthquake Engineering, Bureau ofIndian Standards, New Delhi.
6. IS 1382: 1993 Guidelines for Improving Earthquake Resistance of Earthen Buildings
7. Bureau of Indian Standards, New Delhi.
8. S 13828: 1993 Guidelines for Improving Earthquake Resistance of Low Strength MasonryBuildings, Bureau of Indian Standards, New Delhi.
9. IS 13935: 1993 Guidelines for Repair and Seismic Strengthening of BuildingsBureau ofIndian Standards, New Delhi.
10. SP:24 (S&T) - 1983 Explanatory Handbook on Indian Standard Code of Practice for Plainand Reinforced Concrete (IS 456:2000), Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able

1. To design the earthquake resistance structures.
2. To understand the behaviour of structure during earthquake.
3. To recommend the materials used for construction in the earthquake prone areas.
4. To analyze the building frames for dynamic loadings.
5. To provide the detailings of reinforcement for seismic analysis.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3		3		3								2	1	1	
CO2	3				3	2	1						2	1	1	
CO3	3				2	3	2						2	1	1	
CO4	3	3		3	3								3	2	3	
CO5	3	3	3	3	3								3	3	3	

22CZOE606	FOUNDATION ENGINEERING	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To impart basic knowledge on design of foundations and its behaviours underdifferent soil conditions to carry out proper foundation design.

UNIT I

Field Soil Exploration – Soil exploration techniques – Equipments of soil exploration - Auguring and boring – Wash boring and rotary drilling – Depth of boring – Spacing of borehole – method of collection of disturbed and un-disturbed soil samples - Split spoon sampler, Thin wall sampler, Stationery piston sampler – Field tests-Penetration tests (SPT and SCPT) – Bore log report – Data interpretation – Strength parameters and Liquefaction potential – Selection of foundation based on soil condition – Discussion on sample Soil investigation report.

UNIT II

Necessity for shallow foundations – Relevant IS code standards–Bearing capacity of shallow foundation on homogeneous deposits- Terzaghi's formula and IS code formula –Factors affecting bearing capacity. Bearing capacity from in-situ tests (SPT, SCPT and plate load) – Effect of water table- Allowable bearing pressure – Safe bearing capacity – Seismic considerations in bearing capacity evaluation. Problems to assess bearing capacity

Settlement of foundations – Immediate, consolidation and secondary(creep) Settlements – Elastic Settlement of footings – Correction for depth and width of foundation - Determination of total Settlement of foundations on cohesion-less and cohesive soils as per relevant IS standards – Total and differential settlements – Allowable settlements as per relevant IS standards – Methods of minimizing total and differential settlements.

UNIT III

Contact pressure distribution on base of footings under rigid and flexible footings - Modulus of sub-grade reaction on rigid and flexible footings – Problems on contact pressure distributions beneath the isolated, combined ,strap and mat foundations for axial and eccentric column loads. Draw shear force and bending moment diagrams using appropriatecontact pressures beneath the foundations.

UNIT IV

Types of piles and their function – Factors influencing the selection of pile – Ground heave and pile heave effects- Effective length –Point of inflection - Load carrying capacityof single pile in cohesion-less or granular and cohesive soils as per relevant IS standards–static formula – Dynamic formulae (Engineering news and Hiley's) – Capacity from in-situ tests (SPT and SCPT) – Negative skin friction – Uplift capacity- Group capacity by different methods – Settlement of pile groups – Interpretation of pile load test (routine test only) – Under reamed piles – Capacity under compression and uplift.

UNIT V

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations with and without surcharge and trafficloads – Culmann Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls.

TEXT BOOKS

1. Moothy V.N.S., "*Soil Mechanics and Foundation Engineering"*, CBS Publishers andDistributers Ltd., New Delhi, 2007.
2. Gopal Ranjan and Rao A.S.R., "*Basic and Applied soil mechanics"*, New AgeInternational Pvt. Ltd, New Delhi, 2005.

REFERENCES

1. Das B.M. "*Principles of Foundation Engineering",* Fifth Edition, Thompson Asia Pvt.Ltd., Singapore, 2003.
2. Kaniraj S.R., "*Design aids in Soil Mechanics and Foundation Engineering"*, TataMcGraw Hill Publishing Company Ltd., New Delhi, 2002.
3. Punmia B.C. "*Soil Mechanics and Foundations"*, Laxmi Publications Pvt.Ltd., NewDelhi, 2005.
4. Venkatramaiah C. "*Geotechnical Engineering"*, New Age International Publishers, NewDelhi, 2007 (Reprint).
5. Arora K.R, "*Soil Mechanics and Foundation Engineering"*, Standard Publishers andDistributors, New Delhi, 2005.
6. Purushothama Raj. P*., "Soil Mechanics and Foundation Engineering"*, Second Edition,Pearson Education, Delhi, 2013.
7. Varghese, P.C., "*Foundation Engineering"*, Prentice Hall of India Private Limited,New Delhi, 2005.

STANDARDS

1. IS 6403: 1981 (Reaffirmed 1997), Bearing capacity of shallow foundation, Bureau ofIndian Standards, New Delhi.
2. IS 8009 (Part1):1976 (Reaffirmed 1998), Shallow foundations subjected to symmetricalstatic vertical loads, Bureau of Indian Standards, New Delhi.
3. IS 8009 (Part2):1980 (Reaffirmed 1995), Deep foundations subjected to symmetricalStatic vertical loading, Bureau of Indian Standards, New Delhi, 1992
4. IS 2911(Part1):1979 (Reaffirmed 1997), Concrete Piles, Bureau of Indian Standards,New Delhi.
5. IS 2911(Part2):1979 (Reaffirmed 1997), Timber Piles, Bureau of Indian Standards, NewDelhi.
6. IS 2911(Part 3):1979 (Reaffirmed 1997), Under Reamed Piles, Bureau of IndianStandards, New Delhi.
7. IS 2911 (Part 4):1979 (Reaffirmed 1997), Load Test on Piles, Bureau of IndianStandards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able

1. To select type of foundation required for the soil at a place and able todesign shallow, foundation, deep foundation and retaining structures.
2. To calculate the safe bearing capacity of soils.
3. To advise the type of foundation suitable for the particular soil type.
4. To know the tests required to conduct for the soil type and how to carry outthose tests.
5. Calculate the properties of soils and to estimate the optimum levels forrecommending the foundation sizes.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1				3		1								2	2	
CO2		2	2	2									1	2	1	
CO3		3	3	3	2								2	2	2	
CO4		2	3	2	2								1	2	2	
CO5		2	2	3	2	1							1	2	2	

22CZOE705	HIGH RISE BUILDINGS	L	T	P	C
		3	-	-	3

22CZOE801	DESIGN AND CONSTRUCTION OF STEEL BUILDINGS	L	T	P	C
		3	-	-	3

22CZOE802	REPAIR AND REHABILITATION OF CONCRETE STRUCTURES	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

1. 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 andThaw – 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 stresslevels – 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, SpitPins, 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 – RadioActive 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 Bondingtechnique – Fibre Sheet Bonding Technique

TEXT BOOKS

1. Peter H. Emmons, *Concrete Repair and Maintenance*, Galgotia Publishers, NewDelhi, 2002.
2. Vidivelli.B, *Rehabilitation of Concrete Structures*, Standard Publishers Distributors,New Delhi, 2015.

REFERENCES

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 completion of the course students will be able

1. To understand about the mechanics of deterioration of concrete.
2. To estimate and analyze the degree of damage by testing methods.
3. To identify the repairs and suitable repair methods and materials.
4. To gain the knowledge about rehabilitation and retrofitting of structural members.
5. To understand the repair and strengthening of RC structures with reasonable cost.

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	2	2	2	3	3	2	2	1	2	3	3	2	2
CO2	3	3	2	2	2	2	3	3	2	2	1	2	3	3	2	2
CO3	3	2	2	3	3	2	3	3	2	2	1	2	3	3	2	2
CO4	3	3	3	3	3	2	3	3	2	2	1	2	3	3	3	2
CO5	3	2	2	2	3	2	2	2	2	2	2	2	3	3	2	2

22CZOESCN	FINITE ELEMENT METHOD	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To learn the analysis of structures with a versatile technique finite element methods 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

Element stiffness formulation for truss elements in local and global coordinates, beams, CST elements, Load vectors for gravity, surface and body forces.

UNIT IV

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

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. Seshu P, "*Finite Element Analysis",* Prentice Hall of India, New Delhi, 2005.
2. Chandrupatla, T.R. and Belegundu, A.D, "*Introduction to Finite Element in Engineering"*, Prentice Hall, Delhi, 2003

REFERENCES

1. Krishnamoorthy.C.S, "*Finite Element Analysis - Theory and Programming",* TataMcGraw Hill Publications, New Delhi,1995.
2. Rajasekaran.S, "*Finite Element Analysis in Engineering Design",* S.Chand and Co.,New Delhi, 2014.
3. Cook.R.D, "*Concepts and Applications of Finite Element Analysis",* Tata McGraw Hill Publications, New Delhi, 1989.
4. Desai.C.S & Abel.J.F, "*Introduction to the FEM",* Affiliated East West Press, New Delhi,1972.
5. Rao.S.S, "*The Finite Element Method in Engineering"*, Butters worth-Heinemann Publishing, Burlington, 2000.
6. Reddy J.N, "*An Introduction to Finite Element Method"*, International Edition, McGrawHill, New Delhi, 2006.

COURSE OUTCOMES

At the completion of the course students attains

1. The knowledge of solving physical problems using finite element softwares.
2. To develop computer coding for any structural problem and creating software packages.
3. The knowledge in solving practical problems by global stiffness matrix approaches fortruss, beam, etc.
4. The knowledge of modelling techniques of the problems.
5. The knowledge of using FEM softwares for the practical problems and to find the solution.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3		3	3								3	2	3	
CO2	3	3	3	3	3								3	3	3	
CO3	3	3	3	3	3								3	3	3	
CO4	3		2	2	3								3	2	3	
CO5	3	3	3	3	3								3	3	3	

22CZOESCN	SERVICES IN HIGH RISE BUILDINGS	L	T	P	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 V

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.

REFERENCES

1. Cady, W.G., *Piezoelectricity,* Dover Publications, New York, 1964.

COURSE OUTCOMES

1 To Identify the Important Consideration involved in planning of building services
2 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
3 To understand the sanitation services such as sewerage collection and disposal in high rise buildings
4 To know the lift and escalator and their structural provisions
5 To understand the air conditioning provisions in high rise building and fire fighting services.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3					3		3			2	2	3	2	3	
CO2	3					3		3			2	2	2	2	2	
CO3	3					3		3			2	2	2	2	3	
CO4	3					3		3			2	2	3	2	2	
CO5	3					3		3			2	2	3	2	2	

22CZOESCN	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the concepts IPR
- To understand Trademarks, Trade Secretes and GI of goods.
- To understand Copyrights, Patents and Industrial Designs.
- To learn about how to manage IP rights and legal aspects.
- To understand the concepts of Cyber laws in IPR.

UNIT - I Introduction to Intellectual Property:
IPR - Definition - Types of IPR: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications, IP as a factor in R&D; Few Case Studies WTO - Definition - Functions - Forms of IPR Protection.

UNIT–II Trade Marks:
Purpose and function of trademarks, Acquisition of trade mark rights, transfer of rights, Selecting and evaluating trademark, registration of trademarks, claims.
Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriation of trade secrets, trade secret litigation. Geographical Indication of Goods: Basic aspects and need for the registration

UNIT–III Patents:
Copyrights: Fundamentals of copyright law, originality of material, right of reproduction, right to perform the work publicly, copyright ownership issues, notice of copyright.
Foundation of patent law, patent searching process, Basic Criteria of Patentability **Industrial Designs:** Kind of protection provided in Industrial design

UNIT–IV IP Rights
Managing IP Rights: Acquiring IP Rights: letters of instruction, joint collaboration agreement.
Protecting IP Rights: nondisclosure agreement, cease and desist letter, settlement memorandum.
Transferring IP Rights: Assignment contract, license agreement, deed of assignment

UNIT-V Cyber law
Introduction to Cyber law: Information Technology Act, cybercrime and e-commerce, data security, confidentiality, privacy, international aspects of computer and online crime.

TEXT BOOKS
1. Dr.M.K. Bhandari " Law relating to Intrllectual Property" January 2017 (Publisher By Central Law Publications).
2. Dr. R. Radha Krishna and Dr. S Balasubramanian "Text Book of Intellectual Property Right", First Edition New Delhi 2008. Excel Books.
3. P Narayan " Text Book of Intellectual Property Right". 2017, Publisher: Eastern Law House.

REFERENCE BOOKS

1. Bare Act, The Indian Patent Act 1970 and the Patent Rules, Universal Law Publishing Co. Pvt.

Ltd., 2007.
2. Mittal D.P., Indian Patents Law. Taxmann Allied Services (p) Ltd., 1999.
3. Deborah E Bouchoux, Intellectual Property: Right: The Law of Trademarks, Copyrights, Patents and Trade Secrets, 2012.
4. Gerald R. Ferrera,Cyber law: Text and Cases, South-Western Cengage Learning, 2012.
5. N.K Acharya, Intellectual property rights, Scandinavian Languages Edition, 2021.
6. Kompal Bansal, Fundamentals of Intellectual Property for Engineers, BS Publications 2013.
7. P. Radhakrishna, Intellectual Property Rights: Text and Cases, Excel Books, 2008.

COURSE OUTCOMES

1. Learner should be able to demonstrate understanding of basic concepts of IPR.
2. Able to differentiate between Trademarks, Trade secrets and GI of goods.
3. Able to understand Copyrights, Patents and Industrial Designs.
4. Able to manage and protect IP
5. Will gain Knowledge on Cyber law

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2					2			2				2			2
CO2	2					2			2				2			2
CO3	2					3		3	2		3		2			2
CO4	2					2		3	2				2			2
CO5	2					2		3	2				2			2

22CZOESCN	CYBER SECURITY	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the basics of Cyber Security Standards and Policies.
- To know the legal, ethical and professional issues in Cyber Security.
- To Understand Cyber Frauds and Abuse and its Security Measures.
- To know the technological aspects of Cyber Security.

UNIT I FUNDAMENTALS OF CYBER SECURITY

Security Problems in Computing – Cryptography Basics – History of Encryption – Modern Methods – Legitimate versus Fraudulent Encryption methods – Encryption used in internet.

UNIT II CYBERCRIME AND CYBER OFFENSES

Cybercrime and information security – cybercriminals – classification of cybercrimes – email spoofing – spamming - cyber defamation – internet time theft – forgery – web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyber offenses – Categories – Planning the attacks – Cyber talking – Cyber café and Cyber Crimes – Botnets.

UNIT III TOOLS AND METHDS USED IN CYBERCRIME

Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Spywares – Virus and Worms – Trojan Horses and Backdoors – Steganography – DoS and DDoS Attacks.

UNIT IV SECURITY POLICIES

Introduction – Defining User Policies – Passwords – Internet Use – Email Usage – Installing / Uninstalling Software – Instant Messaging – Defining System Administrative Policies – Defining Access Control Developmental Polices Standards, Guidelines and Procedures – Basics of assessing a system.

UNIT V COMPUTER FORENSICS

General Guidelines – Finding Evidence on the PC – Finding Evidence in system Logs – Windows Logs – Linux Logs – Getting Back Deleted Files – Operating System Utilities – The Windows Registry.

TEXT BOOKS

1. Nina Godbole, Sunit Belapure, " Cyber Security: Understanding Cyber Crimes, Computer Forensics and legal Perspectives", Wiley, 2011.
2. Chuck Easttom, " Computer Security Fundamentals", 2nd Edition, Pearson Education,2012.

REFERENCES

1. Charles B. Pfleeger, Shari Lawrence pfleeger, " Security in Computing ", 3rd Edition, Pearson Education, 2003.
2. Wiiliam Stalling, " Cryptography and Network Security – Principles and Practices", 3rd Edition, Pearson Education, 2003.
3. Atulkahate, "Cryptography and Network Security", TataMcGraw Hill,2000.

COURSE OUTCOMES

Upon Completion of this course, Students will able to

1. Explain in general security issues.
2. Discuss various cybercrime and offenses
3. Use relevant tools and methods in cybercrime.
4. Apply Security policies in cyber forensics.
5. Outline the strategies adopted in computer forensics.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1					2	2		3	3				2	1	2	2
CO2						2		3	3	2			2	1	2	2
CO3					2	2		3	3				2	1	2	2
CO4						2		3	3	1			2	1	2	2
CO5						2		3	3	2			2	1	2	2

22CZOESCN	SMART CITIES	L	T	P	C
		2	-	-	2

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.

REFERENCES

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

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

1. Understand the concept and practice of “smart cities” across the globe
2. Know the various Infrastructures for smart cities.
3. To understand the various other services and public safety in smart cities.
4. To understand role of smart data Management
5. Initiate the ICT in smart city for economic development of India.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1			2	2	3	3	3	3	3			2		2	2	2
CO2			2	2	3	3	3	3	3			2		2	2	2
CO3			2	2	3	3	3	3	3			2		2	2	2
CO4			2	2	3	3	3	3	3	3		2		2	2	2
CO5			2	2	3	3	3	3	3		3	2		2	2	2

22CZOESCN	NCC STUDIES (Army Wing)	L	T	P	C
		2	-	2	3

COURSE OBJECTIVE

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

Unit – I (Lecture)

NCC Organisation and National Integration

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

Unit – II (Lecture)
Personality Development and Leadership
Introduction - Factors influencing / shaping Personality - Self-Awareness – Know yourself/ Insight - Communication Skills - Leadership Traits – Types – Attitude - Time Management - Effects of Leadership - Stress Management Skills - Interview Skills - Conflict Motives - Resolution - Importance of Group / Team Work - Influencing Skills - Body Language - Sociability: Social Skills

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

Unit – IV (Lecture)
Specialized Subject (Army Wing)
Basic structure of Armed Forces- Military History – War heroes- battles of Indo-Pak war- Param Vir Chakra- Career in the Defence forces- Service tests and interviews-Fieldcraft and Battlecraft-Basics of Map reading.

Unit – V (Practical)
Basic Physical Training and Weapon Training
Basic physical Training – various exercises for fitness (with Demonstration) - Food – Hygiene and Cleanliness. Drill- Words of commands- position and commands- sizing and forming- saluting- marching (WITH DEMONSTRATION)
Main Parts of a Rifle- Characteristics of .22 rifle- Characteristics of 7.62mm SLR- Characteristics of 5.56mm INSAS rifle - stripping and assembling – position and holding- safety precautions – range procedure- firing simulation.

TEXT BOOK:
1. “National Cadet Corps- A Concise handbook of NCC Cadets”, Ramesh Publishing House, New Delhi, 2014.

REFERENCES:
1. “Cadets Handbook – Common Subjects SD/SW”, published by DG NCC, New Delhi.
2. “Cadets Handbook- Specialized Subjects SD/SW”, published by DG NCC, New Delhi.
3. “NCC OTA Precise”, published by DG NCC, New Delhi.

COURSE OUTCOMES:
On completion of the course, the students will be able to

1. Display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion
2. Acquaint and provide knowledge on personality development, self awareness, communication skills with leadership traits to work as a team and sociability values
3. Understanding about social evils and shall inculcate sense of whistle blowing against such evils and ways to eradicate such evils
4. Acquaint, expose & provide knowledge about Army/Navy/ Air force and to acquire information about expansion of Armed Forces, service subjects and important battles.
5. Demonstrate health exercises, the sense of discipline, improve bearing, smartness, turnout, develop the quality of immediate and implicit obedience of orders and basic knowledge of weapons and their use and handling.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1						2		2	2	1		2				2
CO2						2		2	2	1		2				2
CO3						2		2	2	1		2				2
CO4						2		2	2	1		2				2
CO5						2		2	2	1		2				2

HONOURS ELECTIVES

22CZHESCN	BEHAVIOUR OF REINFORCED CONCRETE STRUCTURES	L	T	P	C
		3	-	-	4

COURSE OBJECTIVES

- To describe the behaviour of concrete under uniaxial compression-bendingand 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
- Tto 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 codalStandards. 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 severability - Behaviour of Beams under flexure at severability limitstate- Factors influencing short and long terms deflection–control of deflection–Problems related toDeflection, 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.

REFERENCES

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.
9. Wang, C.K & Salmon, C.G, Reinforced Concrete Design, John Willey & Sons, 2002.

COURSE OUTCOMES

1. To analyze the behaviour of concrete and to specify the design methodologies for Reinforced Concrete members
2. To describe the importance and types of limit states for structural design
3. To describe the requirements of shear and torsional capacities of concrete beams for practical design problems
4. To describe the requirements of limit state of serviceability of concrete beams for practical design problems
5. To suggest proper structural reinforcement detailing norms as per codal Standards for beams, slabs , columns and Footings

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3			2			2	2					2	2		1
CO2	3	2	2					2					2	2		1
CO3	3	2	2					2					2	2		1
CO4	3	2	2					2					2	2		1
CO5	3	2	2					2					2	2		1

22CZHESCN	DYNAMICS OF STRUCTURES	L	T	P	C
		3	-	-	4

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 experimentaldamping 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.

REFERENCES

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

1. To analyze the basics of structural dynamic systems and specify the requirements for building design
2. To describe the importance and types of Free Vibration characteristics ofSingle Degree offreedom systems with damping without damping
3. To describe the requirements of Forced Vibration characteristics of idealized structural dynamic systems
4. To analyse the dynamic systems for assessing the Force Transmissibility and the viscousdamping coefficients
5. To suggest proper dynamic MDOF system analysis to model for building frames subjected to dynamic loads

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3			2			2	2					2	2		1
CO2	3	2	2					2					2	2		1
CO3	3	2	2					2					2	2		1
CO4	3	2	2					2					2	2		1
CO5	3	2	2					2					2	2		1

22CZHESCN	BRIDGE ENGINEERING	L	T	P	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 perIRC 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.

REFERENCES

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 SeismicForces - 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 (Loadsand 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 (Elastromeric Bearings).

COURSE OUTCOMES

1. To study the IRC codel standards for carrying out the critical loading conditions for bridges deckslabs
2. To describe the importance of pipe and slab culverts and its design standards as per IRC for practical problems
3. To describe design requirements of box culverts and its design as per IRC standards for practical problems
4. To design the pre-stressed concrete girders and detailing as per IRC standards for practical problems
5. 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

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3	2				2								2
CO2	3	3	3	2				2					2	2		
CO3	3	3	3	2				2					2	2		
CO4	3	3	3	2				2					2	2		
CO5	3							2					2	2		

22CZHESCN	COMPOSITES FOR CONSTRUCTION	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the basic properties of composite Materials and its types
- To analyse the various fabrication methods and testing standards for various composite Materials.
- To create awareness about the fire retardant characteristics and temperature effects in various composite Materials.
- Analysis of composite Beams
- To describe the various connection methods used for composite construction and their practical applications.

UNIT I

Introduction to composite construction – Physical and Mechanical properties of composite Materials– Types of composite materials - Application of composite materials for Civil Engg.Infrastructure – Strength and Durability asperses of composite materials

UNIT II

Introduction to composite Materials Fabrication Techniques– Quality Control during Manufacture – Testing Methodologies – Destructive and Nondestructive testing - Mitigation Strategies – Codal Standards.

UNIT III

Introduction to Fire resistant Polymer Composites - Fire resistant characteristics of Composite materials – Structural properties of Polymer Composites in Fire – Fire protection coatings – Introduction to Fatigue behaviour of Composite materials- Testing of Composite materials under Fatigue- Codal standards

UNIT IV

Analysis of composite beams – Composite floor Girders and Slabs - Composite column subjected to axial loads and moment – Shear connectors and their functions and types.

UNIT V

Introduction to connection techniques for composite members – Types of connections- Behaviour of connections under tension and compression – Modes of failure- Design of connections.

TEXT BOOKS

1. Madhujit mukhopadhyay; Mechanics of composite materials and structure, Universities press, Telangana, 2004.
2. Jones, R.M., Mechanics of composite materials, McGraw Hill, Tokyo, 1998.

REFERENCES

1. Ravindra K. Dhir, kelvin a paine, moray d. Newlands, Composites materials in concrete construction, Ice publishing, 2012.
2. Vistasp M. Karbhari, Durability of composites for civil structure applications, wood head publishing, 2012.
3. Lawrance C. Bank, Composite Construction, John Weiley sons & inc, USA, 2006.
4. Carlo Pelleqrino, Josesena, Cruz; Design procedure for the use of composites instrengthening of reinforced concrete structures, Springer, 2016.

COURSE OUTCOMES

1. To analyze the basic properties of composite Materials and specify the requirements for field applications
2. To describe the various fabrication methods and testing standards for various compositeMaterials
3. To describe the requirements of composite Materials under elevated temperatures
4. To design the composite Members under strength and serviceability conditions
5. To suggest proper connection methods for the design of composite construction

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3		2					1							3	
CO2	3		2					1					2		2	
CO3	3		2					1					2		2	
CO4	3		2					1					2		2	
CO5	3		2					1					2		2	

22CZHESCN	DESIGN OF PLATES AND SHELLS	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the basics of plated structures and their structural actions
- To analyse the plated structures with different boundary conditions.
- To understand the basics of shell structures and its structural behaviors
- To analyse the cylindrical shell roof for practical problems
- To describe the design methods for various shall and folded plated structures.

UNIT I

Introduction to plate structures - Thin and thick plates - Structural action of plates – Assumptions involved in plate theories - Differential equation for cylindrical bending of plates – Cylindrical bending of uniformly loaded rectangular plates with simply supported and built-in edges – Small deflection theory of laterally loaded rectangular plates - Kirchoffs boundary conditions - Corner effects

UNIT II

Simply supported rectangular plates under Sinu-soidal load - Navier solution - Levy's method - Symmetrical bending of laterally loaded circular plates - Circular plates with simply supported and built-in edges - Bending of annular plates.

UNIT III

Introduction to shell structures - Classification of shells - Membrane action - Stressed shell element and stress resultants - Load transfer mechanism - Characteristics of shell surfaces - Structural behaviour of shells - Membrane theory of cylindrical shells

UNIT IV

Analysis of circular cylindrical shells using Bending theory - Comparison of various bending theories Introduction to other types of shells.

UNIT V

Design of Prismatic folded plates - Design of Circular cylindrical barrel shell roofs - Design of Spherical dome - Design of Conical dome - Design of HYPAR shell - Design of Helicoids.

TEXT BOOKS

1. Ramaswamy G.S, Design & Construction of Concrete Shell Roofs, R.E. Krieger, Malabar,USA, 1984.
2. Stephen Timoshenko, S Woinowsky-Krieger, Theory of plates and shells, McGrawHill,New Delhi,2010.

REFERENCES

1. Rudolph Szilard, Theories and Applications of Plate Analysis, John Wiley, Chapman andHall, Hoboken, NJ, 2004.
2. Timoshenko, S. and Krieger S.W. “Theory of Plates and Shells”, McGraw Hill BookCompany, New York, 2003.
3. Chandrashekahara, K. Theory of Plates, University Press (India) Ltd., Hyderabad, 2001.
4. Szilard, R., “Theory and Analysis of Plates - Classical and Numerical Methods”, PrenticeHall Inc., 2004.
5. J.Raamachandran. “Thin shells; Theory and problems”, Universities press.

COURSE OUTCOMES

1. To analyze the basics of plated structures and specify the requirements for practical applications
2. To describe the analysis of plated structures with different boundary conditions
3. To describe the basics of shell structures and their structural applications
4. To analyze the cylindrical shell roof for practical problems
5. To suggest the design methods for various shall and folded plated structures for practicalproblems

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3		2	1			1	3							3	
CO2	3		2	1			1	3					3	2		
CO3	3		2	1			1	3					3	2		
CO4	3		2	1			1	3					3	2		
CO5	3		2	1			1	3					3	2		

22CZHESCN	DISASTER RESISTANT DESIGN OF STRUCTURES	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To understand the basics of Earthquake Resistant design of structures and its codal standards
- To analyse the various building configuration and its importance in seismic analysis.
- To create awareness about the Cyclone-Resistant Design of Buildings as Per Indian Standards.
- To analyse Fire Resistant Design of Buildings as Per Indian Standards
- To describe the Blast Resistant Design of Buildings with relevant IS codal design provisions.

UNIT I

Introduction to earthquakes and their originations -– Earthquake Resistant design of structures -– Response of structures to earthquakes – Soil Characteristics and their response to earthquakesSeismic Resistantstructural materials – Methods of seismic analysis – Review of the Indian seismic code IS:1893 – 2002 (Part-I) provisions for buildings – Earthquake design philosophy
–Assumptions – Displacements and drift requirements – Provisions for torsion – Seismic Analysis of a multi-storeyed buildings.

UNIT II

Plan Configuration of Buildings – Torsion Irregularities – Re-entrant corners – Nonparallel systems
– Diaphragm Discontinuity – Vertical Discontinuities in load path – Irregularity in strength and stiffness – Mass Irregularities – Vertical Geometric Irregularity – Proximity of Adjacent Buildings.Types – Design of Shear walls as per IS: 13920 – Detailing of reinforcements.

UNIT III

Cyclone-Resistant Design of Buildings as Per Indian Standards - Winds Damage Buildings- Catastrophic Failures- Component Failures- Damaging Effects of Cyclone on Houses- Design Wind Speed and Pressures- Design of wind resistant buildings-Discussion of codal provisions IS 15498- 2004 guidelines for improving the cyclonic resistance of low rise Buildings.

UNIT IV

Fire –Classification of fire- cause of fire- safety measures. Smoke- volume and quality of smoke- Types of fire extinguishers- Types of firefighting system- Active and passive fire control design of buildings- General design requirements of building design in fire prevention- Review of the Indian standard code of practice for fire safety of buildings IS:1642 – 1989 provisions for buildings.

UNIT V

Blast Resistant design of structures – Introduction – Blast force on structures – Response of structures to blast loading – Planning for blast resistant buildings considering architectural and structural aspects with relevant IS codal design provisions.

TEXT BOOKS

1. Jaikrishna & Chandrasekar, Elements of Earthquake Engineering.
2. Dowrick,D.J., Earthquake Resistant Designs, Wiley, 2nd Edition, New Delhi, 2009.
3. Ramana Murthy, “Disaster Management”, Dominant, New Delhi, 2004.
4. RajdeepDasgupta, Disaster Management and Rehabilitation, Mittal Publishers, New Delhi, 2007.

REFERENCES

1. Disaster Management in India- A Status Report- Published by the National Disaster Management Institute, Ministry of Home Affairs, Govt. of India.2004.
2. Murthy D B N, “Disaster Management: Text and Case Studies”, Deep and Deep Publications (P) Ltd., New Delhi, 2007.
3. Sundar I and Sezhiyan T, “Disaster Management”, Sarup and Sons, New Delhi, 2007.
4. AngusMacDonaldJ., *Wind Loading on Buildings*, Wiley, New Delhi, 1975.
5. Alan Garnett Davenport, “Wind Loads on Structures”, National Research Council, Canada.
6. Schroll, R. C. (2002). *Industrial fire protection handbook.* (2nd ed.). CRC Press: Boca Raton, FL. ISBN: 1587160587
7. Lawson, T.V., *Wind Effects on Buildings*, Applied Science Publishers, London, 1980.

COURSE OUTCOMES

1. To analyze the basics of Earthquake Resistant design of structures and the basic requirementsduring natural calamity
2. To describe the importance and types of various building configuration in seismic analysis
3. To describe the requirements of Cyclone-Resistant Design of Buildings as Per Indian Standards
4. To construct Fire -Resistant Design of Buildings as Per Indian Standards
5. To suggest proper Blast Resistant Design of Buildings with relevant IS codal design provisionsfor advanced studies

	Mapping of COs with POs												Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3			2	1	2	2	2	2	2	2	3	2		3	3
CO2	3			2	1	2	2	2	2	2	2	3	3			
CO3	3			2	1	2	2	2	2	2	2	3	3			
CO4	3			2	1	2	2	2	2	2	2	3	3			
CO5	3			2	1	2	2	2	2	2	2	3	3			

22CZMISCN	CONSTRUCTION TECHNIQUES AND MANAGEMENT	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To know the fundamentals of the construction of structures from the beginning to theend
- To understand the construction projects planning and methods of execution, contracts and tendering, management methods and assessing the probability ofcompletion
- To know the various construction techniques involved in the execution ofconstruction.
- To know the availability of various equipments used for the construction and theirrelated problems.
- To manage the various activities of construction, project monitoring and control overthe contracts.

UNIT I Basics of Construction

Unique features of construction, construction projects- types and features, phases of aproject, agencies involved and their methods of execution; Construction project planning- Stages of project planning: pre-tender planning, preconstruction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content,concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on noderepresentation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

UNIT II Construction Methods

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 constructionmethods for steel structures; Basics of construction methods for Bridges.

UNIT III Construction Equipments

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;

Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction.

UNIT IV Project Monitoring & Control

Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost over runs and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

UNIT V Contracts Management

Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price). Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination, Changes & variations, Dispute Resolution methods - Construction Costs: Make-up of construction costs; Classification of costs, time-cost trade-off in construction projects, compression and decompression.

TEXT BOOKS

1. Varghese, P.C., "*Building Construction"*, Prentice Hall India, 2007.
2. *National Building Code,* Bureau of Indian Standards, New Delhi, 2017.

REFERENCES

1. Chudley, R., "*Construction Technology"*, ELBS Publishers, 2007.
2. Peurifoy, R.L. *"Construction Planning, Methods and Equipment",* McGraw Hill, 2011.
3. Nunnally, S.W., *"Construction Methods and Management",* Prentice Hall, 2006.
4. Jha, Kumar Neeraj., *"Construction Project management, Theory & Practice",* PearsonEducation India, 2015.
5. Punmia, B.C., Khandelwal, K.K., *"Project Planning with PERT and CPM",* LaxmiPublications, 2016.

COURSE OUTCOMES

- To know the fundamentals of the construction of structures from the beginning to the end
- To plan and execute the construction projects along with contracts and tendering, management methods and assessing the probability of completion
- To know the various construction techniques involved in the execution of construction.
- To know the availability of various equipments used for the construction and their related problems.
- To manage the various activities of construction, project monitoring and control over the contracts.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1					3	2	3	2	2	2	3	2			3	3
CO2					2	2	2	3	2	2	3	2			3	3
CO3					3	3	3	2	2	3	2	2			3	3
CO4					2	2	2	2	3	2	3	2			3	3
CO5					3	2	2	2	2	2	2	2			3	3

22CZMISCN	SMART MATERIALS AND SMART STRUCTURES	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- To know the different products of smart materials
- To know the purpose of Piezoelectric Ceramics, Piezo-polymers, MagnetostrictiveMaterials, 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 andIntelligent 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, Perovskyte PiezoceramicMaterials, 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 Identificationusing 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, HybridVibration 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 ElementModelling of Smart Composite Beams.

UNIT V

Self-Sensing Piezoelectric Transducers, Energy Harvesting Materials, AutophagousMaterials, 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

REFERENCES

1. Cady, W. G., *Piezoelectricity*, Dover Publication, New York, 1964

COURSE OUTCOMES

- To know the different products of smart materials
- To understand the properties of Piezoelectric Ceramics, Piezo-polymers, Magnetostrictive Materials, Electro active Polymers, Shape Memory Alloys, Electro and Magneto Rheological Fluids,
- To understand the 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.

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1			3	2	3										3	
CO2				2	3										3	
CO3			3		3										3	
CO4			3	2	3										3	
CO5				2	3										3	

22CZMISCN	GROUND IMPROVEMENT TECHNIQUES	L	T	P	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 methodologyare dealt.

UNIT I

Introduction - Methods of ground improvement - Geotechnical problems in alluvial, lateritic and Black Cotton soils - Selection of suitable ground improvement methods based onsoil conditions.

UNIT II

Drainage and dewatering - Drainage techniques - Vacuum and electro - Osmotic methods – Seepage analysis for 2D flow fully and partially penetrating slots in homogeneousdeposits.

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

2. Robert M Koerner, Construction and Geotechnical Methods in FoundationEngineering, McGraw-Hill, Inc, USA, 1984.
3. Mike Moseley, Klaus Kirsch, Ground Improvement, Taylor & Francis Ltd, SponPress,London, 2003.

REFERENCES

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

- To identify the Methods of ground improvement
- To recognize the Drainage techniques
- To be familiar with In-situ treatment of granular and cohesive soils
- To be thorough with Earth reinforcement - concept - Types of reinforcing materials
- To classify and to be aware of the Grouting techniques - Grouting equipments

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3							3	1	3					3	
CO2	3			3				3	1	3					3	
CO3	3			3				3	1	3					3	
CO4	3			3				3	1	3					3	
CO5	3			3				3	1	3					3	

22CZMISCN	THEORY OF ELASTICITY AND PLASTICITY	L	T	P	C
		3	-	-	3

COURSE OBJECTIVES

- This course helps the students to understand the elastic and plastic behaviours of engineering materials and to evaluate stresses and strains developed in materials moreexactly.

UNIT I

Basic equations - Stress and strain at a point - Generalized Hooke's law - Plane stressand plane strain - Equilibrium conditions - Compatibility conditions. Two-dimensional problems in Cartesian Co-ordinates - Airys stress function.

UNIT II

Three-dimensional problems - Analysis of stress and strain - Pure bending of a prismatic bar – Vector of equilibrium equations - solution of equilibrium equations - Use ofpotential functions - Bettis method - Method of integral transforms - Simple applications.

UNIT III

Energy methods - Castiglianos theorem - Principle of Virtual work - Principle of stationary potential energy - Principle of least work - Rayleighs method - Rayleigh-Ritz method- inite difference method - Simple applications.

UNIT IV

Plasticity - Plastic deformation - Mechanism - Factors affecting plastic deformation -Strain hardening - Luders lines - Plastic stress-strain relations - Empirical equations - Theoryof plastic flow - Concept of plastic potential - Yield criteria - Yield conditions - Experimentalevidence - Geometric representation of yield criteria. Plastic deformation in tension – Stressstrain curves - Advantages of true Stress strain diagram - Stress in the neck of a cylindricalspecimen and in the neck of a flat plate in tension and sphere under internal pressure - Instability in compression.

UNIT V

Plastic bending of beams - Idealised Stress strain diagram - Residual stresses in plasticbending – Plastic bending of unsymmetrical sections - Deflection under plastic bending. Plastic Torsion - Circular and non-circular shafts - Residual stresses - Sand heap analogy –Shape factors in torsion.

TEXT BOOKS

1. Stephen Timoshenko, J N Goodier, Theory of Elasticit,McGraw-Hill, New Delhi, 2003.
2. Sadhusingh, Theory of Elasticity, Khanna Publishers, New Delhi, 1988.

REFERENCE BOOKS

1. Johnson W, P B Mellor, Plasticity for Mechanical Engineers, Princeton, N.J.VanNostrand, London, 1966.

COURSE OUTCOMES

- To understand the Basic equations of Stress and strain at a point
- To be familiar with Three-dimensional problems in Analysis of stress and strain
- To understand the Energy methods - Castiglianos theorem and Principle of Virtual work
- To recognize the Plastic deformation and its Mechanism
- To learn the plastic bending of beams

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	3	3										3			
CO2	3	3	3										3			
CO3	3	3	3										3			
CO4	3	3	3										3			
CO5	3	3	3										3			

22CZMISCN	URBAN AND RURAL PLANNING	L	T	P	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 principles involved in planning public buildings.

UNIT I

Objects 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

Types of surveys–Collection of Data– Importance of zoning– Classification of Zoning–Use of zoning– Height zoning–Density zoning –Housing–Planning of neighbourhood units–Types of Layouts – Classification of housing– Housing problems in India.

UNIT III

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

Urban Renewal – Re planning of the existing towns – Objects of re planning–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–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. Hiraskar. K.G., *Fundamentals of Town Planning*, Danpatrai & Sons., New Delhi,2012
2. Rangwala. S.C., *Town Planning,* Charotar Publishing House Pvt. Limited, Gujarat,2009.

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. Goel. S.L.,Urban Development and Management, Deep and Deep Publications, NewDelhi, 2002.
4. Thooyavan. K.R., Human Settlements – A Planning Guide to Beginners, M.A.Publications, Chennai, 2005.

COURSE OUTCOMES

- To enable students to develop knowledge Principles of Town Planning
- To understand the Types of surveys and Importance of zoning
- To introduce the regulations and laws related to urban planning
- To know the principles involved in planning public buildings
- To know about the Planning and Principles of Rural Housing Schemes

Mapping of COs with POs													Mapping with PSOs			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1						3			3		3	3			3	3
CO2						3			3		3	3			3	3
CO3						3			3		3	3			3	3
CO4						3			3		3	3			3	3
CO5						3			3		3	3			3	3