



**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, IChE, IEEE, SAE, ASHRAE, CSI and IWS

### **5.1 B.E (Honours) Degree**

A student shall be eligible to get Under Graduate degree with Honours, if he/she completes an additional 20 credits. Thus the total credits 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  $OGPA/CGPA = \frac{\sum C_i GP_i}{\sum C_i}$**

$C_i$ - 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**

<b>S.No .</b>	<b>Branch of Study in B.E</b>	<b>Honours Elective Courses from Same and Allied Departments of</b>	<b>Minor Engineering Courses from Other Departments of</b>
1	Civil Engineering		<ol style="list-style-type: none"> <li>1. Mechanical Engineering</li> <li>2. Electrical Engineering</li> <li>3. Chemical Engineering</li> <li>4. Computer Science and Engineering</li> <li>5. Computer Science and Engineering (Artificial Intelligence and Machine Learning)</li> </ol>
2	Civil and Structural Engineering	<ol style="list-style-type: none"> <li>1. Civil Engineering</li> <li>2. Civil and Structural Engineering.</li> </ol>	<ol style="list-style-type: none"> <li>6. Computer Science and Engineering(Data Science)</li> <li>7. Mechanical (Manufacturing) Engineering.</li> <li>8. Electronics and Instrumentation Engineering</li> <li>9. Information Technology</li> <li>10. Electronics and Communication Engineering.</li> </ol>
3	Mechanical Engineering		<ol style="list-style-type: none"> <li>1. Civil Engineering</li> <li>2. Civil and Structural Engineering.</li> <li>3. Electrical Engineering</li> <li>4. Chemical Engineering</li> <li>5. Computer Science and Engineering</li> <li>6. Computer Science and Engineering (Artificial Intelligence and Machine Learning)</li> </ol>
4	Mechanical (Manufacturing) Engineering.	<ol style="list-style-type: none"> <li>1. Mechanical Engineering</li> <li>2. Mechanical (Manufacturing) Engineering.</li> </ol>	<ol style="list-style-type: none"> <li>7. Computer Science and Engineering (Data Science)</li> <li>8. Electronics and Instrumentation Engineering.</li> <li>9. Information Technology</li> <li>10. Electronics and Communication Engineering.</li> </ol>

<b>S.No</b>	<b>Branch of Study in B.E</b>	<b>Honours Elective Courses from Same and Allied Departments of</b>	<b>Minor Engineering Courses from Other Departments of</b>
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	1. Civil Engineering 2. Mechanical Engineering 3. Mechanical (Manufacturing) Engineering.

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

## DETAILS OF COURSE CODE

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

**The first two digits relate to the year from which the Regulations commence  
7<sup>th</sup> digit represents the semester and 8<sup>th</sup> and 9<sup>th</sup> digits represent the serial number of courses.**



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**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
<b>Total Credits</b>									<b>20.5</b>

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
<b>Total Credits</b>									<b>20.5</b>
* 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/D	CA	FE	Total	Credits
22ETBS301	BS-V	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
22CEPC304	PC-I	Construction Engineering	3	-	-	25	75	100	3
22CEPC305	PC-II	Fluid Mechanics	3	-	-	25	75	100	3
22CEPC306	PC-III	Concrete Technology	3	-	-	25	75	100	3
22CESP307	ESP-V	Computer Aided Building Drawing	-	-	4 (2*2)	40	60	100	2
22CECP308	PCP-I	Fluid Mechanics Laboratory	-	-	3	40	60	100	1.5
22CECP309	PCP-II	Concrete and Construction Materials Laboratory	-	-	3	40	60	100	1.5
<b>Total Credits</b>									<b>24</b>

SEMESTER IV									
Course Code	Category	Course	L	T	P/D	CA	FE	Total	Credits
22CEBS401	BS-VI	Probability and Statistics for Civil Engineering	3	-	-	25	75	100	3
22CEES402	ES-V	Solid Mechanics	3	-	-	25	75	100	3
22CEPC403	PC-IV	Surveying	3	-	-	25	75	100	3
22CEPC404	PC-V	Applied Hydraulic Engineering	3	-	-	25	75	100	3
22CEPC405	PC-VI	Soil Mechanics & Foundation Engineering	3	-	-	25	75	100	3
22CEPC406	PC-VII	Strength of Materials	3	-	-	25	75	100	3
22ETHS407	HS-II	Universal Human Values	2	1	-	25	75	100	3
22CECP408	PCP-III	Surveying Laboratory-I	-	-	4 (2*2)	40	60	100	2
22CECP409	PCP-IV	Hydraulic Engineering Laboratory	-	-	3	40	60	100	1.5
22CECP410	PCP-V	Strength of Materials Laboratory	-	-	3	40	60	100	1.5
<b>Total Credits</b>									<b>26</b>

**Students must undergo Internship for a total of 4 weeks during vacation which will be assessed in the forthcoming V Semester.**

SEMESTER V										
Course Code	Category	Course	L	T	P/D	CA	FE	Total	Credits	
22CEPC501	PC-VIII	Environmental Engineering	3	-	-	25	75	100	3	
22CEPC502	PC-IX	Advanced Surveying	3	-	-	25	75	100	3	
22CEPC503	PC-X	Structural Analysis	3	-	-	25	75	100	3	
22CEPC504	PC-XI	Structural Concrete Design	3	-	-	25	75	100	3	
22CEPE505	PE-I	Professional Elective – I	3	-	-	25	75	100	3	
22CEPE506	PE-II	Professional Elective – II	3	-	-	25	75	100	3	
22CEOE507	OE-I	Open Elective - I	3	-	-	25	75	100	3	
22CECP508	PCP-VI	Environmental Engineering Laboratory	-	-	3	40	60	100	1.5	
22CECP509	PCP-VII	Surveying Laboratory-II	-	-	3	40	60	100	1.5	
22CECP510	PCP-VIII	Soil Mechanics Laboratory	-	-	3	40	60	100	1.5	
22ETIT511	IT-I	Industrial Training / Rural Internship/Innovation / Entrepreneurship	<i>Four weeks during the summer vacation at the end of IV Semester</i>						100	4.0
<b>Total Credit</b>									<b>29.5</b>	

SEMESTER VI									
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits
22CEPC601	PC-XII	Highway Engineering	3	-	-	25	75	100	3
22CEPC602	PC-XIII	Structural Steel Design	3	-	-	25	75	100	3
22CEPE603	PE-III	Professional Elective – III	3	-	-	25	75	100	3
22CEPE604	PE-IV	Professional Elective – IV	3	-	-	25	75	100	3
22CEPE605	PE-V	Professional Elective – V	3	-	-	25	75	100	3
22CEOE606	OE-II	Open Elective – II	3	-	-	25	75	100	3
22CECP607	PCP-IX	Highway Engineering Laboratory	-	-	3	40	60	100	1.5
22CECP608	PCP-X	Structural Design and Detailing Laboratory	-	-	3	40	60	100	1.5
<b>Total Credits</b>									<b>21</b>

**Students must undergo Internship for a total of 4 weeks during 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-III	Engineering Ethics	2	-	-	25	75	100	2	
22CEPC702	PC-IV	Estimation, Costing & Valuation Engineering	3	-	-	25	75	100	3	
22CEPE703	PE-VI	Professional Elective – VI	3	-	-	25	75	100	3	
22CEPE704	PE-VII	Professional Elective – VII	3	-	-	25	75	100	3	
22YYOE705	OE-III	Open Elective – III	3	-	-	25	75	100	3	
22CECP706	PCP-XI	Estimation, Costing & Valuation Engineering Laboratory	-	-	3	40	60	100	1.5	
22ETIT707	IT-II	Industrial Training / Rural Internship / Innovation / Entrepreneurship	<i>Four weeks during the summer vacation at the end of VI Semester</i>				100	100	4	
<b>Total Credits</b>									<b>19.5</b>	

# YY – Programme Code of the programme which offers the Open Elective Course

SEMESTER VIII										
Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	
22CEOE801	OE-IV	Open Elective-IV	3	-	-	25	75	100	3	
22CEOE802	OE-V	Open Elective-V	3	-	-	25	75	100	3	
22CEPV803	PV-I	Project Work and Viva Voce		PR	S	40	60	100	6	
				10	2					
<b>Total Credits</b>									<b>12</b>	

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



<b>CURRICULUM BREAKDOWN STRUCTURE</b>										
<b>Summary of Credit Distribution</b>										
<b>Category</b>	<b>Semester</b>								<b>Total number of credits</b>	<b>Curriculum Content (% of total number of Credits of the program)</b>
	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	<b>V</b>	<b>VI</b>	<b>VII</b>	<b>VIII</b>		
<b>BS</b>	<b>12.0</b>	<b>7.0</b>	<b>4.0</b>	<b>3.0</b>					<b>26.0</b>	<b>15.03</b>
<b>HS</b>	<b>1.5</b>	<b>4.0</b>		<b>3.0</b>			<b>2.0</b>		<b>10.5</b>	<b>6.07</b>
<b>ES</b>	<b>6.0</b>	<b>8.5</b>	<b>8.0</b>	<b>3.0</b>					<b>25.5</b>	<b>14.74</b>
<b>MC</b>	<b>1.0</b>	<b>1.0</b>							<b>2.0</b>	<b>1.16</b>
<b>PC</b>			<b>12.0</b>	<b>17.0</b>	<b>16.5</b>	<b>9.0</b>	<b>4.5</b>		<b>59.0</b>	<b>34.10</b>
<b>PE</b>					<b>6.0</b>	<b>9.0</b>	<b>6.0</b>		<b>21.0</b>	<b>12.14</b>
<b>OE</b>					<b>3.0</b>	<b>3.0</b>	<b>3.0</b>	<b>6.0</b>	<b>15.0</b>	<b>8.67</b>
<b>IT</b>					<b>4.0</b>		<b>4.0</b>		<b>8.0</b>	<b>4.62</b>
<b>PV</b>								<b>6.0</b>	<b>6.0</b>	<b>3.47</b>
<b>Semester wise Total</b>	<b>20.5</b>	<b>20.5</b>	<b>24.0</b>	<b>26.0</b>	<b>29.5</b>	<b>21.0</b>	<b>19.5</b>	<b>12.0</b>	<b>173.0</b>	<b>100.00</b>

**PROFESSIONAL ELECTIVES** (Page No: 127-163)

<b>Sl. No.</b>	<b>Course Code</b>	<b>Title of Subject</b>	<b>Credits</b>
<b>Professional Elective – I&amp; II</b>			
1	22CEPESCN	Engineering Geology	3
2	22CEPESCN	Irrigation Engineering	3
3	22CEPESCN	Integrated Water Resources Management	3
4	22CEPESCN	Transportation Engineering	3
5	22CEPESCN	Traffic Engineering & Management	3
<b>Professional Elective –III, IV &amp; V</b>			
6	22CEPESCN	Advanced Construction Techniques	3
7	22CEPESCN	Construction Planning & Management	3
8	22CEPESCN	Industrial Wastewater Engineering	3
9	22CEPESCN	Remote Sensing & GIS	3
10	22CEPESCN	Surface & Groundwater Hydrology	3
11	22CEPESCN	Membrane Technology	3

12	22CEPESCN	Railways, Airports and Harbour Engineering	3
13	22CEPESCN	Climate Change Adaptation & Mitigation	3
<b>Professional Elective –VI&amp; VII</b>			
14	22CEPESCN	Pre Fabricated Structures	3
15	22CEPESCN	Architecture	3
16	22CEPESCN	Urban Planning & Development	3
17	22CEPESCN	Pre-Stressed Concrete	3
18	22CEPESCN	Rehabilitation Structures	3
19	22CEPESCN	Green Building	3

**OPEN ELECTIVES** (Page No: 164-185)

Sl. No	Course Code	Title of Subject	Credits
1	22CEOESCN	Air Pollution Monitoring & Control	3
2	22CEOESCN	Municipal Solid Waste Management	3
3	22CEOESCN	Environmental Impact Assessment	3
4	22CEOESCN	Economics & Finance For Civil Engineering	3
5	22CEOESCN	Coastal Engineering	3
6	22CEOESCN	Total Quality Management	3
7	22CEOESCN	Computer Aided Design of Structures	3
8	22CEOESCN	Sustainable Construction Methods	3
9	22CEOESCN	Disaster Management	3
10	22CEOESCN	Introduction to Smart Cities	3
11	22CEOESCN	NCC Studies (Army Wing/ Naval Wing)	3
12	22CEOESCN	Online MOOC course or other courses	3

**HONOUR ELECTIVES** (Page No: 186-205)

Sl. No	Course Code	Title of Subject	Credits
1	22CEHESCN	Special Concrete Structures	4
2	22CEHESCN	Earthquake Engineering	3
3	22CEHESCN	Advanced Water Treatment	4
4	22CEHESCN	Watershed Management	3
5	22CEHESCN	Geoenvironmental Engineering	3
6	22CEHESCN	Intellectual Property Rights	3
7	22CEHESCN	Sustainable Engineering and Technology	3

8	22CEHESCN	Total Station and GPS Surveying	4
9	22CEHESCN	Intelligent Transport System	4
10	22CEHESCN	Participatory Water Resources Management	4

#### MINOR ENGINEERING ELECTIVES

Sl. No	Course Code	Title of Subject	Credits
1	22CEMESCN	Advanced Water Treatment	4
2	22CEMESCN	Climate Change Adaptation & Mitigation	3
3	22CEMESCN	Environmental Impact Assessment	3
4	22CEMESCN	Total Quality Management	3
5	22CEMESCN	Urban Planning & Development	3
6	22CEMESCN	Special Concrete Structures	4
7	22CEMESCN	Sustainable Engineering and Technology	3
8	22CEMESCN	Total Station and GPS Surveying	4
9	22CEMESCN	Intelligent Transport System	4
10	22CEMESCN	Participatory Water Resources Management	4

#### ONE CREDIT COURSES

Sl. No	Course Code	Title of Subject
1	22CEOCSCN	Drone Surveying And Mapping
2	22CEOCSCN	Revit Architecture
3	22CEOCSCN	STAAD PRO
4	22CEOCSCN	Surveying Using Total Station

#### VALUE ADDED COURSES

Sl. No	Course Code	Title of Subject
1	ECIVVAC01	Sustainable Water Resources Management

## PROFESSIONAL ELECTIVES

The List of Courses under Professional Elective Category must be those courses which will be offered by the Department concerned – for the students from the same Department.

The first two characters must be the code of the branch offering the Professional Elective.

Since the last three characters are not known beforehand, the code for Professional electives can be given as follows

### PESCN IN THE LIST OF PROFESSIONAL ELECTIVES

	Regulation		Programme Code		Professional Elective		Sem	Course No.	
Course Code	R	R	X	X	P	E	S	C	N
Dept. offering PE	_____		_____	_____	_____	_____	_____	_____	_____
Professional Elective	_____		_____	_____	_____	_____	_____	_____	_____
Semester in which PE is offered	_____		_____	_____	_____	_____	_____	_____	_____
Course Number	_____		_____	_____	_____	_____	_____	_____	_____

The List of Courses under Open Elective Category must be those courses which will be offered by the Department concerned – for the students from either the same Department and/or for the students from other Departments in FEAT.

In 6<sup>th</sup> and 7<sup>th</sup> Sem, the OE courses are taken from other Depts in FEAT, hence the codes are Y Y O E 6 0 6 & Y Y O E 7 0 5 in the TABLE where the first two characters are code of the branch offering the Open Elective (not known beforehand).

The 8<sup>th</sup> Sem OE can be given the code as, X X O E 8 0 1 & X X O E 8 0 2 in the TABLE-where XX corresponds to the branch code of the same Dept.

Since the last three characters are not known beforehand, the code for open electives can be given as follows, X X O E S C N in the List of Open Electives.

## HONOURS ELECTIVES

	Branch Code		Honour Elective		Sem	Course No.	
Course Code	Y	Y	H	E	S	C	N
Dept. offering HE	_____	_____	_____	_____	_____	_____	_____
Honours Elective	_____	_____	_____	_____	_____	_____	_____
Semester in which HE is offered	_____	_____	_____	_____	_____	_____	_____
Course Number	_____	_____	_____	_____	_____	_____	_____

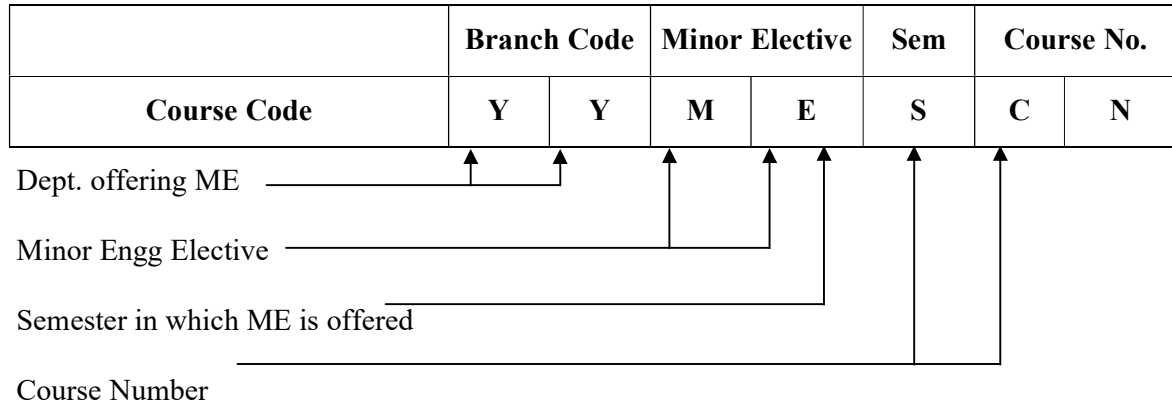
Course Number

The List of Courses under Honours Elective Category must be those courses which will be offered by the Department concerned – for their own students.

The first two characters must be the branch code of the branch offering the Open Elective.

Since the last three characters are not known beforehand, the code for open electives can be given as follows H E S C N in the List of Honours Electives.

**MINOR ENGINEERING ELECTIVES**



The List of Courses under Minor Engineering Elective Category must be those courses which will be offered by the Department concerned – for the students from other Departments in FEAT.

The first two characters must be the branch code of the branch offering the Minor Engineering Elective.

Since the last three characters are not known beforehand, the code for open electives can be given as follows, \_\_ M E S C N in the List of Minor Engineering Electives.

## SEMESTER I

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

### **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, 36<sup>th</sup> Edition, 2010

## REFERENCE BOOKS

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9<sup>th</sup> publishers, Reprint,2002.
2. Erwin kreyszig,"Advanced Engineering Mathematics",9<sup>th</sup> Edition, JohnWiley &Sons,2006.
3. Ramana B.V., "Higher Engineering Mathematics",Tata McGraw Hill New Delhi,11<sup>th</sup> 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: monochromaticity, 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, CO<sub>2</sub>), 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 - Dual 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, 2<sup>nd</sup> 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., 7<sup>th</sup> 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 - H<sub>2</sub>-O<sub>2</sub> 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" Dhanpat Rai & Sons, New Delhi.
2. Dara, S.S. and Umare, S.S. (2014) "Text Book of Engineering Chemistry" S. Chand & Co. Ltd., New Delhi.
3. Gopalan, R., Venkappaya, D. and Nagarajan, S. (2008) "Engineering Chemistry" Tata 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 of India.

### 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			
	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 சமணப் பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

**அலகு II: மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை: 3**  
நடுகல் முதல் நவீன சிற்பங்கள் வரை V ஐம்பொன் சிலைகள்- பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளூர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

**அலகு III: நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: 3**  
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

**அலகு IV: தமிழர்களின் திணைக் கோட்பாடுகள்: 3**  
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

**அலகு V: இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: 3**  
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப் புத்தகங்களின் அச்ச 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 Justice in 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. Thinaï concept of Tamils -Flora and Fauna of Tamils &Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

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.

**6. TEXT-CUM-REFERENCE BOOKS**

1. தமிழக வரலாறு – மக்களுக்கும் 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. பெருநை- 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)(Published by: 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



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

### **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 Fluorescent Lamp (18W)
14. Study of various categories of Fuses and Insulators
15. Study and test the operation of Automatic Iron Box
16. Testing the buck/boost functions of the domestic stabilizer

### **COURSE OUTCOMES**

At the end of 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.

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

## SEMESTER II

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

### **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 Heasley, "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 be 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, 36<sup>th</sup> Edition, 2010.
2. Erwin kreyszig, "Advanced Engineering Mathematics", 9<sup>th</sup> Edition, John Wiley & Sons, 2006.

## **REFERENCE BOOKS**

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9<sup>th</sup> Edition, Pearson, Reprint, 2002.
2. W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", 9<sup>th</sup> Edn., Wiley India, 2009.
3. S. L. Ross, "Differential Equations", 3<sup>rd</sup> Ed., Wiley India, 1984.
4. J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7<sup>th</sup> Ed., McGraw 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's theorems.
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. Satheesh Gopi, 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. Satheesh Gopi, 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, McGraw 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

1. Understand the concepts related with electrical circuits and AC fundamentals.
2. Acquire knowledge on the concepts of DC machines, Transformers and AC machines
3. 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

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

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

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

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

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

TOTAL : 15 PERIODS

- Weaving and Ceramic Technology:**Weaving Industry during Sangam Age - Ceramic technology - Black and Red Ware Potteries (BRW) - Graffiti on Potteries.
- 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.
- 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.
- 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.
- 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. பொருதை - 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 micro-sized objects.

### LIST OF EXPERIMENTS

1. Air Wedge
2. Newton'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 immiscible liquids
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 soapification of oil.
3. Calculate the quantity of adsorbate adsorbed by charcoal.
4. Determine the impurity from Pharmaceutical products and hardness of water.
5. Determine exact concentration of acid and bases present in the industrial wastes.

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.

<b>Mapping of Course Outcomes with Programme Outcomes</b>												
<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
<b>CO1</b>	<b>2</b>	<b>1</b>	<b>1</b>		<b>2</b>							
<b>CO2</b>	<b>2</b>	<b>1</b>	<b>1</b>		<b>2</b>							
<b>CO3</b>	<b>2</b>	<b>1</b>	<b>1</b>		<b>2</b>							
<b>CO4</b>	<b>1</b>	<b>1</b>	<b>1</b>		<b>2</b>							
<b>CO5</b>	<b>1</b>	<b>1</b>	<b>1</b>		<b>2</b>							

<b>22ETSP208</b>	<b>ENGINEERING GRAPHICS</b>	<b>L</b>	<b>T</b>	<b>P/D</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>3</b>	<b>3</b>

### **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 through drawing
- To develop the skills to read manufacturing and construction drawings used in industry
- To develop a working knowledge of the layout of plant and equipment
- To develop skills in abstracting information from calculation sheets and schematic diagrams to produce working drawings for manufacturers, installers and fabricators

## **UNIT I: INTRODUCTION TO ENGINEERING DRAWING**

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

## **UNIT II: ORTHOGRAPHIC PROJECTIONS**

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

## **UNIT III: PROJECTIONS OF REGULAR SOLIDS**

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

## **UNIT IV: SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS,**

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

## **UNIT V: ISOMETRIC PROJECTIONS**

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

## **OVERVIEW OF COMPUTER GRAPHICS COVERING**

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

## **CUSTOMIZATION & CAD DRAWING**

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

## ANNOTATIONS, LAYERING & OTHER FUNCTIONS

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

## TEXT/REFERENCE BOOKS

1. 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 ENGINEERING

### VISION

To become **School of Excellence in Civil Engineering** with **Conformity, Quality and Standards** in **teaching, research, training and consultancy** towards producing globally competent Civil Engineers.

### MISSION

- M1:** To promote quality in education, research and professional training for satisfying the needs of industry and society.
- M2:** To provide state-of-the-art facilities and resources that contributes to a congenial learning environment.
- M3:** To establish Centers of Excellence in emerging areas of Civil Engineering for the students to acquire domain specific expertise and also facilitate industry- institution interaction.
- M4:** To inspire the students to pursue higher education and take competitive examinations and various career enhancing programs.
- M5:** To instill the professional ethics and their role for sustainable development and corruption-free country.

### PROGRAMME OUTCOMES

After the successful completion of the B.E. (Civil Engineering) Degree Programme, the graduates will be able to:

- PO1: Engineering Knowledge:** Apply knowledge of mathematics, science and engineering concepts to solve problems related to civil engineering.
- PO2: Problem Analysis:** Identify, formulate and analyze Civil Engineering problems using the first principles of mathematics, sciences and engineering sciences and reach substantiate conclusions.
- PO3: Design/Development of Solutions:** Design solutions for complex Civil Engineering problems and design system components satisfying standards laid by Indian Standard codes or processes to meet societal needs within realistic constraints.
- PO4: Conduct Investigations of Complex Problems:** Develop skills, select and apply modern engineering tools such as FEM, CAD, GIS and techniques for soft computing and optimization, including prediction and modeling of complex civil engineering problems.
- PO5: Modern Tool Usage:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
- PO6: The Engineer and Society:** Assess the societal needs and bring solutions with ethical principles in professional civil engineering practice with commitment, adhering to the norms of Civil Engineering practice.

- PO7: Environmental and Sustainability:** Interact effectively with the engineering community and properly communicate with the society as well, by being able to comprehend through effective technical reports, documents, presentations and drawings, give and receive clear instructions, imperative to decision making for successful execution.
- PO8: Ethics:** Demonstrate the knowledge and understanding of the engineering and management principles and apply these to one's work in construction, finance & asset management, public policy and administration in executing projects, as a member or leader in a team with self-confidence and courage.
- PO9: Individual and Teamwork:** Appreciate the need to develop ability to design, implement and evaluate a field program to meet desired requirements within dynamic constraints related to economy, environment, social, political, health and safety aspects, manufacturability and sustainability, precisely the ability to engage in lifelong learning in the broadest context of technological change.
- PO10: Communications:** Recognize the importance of Civil Engineering professional development by pursuing postgraduate studies or face competitive examinations that offer challenging and rewarding careers.
- PO11: Project Management and Finance:** Create innovative construction materials to improve the performance of infrastructure in case of buildings and transportation systems.
- PO12: Life-Long learning:** Develop and apply high performance structural materials and disaster-resistant systems.

### PROGRAM EDUCATIONAL OBJECTIVES

<b>PEO 1</b>	To impart knowledge in the fundamentals of Civil Engineering such as Surveying, Planning, Structural Analysis, Design, Costing and Construction.
<b>PEO 2</b>	To develop soft skill and value addition through software platforms such as SURFER, 3D Home Architect, ARCHICAD, STAAD Pro, ArcGIS, QGIS, ANSYS, ERDAS, etc.
<b>PEO 3</b>	To ensure necessary aptitude and ethics through class room teaching, laboratory practice and field demonstration towards pursuing a quality professional practice.
<b>PEO 4</b>	To sensitize the need and importance to pursue for higher studies, research and exclusive preparations for competitive examinations.
<b>PEO 5</b>	To provide the subject specific expertise with objective information on the professional challenges with rational methodologies towards innovative solutions.

## PROGRAM SPECIFIC OUTCOMES

The Civil Engineering curriculum prepares graduates to attain:

**PSO 1:** Apply principles of engineering, basic science and mathematics to model, analyze, design civil systems and processes.

**PSO 2:** Plan, operate, control, maintain and improve civil systems, components and Processes.

**PSO 3:** Prepare the students to work professionally as civil engineers.

	<b>M1</b>	<b>M2</b>	<b>M3</b>	<b>M4</b>	<b>M5</b>
PEO <sub>1</sub>	2	2	1	2	2
PEO <sub>2</sub>	3	1			2
PEO <sub>3</sub>	1	3		2	1
PEO <sub>4</sub>	2			1	1
PEO <sub>5</sub>	1			3	1

	PO <sub>1</sub>	PO <sub>2</sub>	PO <sub>3</sub>	PO <sub>4</sub>	PO <sub>5</sub>	PO <sub>6</sub>	PO <sub>7</sub>	PO <sub>8</sub>	PO <sub>9</sub>	PO <sub>10</sub>	PO <sub>11</sub>	PO <sub>12</sub>
PEO <sub>1</sub>	3	1	2				1	2	3			2
PEO <sub>2</sub>	3	2	2		3							
PEO <sub>3</sub>	1	1										
PEO <sub>4</sub>	3	2	3		1		3					
PEO <sub>5</sub>				3				1	1	1		

### THIRD SEMESTER

22ETBS301	MATHEMATICS – III	L	T	P	C
		3	1	0	4

#### COURSE OBJECTIVES

- To learn, partial differential equations, Fourier series, Boundary value problems.
- To learn the transforms such as Sine, Cosine, Fourier transform and Z – transforms.
- To gain knowledge of the method to find the Solution of difference equations.

#### Unit–I

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

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

Solutions of one dimensional wave equation – One dimensional heat equation (without derivation) – Fourier series solutions in Cartesian Co-ordinates.

#### Unit–IV

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval’s identity.

#### Unit–V

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, 6<sup>th</sup> edition., (Vol I & II) S.Chand & Co Ltd. 2006, New Delhi.
2. Ventakataraman M.K., Engineering Mathematics, The National Publishing Co., Chennai, 2015.

#### REFERENCES

1. Veerarajan T., Engineering Mathematics, 3<sup>rd</sup> edition, Tata McGraw Hill Pub.,2011.
2. Singaravelu A., Engineering Mathematics, Meenakshi Publications, Chennai, 2004.
3. Nayaranan S, Manicavchagom Pillay T.K. and Ramanaiah G., Advanced Mathematics for Engineering students, Vol.2 & 3, S. Viswanathan Publishers Pvt. Ltd.,2009.

4. BaliN.P. and Manish Goyal, A Textbook of Engineering Mathematics, 12<sup>th</sup> Edition, Laxmi Publications Pvt. Ltd., 2020.

## WEB REFERENCE

[https://onlinecourses.nptel.ac.in/noc23\\_ma33/preview](https://onlinecourses.nptel.ac.in/noc23_ma33/preview)

## COURSE OUTCOMES

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

- Partial differential equations.
- Fourier series.
- Fourier transform.
- Z – transforms and the methods of solving them.
- Solving boundary value problems.

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

22ETES302	ENVIRONMENTAL STUDIES	L	T	P	C
		3	0	0	3

## COURSE OBJECTIVES

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

## **Unit-I**

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 and ground water – floods – drought – conflicts over water – dams – benefits and problems. Mineral resources: Use and exploitation – environmental effects of extracting and using mineral resources – Food resources: World food problems – changes caused by agriculture and overgrazing – effects of modern agriculture – fertilizer – pesticide problems – Energy resources: Growing energy needs – renewable and non – renewable energy sources – use of alternate energy sources. Land resources: Land as a resource land degradation – man induced landslides – soil erosion and desertification. – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

## **Unit-II**

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

## **Unit-III**

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

## **Unit-IV**

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

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

## **Unit–V**

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

### **Field work**

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

### **TEXT BOOKS**

1. Agarwal, K.C. Environmental Biology, Nidi Publ, Ltd. Bikaner, 2001.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net I. 2005

### **REFERENCES**

1. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
2. Clark R.S., Marine Pollution, Clarendon Press Oxford (TB), 1992.
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p.
4. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p.
5. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay I. 2003
6. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
7. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB).1996
8. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p.
9. Survey of the Environment, The Hindu (M) 2002.
10. Trivedi R.K., 2010 Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media I.
11. Trivedi R. K. and P.K. Goel, 2003 Introduction to Air pollution, Techno – Science Publication (TB).
12. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p.

### **WEB REFERENCE**

**[https://onlinecourses.swayam2.ac.in/cea22\\_ge22/preview](https://onlinecourses.swayam2.ac.in/cea22_ge22/preview)**

## COURSE OUTCOMES

At the end students can able to:

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

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

22ETES303	ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3

## COURSE OBJECTIVES

- To introduce the fundamentals of forces and their effects with their governing laws.
- To understand the definitions of particle, body forces and their equilibrium conditions.
- To understand dynamics and its related motions.

### Unit-I

Introduction to Engineering Mechanics covering, Force Systems ,Basic concepts, Particle equilibrium in 2-D & 3-D; Vectorial representation of forces ,Vector operations of forces, Coplanar Concurrent Forces, Components in Space, Equilibrium of System of Forces, Equations of Equilibrium of Coplanar Systems and Spatial Systems;.



## Unit-II

Free body diagrams, Types of supports, Action and reaction forces, stable equilibrium, Moments and Couples, Moment of a force about a point and about an axis, Static Indeterminacy, Scalar components of a moment – Varignon’s theorem,– Single equivalent force –Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions, Method of Sections; Method of Joints; nature of member forces; Simple Trusses; Zero force members; Beams & types of beams, Frames.

## Unit-III

Centroid and Centre of Gravity covering, 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-IV

Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Simple contact friction, ladder friction, wedge friction, screw jack, belt friction.

Basic terms, general principles in dynamics; Types of motion, Review of particle dynamics, Kinematics of particles-Rectilinear motion; Uniform acceleration and variable acceleration-relative motion.

## Unit-V

Kinematics of particles-curvilinear motion,(Cartesian, polar, Tangential systems) projectile motion Relative and constrained motion; Newton’s 2<sup>nd</sup> law (rectangular, path, and polar coordinates.

Introduction to Kinetics of Rigid Bodies covering, Instantaneous centre of rotation in plane motion and simple problems; D’Alembert’s principle and its applications in plane motion and connected bodies; Work – kinetic energy, power, potential energy. Impulse – momentum (linear, angular); Impact (Direct and oblique).

**Tutorials** from the above modules covering, To find the various forces and angles including resultants in various parts of wall crane, roof truss, pipes, etc.; To verify the line of polygon on various forces; To find coefficient of friction between various materials on inclined plan; Free body diagrams various systems including block – pulley; To verify the principle of moment in the disc apparatus; Helical block; To draw a load efficiency curve for a screw jack

## TEXT BOOKS

1. Palanichamy, M.S. and Nagan, S., Engineering Mechanics (Statics and Dynamics)”, Tata McGraw Hill Publishing Company, Ltd., New Delhi, 2010.
2. Natesan, S.C., Engineering Mechanics (Statics and Dynamics), First edition, Umesh Publications, New Delhi, 2002.

## REFERENCES

1. Irving H. Shames (2006), Engineering Mechanics, 4<sup>th</sup> Edition, Prentice Hall
2. F.P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I – Statics, Vol II, – Dynamics, 9<sup>th</sup> Ed, Tata McGraw Hill.
3. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press.
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education.
6. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education.
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics.
8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications.
9. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
10. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications.

## WEB REFERENCE

[https://onlinecourses.nptel.ac.in/noc23\\_me01/preview](https://onlinecourses.nptel.ac.in/noc23_me01/preview)

## COURSE OUTCOMES: At the end, Students can able to

1. Explain the forces and its related laws of mechanics in static and dynamic conditions.
2. Analyse the forces and its motions on particles, rigid bodies and structures.
3. Solve the moment of inertia of any sections and masses for the structural members.
4. Understand the principles of kinetics and dynamics.
5. Understand the concept of particle dynamics in motion

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

22CEPC304	CONSTRUCTION ENGINEERING	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To expose the students to construction practice through an understanding of different types of construction materials and their properties.
- To understand the techniques of construction, different finishing works and remedial practices for distressed structures.
- To impart knowledge of modern construction materials and equipments.

#### Unit-I

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: 1983.

#### Unit-II

Introduction – Types of Soils – Classification of soils as per IS standards – Cohesion and Adhesion of soil – Bearing capacity of soil – Methods of assessing Bearing capacity of soils – Types of foundations – Shallow foundations – Deep foundations – Special types of foundations for Shore and Offshore structures – Foundations with Rock Anchors.

#### Unit-III

Introduction – Masonry – Types of Masonry – Reinforced Cement Concrete (RCC) works like Footings, Plinth Beams, Columns, Sill slabs, Lintels, Sunshades, Roof Beams and Roof Slabs – Formwork (Shuttering and Scaffolding) – Types of Formwork - Fabrication of Steel – Bar Bending as per IS Standards (SP 34: 1987) – Placing of Bars in Formwork – Cover Blocks – Types of Roofing systems – Types of Stairs – Types of Doors, Windows and Ventilators.

#### Unit-IV

Methods of Termite proofing – Methods of Damp proofing – Plastering (Interior and Exterior) – Pointing for walls and floors using grouts -Types of floor finishes – Mud flooring, Cement flooring, Ceramic/Vitrified tile flooring, Marble flooring, Granite flooring, Wooden flooring, flooring with puffed panels – White washing – Colour washing with different colour shades available in the markets – Painting – Types of painting for Interior and Exterior application.

#### Unit-V

Use of Shoring and Underpinning - Introduction – Glass – Ceramics – PVC – UPVC – Refractory – Aluminium – Lightweight Concrete blocks – Poly Carbonate sheets – Insulated Puffed sheets – Sealant joints – Uses in construction. Cracks in buildings – Causes – Methods of repairs – Equipments used for repair works.

### TEXT BOOKS

1. Arora.S.P, —Building Construction Technology (Including Engineering Materials), 2010.
2. Rangwala.S.C, —Building Construction, Charotar Publishing House Pvt. Limited, 2009.

## REFERENCES

1. Sharma and Kaul, —Building Construction, S.Chand & Company, New Delhi, 1987.
2. Rajput.R.K, —Engineering Materials, S.Chand & Company, New Delhi. 2008.
3. Dr.Punmia.B.C,—Construction Engineering, Laxmi Publishers Private Limited, New Delhi, 1993.
4. GuptaR.K.—Civil engineering Materials and Construction Practices, Jain Brothers, (New Delhi).

## WEB REFERENCE

[https://onlinecourses.nptel.ac.in/noc23\\_ce18/preview](https://onlinecourses.nptel.ac.in/noc23_ce18/preview)

## STANDARDS

1. SP 21: 1983, 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 Indian Standards, New Delhi.

## COURSE OUTCOMES

At the end of the course students will be able to

- Compare the properties of most common and advanced building materials.
- Acquire knowledge of testing of construction materials, their strength requirements and applications.
- Recognize the functions of different building components.
- Understand the usage of modern building materials and construction equipments.
- Apply techniques to repair buildings.

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

22CEPC 305	FLUID MECHANICS	L	T	P	C
		3	0	0	3

## OBJECTIVES

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

## UNIT I

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; vapor pressure – boiling point – cavitation; surface tension – capillarity – Bulk modulus of elasticity – compressibility.

## UNIT II

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

## UNIT III

Fluid 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- Surface and body forces; Equations of motion – Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation : Venturimeter – Orifice meter and Pitot tube.

## UNIT V

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

## TEXT BOOKS

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

## REFERENCES

1. Ojha C.S.P., R. Berndtsson and P. N. Chadramouli, “Fluid Mechanics and Machinery”, Oxford University Press, 2010.
2. Subramanya, K. “Theory and Applications of Fluid Mechanics”, Tata McGraw Hill, 2<sup>nd</sup> edition, 2018
3. John Finemore, E. and Joseph..B. Franzini “Fluid Mechanics with Engineering Applications”, Indian Edition, 10<sup>th</sup> Edition, Mc Graw Hill Education, 2017.
4. Munson, B.R., Okiishi, T.H., Huebsch, W.W. and Rothmayer, A.P. “Fluid Mechanics” Singapore: Wiley, 7<sup>th</sup> edition 2017

## WEB REFERENCE

[https://onlinecourses.nptel.ac.in/noc23\\_me42/preview](https://onlinecourses.nptel.ac.in/noc23_me42/preview)

## COURSE OUTCOMES

On completion of the course, the student is expected to

1. Understand the differences between solids, liquids and gases and the basic properties of fluids.
2. Understand the concept of fluid pressure and its measurement, principle of hydrostatics, buoyancy and floatation.
3. Understand the concept of fluid kinematics, know the types of flow and types of flow pattern and apply the continuity principle to fluid flow problems
4. Understand the concept of fluid dynamics and apply the continuity, momentum and energy principles to fluid flow problems
5. Understand to estimate the losses in pipes and to analyze the pipes in series and parallel.

Tools used for delivering the lecture

1. Black board (Chalk and Talk)
2. ICT based teaching
3. NPTEL course material
4. Display of Important video on specific topic

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

22CEPC306	CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

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

#### Unit-I

Portland cement – Definition – History – Composition – Hydration of Portland cement – Stiffening and Hardening of cement paste – Specification as per IS Code 269 – 1989 – Types of Portland cement – Physical and Chemical Properties of cement – Testing of cement.

#### Unit-II

Aggregates – Natural and Mineral aggregates – Characteristics of aggregates and their significance – Testing of aggregates – Importance of aggregates in concrete – Specifications as per IS Code 2386 (Part I to VIII) – 1963 – Specifications as per IS Code 383 – 1970 – Water Testing – Specifications.

#### Unit-III

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

Hardened concrete – Mechanical Properties and their significance – Testing methods as per IS Code 516 – 1959 – Compressive strength of concrete and its 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.

## **Unit–V**

Objectives of mix design – Concept of concrete mix proportioning – Methods of mix proportioning – IS Code 10262 – 2009 and ACI Committee 211.1.91 method – Fly ash based mix design – Effect of replacement materials in mix design.

### **TEXT BOOKS**

1. Mehta, P.K. and Monteiro, P.J.M., Concrete, Microstructure, Properties and Materials, Indian Concrete Institute, 4<sup>th</sup> edition, 2017.
2. Shetty, M.S., Concrete Technology, S.Chand & Co., New Delhi, Revised edition, 2006.

### **REFERENCES**

1. Neville, A.M., Properties of Concrete, Pitman Publishing Limited, London, 2011.
2. Gambhir, M.L., Concrete Technology, Tata McGraw Hill Co., New Delhi, 5<sup>TH</sup> edition 2015.
3. Neville, A.M. and Brooks J.J. Concrete Technology, Pearson Education, Indian Reprint, 2002.
4. Gupta, Y.O. “Concrete technology and good construction practices.” New Age International Publishers, New Delhi, 2013.

### **WEB REFERENCE**

**[https://onlinecourses.nptel.ac.in/noc23\\_ce50/preview](https://onlinecourses.nptel.ac.in/noc23_ce50/preview)**

### **STANDARDS**

1. IS: 269 – 1989, Specification for Ordinary Portland cement 33 Grade (Fourth Revision), 1998.
2. IS: 2386 (Part I to VIII) – 1963, Method of Tests for Aggregate for Concrete, Bureau of Indian Standards, New Delhi.
3. IS: 383 – 1970, Specification for Coarse and Fine Aggregates from Natural Sources for Concrete, Bureau of Indian Standards, New Delhi.
4. IS: 516 – 1959, Method of Tests for Strength of Concrete, Bureau of Indian Standards, New Delhi.
5. IS: 10262 – 2009, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.
6. ACI Committee 211.1.91 Standard Practice for Selecting Proportions for Normal, Heavy weight and Mass Concrete, ACI Manual of Concrete Practice Part 1, 1991, American Concrete Institute, Detroit.
7. SP 23:1982, Handbook on Concrete Mixes

### **COURSE OUTCOMES**

At the end of the course students will be able to

1. Identify the properties of cement, aggregate and concrete.



2. Acquire knowledge of testing of cement, aggregate and concrete and their strength requirements.
3. Understand the importance of manufacturing process of concrete.
4. Recognize the functions of different concrete admixtures and its types.
5. Understand the concept of concrete mix proportioning.

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

22CESP307	COMPUTER AIDED BUILDING DRAWING	L	T	P	C
		0	0	4 (2*2)	2

### COURSE OBJECTIVES

- To introduce the student to basic principles of building drawing.
- To learn to draft plan, elevation and sectional views of buildings in accordance with development and control rules satisfying orientation and functional requirements as per National Building Code.
- To enable the students to develop manual and computer aided drafting skills for planning.

### Exercises

1. Conventional symbols.
2. Paneled and flush doors.
3. Paneled and glazed windows.
4. Lean to roof and small sheds.
5. Residential buildings with fully tiled roof with hips & valleys.
6. R.C.C. flat roofed single roomed building.
7. Residential building with single bedroom (load bearing structure).
8. Residential building with double bedroom (framed structure).
9. Residential building with R.C.C. roofed hips & valleys.

10. Residential double storied building with R.C.C. roof.
11. Library building with R.C.C. flat roof.
12. Primary health centre for rural areas with R.C.C. flat roof.
13. Single storied school building with R.C.C. flat roof.
14. Bank building with R.C.C. flat roof.
15. Mini shopping mall building.

### TEXT BOOKS

1. Shah. M.G., Kal.C.M. and Patki. S.Y., Building drawing with an integrated approach to Built Environment, Fifth Edition, 2017.
2. Kaleem. S., Zaidi. A. and Suhail Siddiqui, Drawing and Design of Residential and commercial buildings, Standard Publications, 2016

### REFERENCES

1. Venugopal. K. and Praburaja. V., Building Drawing, New Age International Publishers, 2018
2. Rangwala. S.C., 2017 Civil Engineering Drawing.,
3. Verma. B.P., 2006 Civil Engineering Drawing and House planning.
4. Cloise.Kicklighter. Architecture, Residential Drawing and Design, The Good Heart – Willcox Company Inc., 2016.
5. Donald E.Hepler and Paul I. Wallach., Architecture, Drafting and Design, Tata McGraw Hill Book Co., New Delhi, 1998.

### COURSE OUTCOMES

At the end of the course students will be able to

1. Understand conventional symbols used in drawing.
2. Draft plan, elevation and sectional views of doors & windows, lean to roof and different types of buildings.
3. Understand the regulations as per National Building Code.
4. Identify the functional requirements and building rules.
5. Understand and usage of computer tool to draw a plan of various buildings

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

<b>22CECP308</b>	<b>FLUID MECHANICS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

### **COURSE OBJECTIVES**

- To understand the practical methods for determination of Co-efficient of discharge.
- To study characteristic features of pumps and turbines by carrying out experiments.
- To understand the significance and role of such utilities in their further course of study.

### **LIST OF EXPERIMENTS**

1. Measurement of Viscosity
2. Study of Pressure Measuring Devices
3. Stability of Floating Body
4. Hydrostatics Force on Flat Surfaces/Curved Surfaces
5. Verification of Bernoulli's Theorem
6. Venturimeter
7. Orifice meter
8. Impacts of Jets
9. Flow Visualization – Ideal Flow
10. Length of establishment of flow
11. Velocity distribution in pipes
12. Laminar Flow
  - Determination of Co-efficient of discharge of **Mouthpiece**
  - Determination of Co-efficient of discharge of **Venturimeter**
  - Determination of Co-efficient of Head loss due to **Sudden Change in Section**
  - Determination of Co-efficient of Head loss due to **Friction in Pipes**
  - Determination of Co-efficient of discharge of **Rectangular Notch**
  - Determination of Co-efficient of **Impact of Jet on Vanes**
  - Determination of **Metacentric Height** of a floating vessel.

### **REFERENCES**

1. Subramanya K., Flow in open channels, Tata McGraw Hill, New Delhi 2000.
2. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 2002.
3. Nagaratnam, S., Fluid Machines and Systems, Tata McGraw Hill, 1989.

4. Aris, R. (1989). Vectors, tensors, and the basic equations of fluid mechanics. New York, USA: Dover Publications.

### COURSE OUTCOMES

At the end of the course students will be able to

1. Determine the rate of flow using various experiments.
2. Study the various losses occurred in different sections
3. Compute forces exerted using impact of jet on different vanes.
4. Develop characteristics curves to determine the specific speed of pumps.
5. Develop characteristics curves to determine the specific speed of turbines.

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

22CECP309	CONCRETE AND CONSTRUCTION MATERIALS LABORATORY	L	T	P	C
		0	0	3	1.5

### COURSE OBJECTIVES

To facilitate the understanding of the behavior of construction materials such as

- Fine aggregates
- Coarse aggregate
- Concrete and bricks

### EXPERIMENTS

#### I. TEST ON FINE AGGREGATES

Grading of fine aggregates

Test for specific gravity and test for bulk density

Compacted and loose bulk density of fine aggregate

#### II. TEST ON COARSE AGGREGATE

Determination of impact value of coarse aggregate

Determination of elongation index

Determination of flakiness index

Determination of aggregate crushing value of coarse aggregate

### III. TEST ON CONCRETE

Test for Slump

Test for Compaction factor

Test for Compressive strength – Cube & Cylinder

Test for Flexural strength

### IV. TEST ON BRICKS AND BLOCKS

Test for compressive strength of bricks and blocks

Test for Water absorption of bricks and blocks

Determination of Efflorescence of bricks

Test on tiles

### REFERENCES

1. Construction Materials Laboratory Manual, Anna University, Chennai – 600 025.
2. IS 4031 (Part 1) – 1996 – Indian Standard Method for determination of fineness by dry sieving.
3. IS 2386 (Part 1 to Part 6) – 1963 – Indian Standard methods for test for aggregate for concrete.
4. IS 383 – 1970 Indian Standard specification for coarse and fine aggregates from natural sources for concrete.

### COURSE OUTCOMES

The students will have the required knowledge in the area of

1. Behavior of construction materials
2. Properties of construction materials
3. Properties of construction elements
4. Behavior of fresh and hardened concrete
5. Mechanical and durable properties of bricks and blocks

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

## FOURTH SEMESTER

22CEBS401	PROBABILITY AND STATISTICS FOR CIVIL ENGINEERING	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To introduce the fundamentals of probability and statistics to civil engineering students in order to deal with uncertainty in civil engineering systems
- To emphasize the practical aspects of the use of these methods
- To identify the strength relationship between variables and using regression and correlation.

### Unit-I : Data Description and Treatment & Fundamentals of Probability

Introduction – Types of uncertainty Data description and treatment – Classification of data – nominal, ordinal, interval and ratio scales – Graphical description of the data – histograms and Frequency diagrams – Descriptive measures: Central tendency measures, dispersion measures, percentiles – applications Fundamentals of Probability – Sample sets, sample Spaces and Events – basic operations – mathematics of probability – conditional probability – Baye’s theorem Random variables and their probability distributions – probability of discrete random variables – probability of continuous random variables – applications.

### Unit-II : Probability Distributions for Discrete and Continuous Random Variables

Probability distributions for discrete random variables – Bernoulli’s, Binomial, Geometric and Poisson distributions – applications

Probability distributions for continuous random variables – Uniform, normal, log normal, exponential and gamma distributions – statistical probability distributions – Students’ t, Chi – square and F – distributions – applications.

### Unit-III : Fundamentals of Statistical Analysis and Hypothesis Testing

Fundamentals of statistical analysis – Estimation of parameters – Properties of estimators: bias, precision, , Mean Square Error (MSE) – Estimation of Moments – Method of moments, Method of Maximum likelihood – Sampling distributions of mean and variance – applications Hypothesis Testing: Hypothesis tests of means – Hypothesis tests of variance – Tests of distributions – applications.

### Unit-IV : Analysis of Variance, Confidence intervals and Sample size determination

Analysis of Variance – Test of population means – ANOVA test – One way and Two way classifications – Completely randomized design – Test of population variances – Theorem on moments – applications.

Confidence intervals and Sample size determination – General procedure – confidence intervals for the mean, variance – sample size determination – applications.

### Unit-V : Correlation and Regression Analysis

Correlation analysis – properties of correlation – correlation coefficient – computation of correlation coefficient – applications. Introduction to regression – Zero – intercept model – principle of least squares – fitting linear bivariate model – SEE – applications. Multiple Regression analysis – calibration of multiple linear models – applications.

## TEXT BOOKS

1. Singaravelu, A, 2017, Probability and Statistics ,S.Chand & publishers
2. Gupta S C and Kapoor V K, 2020, Fundamental of Mathematical Statistics,Sultan Chand & Sons, 12<sup>th</sup> Editon

## REFERENCES

1. Bilal M. Ayyub and Richard H. McCuen, 2003, Probability, Statistics, and Reliability for Engineers and Scientists, Second Edition, Chapman & Hall/CRC.
2. Carlton, Matthew A., Devore, Jay L., 2017, With Applications In Engineering, Science, And Technology, Springer International Publishing.
3. Devore, Jay L., Berk, Kenneth N., 2012, Modern Mathematical Statistics With Applications, Springer – Verlag New York.
4. Holicky, Milan, 2013, Introduction to Probability and Statistics for Engineers, Springer – Verlag Berlin Heidelberg.
5. Montgomery, D.C., Runger, G.C. And Hubele, N.F., 2011. Engineering Statistics. Wiley.
6. Ravichandran L., Probability and statistics for engineers 2000, WILEY – INDIA publishers.

## WEB REFERENCE

[https://onlinecourses.nptel.ac.in/noc23\\_ma24/preview.](https://onlinecourses.nptel.ac.in/noc23_ma24/preview)

## 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 operations and evaluations;
2. Use discrete and continuous random variables to model some aspects of the problem; evaluate the probabilistic characteristics of functions of random variables
3. Perform statistical analyses of the data and hypotheses testing
4. Perform analysis of variance, parameter estimation, confidence – interval selection, and selection of sample sizes
5. Perform correlation and regression analyses for fitting a curve or model to data and formulate algorithms to solve problems.

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

22CEES 402	SOLID MECHANICS	L	T	P	C
		3	0	0	3

## COURSE OBJECTIVES

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

## UNIT I 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.

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 for determinate 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 acylinder, 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, Chennai, 2018.
2. Rajput R.K, *Strength of Materials*, S.Chand& Co., Delhi, 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. Gambiher M.L, *Fundamentals of Solid Mechanics*, PHI Learning Pvt.Ltd., New Delhi, 2009.
5. Timoshenko and Gere, *Mechanics of Materials*, Van NosReinhold, New Delhi, 2004.
6. Bhavikatti S.S, *Solid Mechanics*, Vikas Publishing House Pvt. Ltd., New Delhi, 2014

### 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 to the 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 thin walled members.

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

22CEPC403	SURVEYING	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES:

- To introduce the principles of various surveying methods and survey instruments.
- To expose students to levelling by several methods.
- To learn to handle survey instruments and Area and Volume computations.
- To learn to handle survey instruments Theodolite and Tacheometer
- To learn to measure horizontal and vertical angle, heights and distances.
- To solve problems related to curve settings and astronomical
- To understand applications of surveying to civil engineering projects.

### Unit I

Introduction and Principles of surveying – Classification – Chain surveying – Chaining and ranging – Cross- staff – offset – measurement of area by chain traversing – error – obstacles in chain surveying – problems.

Compass surveying – Prismatic compass only – Instruments – Bearing of survey lines – systems and conversions – Local attraction – Latitude and departure – Traversing – Traverse adjustment of closing errors.

## Unit II

Plane Table surveying – instruments and accessories – advantages and disadvantages of plane table surveying – methods – radiation, intersection, traversing, resection – Two- and three-point problems – errors in plane table surveying.

Levelling – MSL – Datum – Technical terms – level and its types – staffs and its types Temporary adjustment – principles of leveling – Reduction of levels – methods – problems. Different types of leveling – correction for curvature – refraction – gradient of a line – problems.- Contours – Contour interval – Methods of contouring – uses.

## Unit III

Computation of area – mid-ordinate – Trapezoidal method – Simpson’s method – Computation of volume – methods – L/S, C/S – Earth work excavation – storage capacity of reservoir – Setting out buildings – Positioning of structure – foundation setting out.

Theodolite surveying – Vernier theodolite – Temporary and permanent adjustments – Measurement of horizontal and vertical angles – Methods of repetition and reiteration – errors in theodolite surveying – elimination of errors

## Unit IV

Trigonometric Survey – heights and distances – base accessible – base inaccessible – single and double plane methods – numerical problems.

Tacheometric surveying – Principles – Methods – Stadia system –Fixed and Movable hair methods – Methods with staff held vertical and normal – Analytic lens – Subtense bar – Tangential method.

## Unit V

Curves – classification – necessity – elements of simple curve – calculation – degree of simple curve – setting out a simple curve – various methods – difficulties in setting out simple curve – numerical problems related to simple curves only.

Field astronomy – geometry of sphere – spherical triangle – solution – Napier’s rule – various co-ordinate systems – shortest distance between two points – earth surface – Equation of time.

**Project works:** General requirements and specifications for Engineering project surveys, Reconnaissance, Preliminary and Locations surveys for highway, railway and canals; Layout of culverts, canals, bridges and buildings.

## TEXT BOOKS

1. Agor. R, “A text book on Advanced Surveying “, Khanna Publishers, 4<sup>th</sup> Edition, New Delhi, 2007.
2. Arora. K.R., “A text book on Surveying Volume I and II”, Standard Publishers, New Delhi, 2018.
3. Punmia, B.C. *Surveying Vol.I and II, Standard Publishers, 2016*

## REFERENCES

1. Duggal, S.K. Surveying Vol. I and II, Tata McGraw Hill, 4<sup>th</sup> edition, 2017
2. Punmia, B.C., Ashok K.Jain and ArunK.Jain, “Surveying Volume I & II”, Laxmi Publications, 2016.
3. Kanetkar, T.P. and Kulkarni, S.V., “Surveying and Levelling”, Pune VidyarthiGrihaPrakashan, 2006

## WEB REFERENCE

[https://onlinecourses.nptel.ac.in/noc23\\_ce05/preview](https://onlinecourses.nptel.ac.in/noc23_ce05/preview).

## COURSE OUTCOMES

At the end of the course students will be able to

1. Possess knowledge about chain surveying, compass, plane table surveying and levelling.
2. Gain knowledge about Survey Instruments Theodolite, Tacheometer, and their adjustments.
3. Use all surveying equipments; prepare LS & CS, contour maps and carryout surveying works related to civil engineering projects.
4. Plan a survey, taking accurate measurements, field booking, plotting and adjustment of traverse –know the astronomical surveying
5. Plan a survey for applications such as road alignment and height of the building undertake measurement and plotting in civil engineering

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

22CEPC404	APPLIED HYDRAULIC ENGINEERING	L	T	P	C
		3	0	0	3

## COURSE OBJECTIVES

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

## **Unit-I**

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

## **Unit-II**

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 method – use of dimensional analysis.

Model investigation – similitude – types of similarities – dimensionless numbers – Reynolds, Froude, Euler, Mach and Weber numbers – Model laws – types of models – application of dynamic similarity to specific model investigations – 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, power and 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 air vessels. 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, Metropolitan Book Co. Pvt. Ltd. Reprint 2011.
2. Subramanya. K., Flow in open channels, Tata McGraw Hill, New Delhi, 5<sup>th</sup> edition, 2019.

**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), New York, 2010.
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.

**WEB REFERENCE**

[https://onlinecourses.nptel.ac.in/noc\\_ce35/preview](https://onlinecourses.nptel.ac.in/noc_ce35/preview).

**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 state conditions.
4. Understand the working principle of pumps.
5. Understand the working principle of turbines.

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

22CEPC405	SOIL MECHANICS AND FOUNDATION ENGINEERING	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To understand the nature, properties and behavioural response of soils is essential for a safe and stable design of foundations.
- To understand the behaviour of soils as a supporting medium for structures.
- To develop knowledge required for successful structural engineering practice

### UNIT I

Introduction–Types of soils, Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weight, degree of saturation, voids ratio, porosity, specific gravity. Relationship between volume weight, voids ratio-moisture content, unit weight-percent air voids, Determination of moisture content by oven dry method, pycnometer, Specific gravity by density bottle method, pycnometer method, unit weight by core-cutter method, sand-replacement method.

### UNIT II

Plasticity Characteristics of Soil – Determination and use of consistency limits- plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Classification of Soils- particle size classification, textural classification, unified soil classification system, Indian standard soil classification system.

### UNIT III

Shear Strength: Definition, Shear strength parameters and theory, shear strength of cohesive and non-cohesive soil. Different shear tests- Direct shear test, Tri-axial shear test, Un confined compression test, Vane shear test. Merits and demerits of Tri-axial shear test. Problems on shear tests.

### UNIT IV

Permeability of Soil –Darcy’s law, validity of Darcy’s law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping-in test, pumping-out test. Permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis-Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets. Problems on permeability tests.

### UNIT V

Necessity for shallow foundations –Bearing capacity of shallow foundation, Terzaghi’s formula and IS code formula –Factors affecting bearing capacity. Allowable bearing pressure – Safe bearing capacity. Problems. Types of piles and their function – Factors influencing the selection of pile, Effective length –Point of inflection –Load carrying capacity of single pile in cohesion less and cohesive soils as per relevant IS standards–static formula – Dynamic formulae (Engineering news and Hiley’s),Problems. Negative skin friction – Uplift capacity – Settlement of Foundations – Ground Improvement techniques – Geotechnical applications for Roads.

## TEXT BOOKS

1. Dr. Punmia.B.C, “Soil Mechanics & Foundation Engineering”, Lakshmi Publications, 2017.
2. Moorthy, V.N.S., “Soil Mechanics & Foundation Engineering”, CRS Press, 2018

## REFERENCES

1. Arora, “Soil Mechanics & Foundation Engineering”, Standard Publishers Distributors, 2020
2. SP 36 – 1 (1987): “Compendium of Indian Standards on Soil Engineering: Part-1 Laboratory Testing of Soils for Civil”, Bureau of Indian Standards, New Delhi.
3. Shamsheer Prakash, “Problems in Soil Mechanics”, Asia Publishing House, 1972.
4. Terzaghi, K. and Peck.R.B, “Soil Mechanics in Engineering Practice”, John Wiley & Sons, 1996.
5. Venkataramaiah. C, “Geotechnical Engineering”, New Age International Publishers, 2017

## WEB REFERENCE

[https://onlinecourses.nptel.ac.in/noc23\\_ce32/preview](https://onlinecourses.nptel.ac.in/noc23_ce32/preview)

## COURSE OUTCOMES

On completion of this module, the student must be able to:

1. Understand the different types of soil based on their formation mechanism and relationships of the soil
2. Understand the behaviour of soils based on their moisture contents and classify any soils based on their particle size distribution and index properties;
3. Understand the physical significance of effective stress and its relation with pore pressure.
4. Effect of capillary action and seepage flow direction on the effective stress at a point in the soil mass.
5. Understand the soil characters such as shear strength and stress distribution.
6. IS 2911 & IS 4651

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



22CEPC406	STRENGTH OF MATERIALS	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To know the method of finding slope and deflection of beams and trusses using energy theorems and to know the concept of analysing indeterminate beam.
- To estimate the load carrying capacity of columns, stresses due to unsymmetrical bending and various theories for failure of material.
- To analyse the members subjected to axial, bending, and torsional loads.

#### Unit-I : Energy Principles

Strain energy and strain energy density – strain energy due to axial load (gradual, sudden and impact loadings), shear, flexure and torsion – Castigliano’s theorems – Maxwell’s reciprocal theorem – Principle of virtual work – UNIT load method – Application of energy theorems for computing deflections in determinate beams, plane frames and plane trusses – lack of fit and temperature effects – Williot Mohr’s Diagram.

#### Unit-II : State of Stress in Three Dimensions

Stress tensor at a point – Stress invariants – Determination of principal stresses and principal planes – Volumetric strain. Theories of failure: Maximum Principal stress theory – Maximum Principal strain theory – Maximum shear stress theory – Total Strain energy theory – Maximum distortion energy theory – Application problems.

#### Unit-III : Columns and Cylinders

Euler’s column theory – critical load for prismatic columns with different end conditions – Effective length – limitations – Rankine – Gordon formula – Eccentrically loaded columns – middle third rule – core of a section – Thin cylindrical and spherical shells – stresses and change in dimensions – Thick cylinders – Compound cylinders – shrinking on stresses.

#### Unit-IV : Indeterminate Beams

Concept of Analysis – Propped cantilever and fixed beams – fixed end moments and reactions – sinking and rotation of supports – Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

#### Unit-V : Advanced Topics

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – Shear Centre – curved beams – Winkler Bach formula – stresses in hooks.

### TEXT BOOKS

1. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, "Theory of Structures" (SMTS) Vol – II, Laxmi Publishing Pvt Ltd, New Delhi 2017.
2. Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 3<sup>rd</sup> edition, 2017.

## REFERENCES

1. Kazimi S.M.A., Solid Mechanics, Tata McGraw Hill Publishing Co., New Delhi, 2017
2. William A. Nash, Theory and Problems of Strength of Materials, Schaum's Outline Series, Tata McGraw Hill Publishing company, 6<sup>th</sup> edition, 2013
3. Singh. D.K., Strength of Materials, Ane Books Pvt. Ltd., New Delhi, 2020.
4. Egor P Popov, Engineering Mechanics of Solids, 2<sup>nd</sup> edition, PHI Learning Pvt. Ltd., New Delhi, 2<sup>nd</sup> edition, 2015.
5. Rajput R.K., Strength of Materials (Mechanics of Solids, S.Chand & company Ltd., New Delhi, 2015.
6. Basavarajiah and Mahadevapa, Strength of Materials, University press, Hyderabad, 2016.

## COURSE OUTCOMES

Students will be able to

1. Determine the strain energy and compute the deflection of determinate beams, frames and trusses using energy principles.
2. Analyze propped cantilever, fixed beams and continuous beams using theorem of three moment equation for external loadings and support settlements.
3. Find the load carrying capacity of columns and stresses induced in columns and cylinders
4. Determine principal stresses and planes for an element in three dimensional state of stress and study various theories of failure
5. Determine the stresses due to unsymmetrical bending of beams, locate the shear center, and find the stresses in curved beams

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

<b>22ETHS407</b>	<b>UNIVERSAL HUMAN VALUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		2	1	0	3

### **COURSE OBJECTIVES**

- Development of a holistic perspective based on self-exploration about themselves (human being), 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**

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

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

### **UNIT-II UNDERSTANDING HARMONY IN THE HUMAN BEING – HARMONY IN MYSELF!**

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

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

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

- 3.1 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.
- 3.2 Understanding the meaning of Trust; Difference between intention and competence.
- 3.3 Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
- 3.4 Understanding the harmony in the society (society being an extension of family): resolution, prosperity, fearlessness (trust) and co-existence as comprehensive Human goals.
- 3.5 Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life 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 AS COEXISTENCE**

- 4.1 Understanding the harmony in the Nature.
- 4.2 Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self- regulation in nature.
- 4.3 Understanding existence as co-existence of mutually interacting units in all-pervasive space.
- 4.4 Holistic perception of harmony at all levels of existence.

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

### **UNIT-V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS**

- 5.1 Natural acceptance of human values.
- 5.2 Definitiveness of Ethical Human Conduct.
- 5.3 Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
- 5.4 Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- 5.5 Case studies of typical holistic technologies, management models and production systems.
- 5.6 Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations.
- 5.7 Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

### TEXT BOOK

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2020

### REFERENCE BOOKS

- 1 Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 3<sup>rd</sup> edition, 2019
- 2 The Story of My Experiments with Truth – by Mohandas Karamchand Gandhi
- 3 Small is Beautiful – E. F Schumacher.
- 4 Slow is Beautiful – Cecile Andrews
- 5 Economy of Permanence – J Ckumarappa
- 6 Rediscovering India – by Dharampal

### COURSE OUTCOMES

By the end of the course,

Students are expected to become more aware of themselves, and their surroundings (family, society, nature);

1. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
2. They would have better critical ability.
3. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
4. They 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.
5. This is only an introductory foundational input. It would be desirable to follow it up by
6. Faculty-student or mentor-mentee programs throughout their time with the institution
7. Higher level courses on human values in every aspect of living. E.g. as a professional

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

<b>22CECP408</b>	<b>SURVEYING LABORATORY – I</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b> <b>(2*2)</b>	<b>2</b>

### **COURSE OBJECTIVES**

- To conduct experiments on Surveying and Levelling.
- Understand the principles of surveying.
- Know about compass surveying and plane table surveying.
- Understand the concepts of leveling and its applications.

### **LIST OF EXPERIMENTS**

#### **I. Chain Surveying**

Study of Chains and its accessories

Ranging a line and taking offsets

Cross – Staff Survey (Area of a traversing by Chain triangulation)

#### **II. Compass Surveying**

Study of prismatic compass and its accessories

Determination of area of an extent by radiation methods

Open Traversing and Closed Traversing

Determination of distance of two inaccessible points

#### **III. Plane Table Surveying**

Study of Plane Table Accessories

Determination of Area of an extent by radiation method

Determination of distances using Intersection method

Determination of a point using resection – Three point problem

#### **IV. Levelling**

Study of Dumpy level and Telescopic Levelling staff

Simple Leveling – Determination of Reduced levels using Height of Collimation Method

Simple Leveling – Determination of Reduced levels using Rise & Fall Method

Differential Leveling – Determination of Reduced levels using Height of Collimation Method

Differential Leveling – Determination of Reduced levels using Rise & Fall Method

## TEXT BOOKS

1. Agor R., A text book on Advanced Surveying, Khanna Publishers, 4<sup>th</sup> Edition, New Delhi, 2007.
2. Arora K.R., A text book on Surveying Volume I and II, Standard Publishers – New Delhi, 2019

## REFERENCES

1. Punmia, B.C., Ashok K. Jain and Arun K. Jain (2005). Surveying Volume I & II Laxmi Publications, 2016.
2. Kanetkar, T.P. and Kulkarni, S.V., Surveying and Levelling, Pune Vidyarthi Griha Prakashan, 2006.
3. Heribert Kahmen and Wolfgang Faig, Surveying, Walter de Gruyter, 1995.
4. Clark D., Plane and Geodetic Surveying, Vols. I and II, C.B.S. Publishers and Distributors, Delhi, Sixth Edition

## COURSE OUTCOMES

At the end of the course students will be able to

1. Possess knowledge on traversing using conventional surveying instruments.
2. Determine the area of the traverse.
3. Find out the inaccessible distance between the points.
4. Determine the difference in elevation and setting the MSL in the various locations.
5. Gain overall knowledge about Survey Instruments, their care and adjustments.

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

<b>22CECP409</b>	<b>HYDRAULIC ENGINEERING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

### **COURSE OBJECTIVES**

Students will be able to

- Verify the principles studied in the course applied hydraulic engineering by performing the experiments.
- Determine the characteristics of various types of Positive displacement pumps
- To understand the applications of impulse momentum principles
- Determine the characteristics of various types of roto dynamic

### **LIST OF EXPERIMENTS**

#### **I. PUMPS**

Determine the performance Characteristics of Centrifugal pumps (Elmo Pump)

Determine the performance Characteristics of Gear pump

Determine the performance Characteristics of Submersible pump

Determine the performance Characteristics of Reciprocating pump

Determine the performance Characteristics of Agricultural pump

Determine the performance Characteristics of Submersible pump

#### **II. Turbines**

Determine the performance Characteristics of Pelton wheel turbine

Determine the performance Characteristics of Francis turbine/Kaplan turbine

### **REFERENCES**

1. Sarbjit Singh."Experiments in Fluid Mechanics", Prentice Hall of India Pvt. Ltd, Learning Private Limited, Delhi, 2009.
2. "Hydraulic Laboratory Manual", Centre for Water Resources, Anna University, 2004.
3. Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2000.
4. Subramanya K. "Flow in open channels", Tata McGraw Hill Publishing Company, 2001.

### **COURSE OUTCOMES**

The students will be able to

1. Gaining knowledge to calculate and design engineering applications involving fluid.
2. Analyze the characteristics of Positive displacement pump.
3. Develop the characteristics curves, thus specific speed can be arrived for the rotodynamic pumps.
4. Determine the performance Characteristics of turbines



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

22CECP410	STRENGTH OF MATERIALS LABORATORY	L	T	P	C
		0	0	3	1.5

### COURSE OBJECTIVES

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

### 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 specimens
5. Impact test
6. Hardness tests on different metals
7. Test on helical springs
8. Torsion test

### REFERENCES

1. Rajput. R.K., Strength of Materials, S.Chand & Co., September 2000.
2. Dr. Punmia. B.C, et al., Strength of Materials and Theory of Structures – Vol.1, Laxmi Publications, 2000.
3. Sadhu Singh, Strength of Materials, Khanna Publishers, New Delhi, 1988.
4. Ramamrutham. S., Strength of Materials, Dhanpat Rai sons, New Delhi, 1992.
5. Hiraskar. G.K., Strength of Materials, Khanna Publishers, New Delhi, 1984.

## COURSE OUTCOMES

At the end of the course students will be able to

1. Understand the different material properties.
2. Gain knowledge between the stress and strain,
3. Develop the Young's modulus and Poisson's ratio
4. Understand the different loading conditions such as traverse and axial
5. Determine the hardness of different metals

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

## FIFTH SEMESTER

22CEPC501	ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	0	0	3

## COURSE OBJECTIVES

- To make the students conversant with basic principles of water and wastewater engineering.
- To learn about collection, conveyance, characterization, treatment and disposal of water and wastewater.
- To apply knowledge of mathematics, physics, chemistry, and microbiology to solve and analyze engineering problems related to water and wastewater collection, transport, quality and treatment.

### Unit-I

Objectives of public water supply schemes; Health acceptability, adequacy, convenience and economy. Per Capita Demand – Population forecasting – Variation in demand pattern Surface and Sub – Surface water sources – Typical Characteristics – Impounded storage reservoirs – Mass curve analysis – Infiltration. Pipes, Wells and Galleries – Tube wells – Construction – Sea & Back water sources – Intake Structures.

## **Unit-II**

Pipe and Channels for transmitting water – Hydraulics of pipe flow – Use of charts and Nomograms for flow computations – Materials for pipes and conduits; Alloys of Steel, Cement Composites and Plastic pipes – Pipe losses – Laying, Jointing and Testing – Appurtenances of pipes – Pumps and Pumping stations – Selection of pumps.

## **Unit-III**

Unit-processes of water treatment – Screening – Coagulation & Flocculation – Clarifier – Clariflocculator – Media Filters: Gravity & Pressure – Filter Medias: Sand, Activated Carbon, Mixing basins – Principles of disinfection – Methods of Disinfection; Chlorination, UV Radiation, Ozonation, etc., – Water softening: Cationic, Anionic and Mixed Beds – Iron and Manganese removal – Operation and maintenance aspects.

## **Unit-IV**

Sewage, Sewer and Sewerage – Collections & Conveyance of sewage – Classification of sewerage system – Quantity of sewage – Fluctuation of sewage flow – Hydraulics of sewers – Self cleaning velocity – Shapes of sewers – Hydraulic design of sewers – Hydraulic design of storm water drains.

## **Unit-V**

Primary & Secondary Treatment processes in wastewater treatment – Aerobic, Anaerobic and combinations of processes – Screens, Grit chamber, Settling tanks, Septic tanks and disposal arrangements. Aerobic and anaerobic processes – Methods of aeration – Activated sludge process – Trickling filter – advanced processes – anaerobic digester – UASBR – Dewatering of sludge – disposal of sludge.

## **TEXT BOOKS**

1. Garg S.K., Water Supply Engineering, Khanna Publishers, Delhi, 3th edition
2. Duggal K.N., Elements of Environmental Engineering, S.Chand & Company, New Delhi, 2004.

## **REFERENCE BOOKS**

1. Arcadio P. Sincerosr, Gregoria A. Sincero, Environmental Engineering a Design Approach, Prentic Hall, New Delhi, 2002.
2. Glynn Henry J. & Gary W.Heinke, Environmental Science and Engineering, Prentice Hall of India, New Delhi, 2004.
3. Garg.S.K, Waste DisPOsal Engineering, Khanna Publishers, New Delhi, 2005.
4. Manser A.G.R. and Keeling A.A, Practical Hand book of Processing and Recycling of Municipal solid Wastes, Lewis Publishers, CRC Press, Taylor & Francis Books India Pvt. Ltd., New Delhi, 1996.
5. Punmia.B.C, Environmental Engineering – II, Laxmi Publications (P) LTD, 2005.
6. Garg.S.K, Sanitary Engineering, Khanna Publishers, New Delhi, 2005.
7. George Tchobanoglous and Frank Kreith, Hand book of Solid waste Management, McGraw Hill, New York, 2002.

## WEB REFERENCE

[https://onlinecourses.nptel.ac.in/noc23\\_ce12/preview](https://onlinecourses.nptel.ac.in/noc23_ce12/preview).

## COURSE OUTCOMES

At the end of the course students will be able to

1. Apply the main procedures and methods of treatment for water and wastewater.
2. To understand the supply and distribution systems.
3. Explain different methodologies for collection and conveyance of water and wastewater.
4. Examine the physical, chemical and biological characteristics of water and wastewater.
5. Suggest suitable methods for treatment and disposal.

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

22CEPC 502	ADVANCED SURVEYING	L	T	P	C
		3	0	0	3

## COURSE OBJECTIVES:

- To understand the geodetic measurements and control survey methodology and its adjustments.
- To understand the use Astronomy, modern surveying such as Total Station and GPS
- To introduce the concepts of various Engineering Project Survey.

### Unit I – Triangulation Survey

Horizontal and vertical control – triangulation – principle – purpose – classification – field work – triangulation station marking – signals – inter visibility of stations – numeric problems – baseline measurements – methods.

Errors in surveying – types – accidental errors – laws of weights – standard error – methods – methods of correlates – normal equation method – least squares.

## **Unit II – Aerial Survey**

Terrestrial Photogrammetry – Terrestrial stereo photogrammetry – Aerial photogrammetry – overlaps – scale of photographs – Vertical and titled photographs distortion in aerial photographs – stereoscopic vision – photo interpretation – Applications.

## **Unit III – Total Station Survey**

Classification – basic measuring and working principles of an Electro – optical and Microwave total station- sources of errors in Electro – optical and Microwave total station – Care and Maintenance of total station – trilateration – Applications.

## **Unit IV – GPS Survey**

Basic concepts – Space, Control and User segments – Satellite configuration – Signal structure – Orbit determination and representation – Ant spoofing and selective availability – hand held and geodetic receivers – Field work procedure – Data processing Applications.

## **Unit V – Miscellaneous**

Reconnaissance – Rout surveys for highways, railways and waterways –setting out methods – hydrographic surveying – tides – MSL – Sounding methods – measurement of current and discharge – Tunnel alignment and setting out – Settlement and Deformation studies.

**Engineering project surveys-** requirements and specifications, various stages of survey work Setting out works- simple circular curves and Building Marking using Total stations – Area Computation Using GPS.

## **TEXT BOOKS**

1. James M.Anderson and Edward M.Mikhail, “Surveying, Theory and Practice”, 7<sup>th</sup> Edition, McGraw Hill, 2001.
2. Bannister and S.Raymond, “Surveying”, 7<sup>th</sup> Edition, Longman 2004.
3. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3<sup>rd</sup> Edition, 2004.
4. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1993.

## **REFERENCES**

1. Roy S.K., “Fundamentals of Surveying”, 2<sup>nd</sup> Edition, Prentice Hall of India, 2004.
2. Arora K.R. “Surveying Vol I & II”, Standard Book House, 10<sup>th</sup> Edition 2008.
3. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer – Verlag, Berlin, 2003.
4. Seeber G, Satellite Geodesy, Water De Gruyter, Berlin,1998.

## **Course Outcomes**

On completion of this course, the student shall be able to

1. Understand the concept of geodetic Survey and its corrections
2. Do the photogrammetric surveying and interpretation

3. Solve the field problems with Total station
4. Know the GPS surveying and the data processing
5. Understand the route surveys and tunnel alignments

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

<b>22CEPC503</b>	<b>STRUCTURAL ANALYSIS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### COURSE OBJECTIVES

- To understand the background on principles of structural Analysis
- Students will be exposed to the theories and concepts of both concrete and steel design and analysis both at the element and system levels
- Hands – on design experience and skills will be gained and learned through problem sets

#### Unit-I

Analysis for moving loads – Influence Line Diagram (ILD) – Muller Breslau Principle for Influence Lines – ILD for simply supported beams – ILD for simple supported beams – ILD for single over hang beams – ILD for Propped cantilever beams with flexural hinges – simply simple 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 – ILD for Simple Plane truss problems. ILD for continuous beams and rigid frames (no problems) – Indirect model analysis for indeterminate structures.

#### Unit-II

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

### **Unit–III**

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 sample support level and different support levels. ILD for moving loads over suspension bridges. Analysis Beams Curved in Plan – Analysis of Space trusses using tension coefficient method.

### **Unit–IV**

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 methods: substitute frame method for gravity loads, Portal and cantilever methods for lateral loads. Simple frames used for water tanks, industrial bends, bunkers and silos Staggering.

Plastic Bending Beams – Assumptions – Plastic moment of resistance – Plastic Modulus Shape and Load factors – Plastic hinge and mechanism – Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems.

### **TEXT BOOKS**

1. Punmia.B.C, et al, Theory of Structures – Vol.I & II, Lakshmi Publications, New Delhi, 2017.
2. Ramamrutham.S & Narayan.R, (1993) Theory of Structures, Dhanpat Rai and Sons, 2014.

### **REFERENCES**

1. Bhavikatti.S.S, Structural Analysis, Vol. I and II, Vikas Publishing House Pvt.Ltd., New Delhi, 4<sup>th</sup> edition.
2. Reddy.C.S, Basic Structural Analysis, Tata McGraw Hill Book Co., New Delhi, 2017
3. Wang.C.K, Intermediate Structural Analysis, Tata McGraw Hill Book Co., New Delhi, 1984.
4. Vazirani and Ratwani, Analysis of Structures – Vol.I.& II, Khanna Publishers, New Delhi, 1999
5. Devdas Menon, —Structural Analysis, Narosa Publishing House, New Delhi, 2009.
6. Viadyanathan. R and Perumal. P, Comprehensive Structural Analysis Vol. I & II, Laxmi Publications, New Delhi, 2003.
7. Negi.L.Sand Jangid.R.S, Structural Analysis, Tata McGraw Hill Book Co., New Delhi, 2003.

8. Gambhir, M.L., Fundamentals of Structural Mechanics and Analysis, PHI Learning Pvt. Ltd., New Delhi, 2011

## WEB REFERENCE

[https://onlinecourses.nptel.ac.in/noc23\\_ce28/preview](https://onlinecourses.nptel.ac.in/noc23_ce28/preview).

## COURSE OUTCOMES

At the end Students will be able to

1. Analyze the indeterminate structures like beams and frames with different end conditions.
2. Explain the concepts of influence lines and its effects.
3. Analyse the arch structures and suspension cable bridges.
4. Solve the structural problems with different methods of analysis.
5. Solve the problems on trusses and elements.

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

22CEPC504	STRUCTURAL CONCRETE DESIGN	L	T	P	C
		3	0	0	3

## COURSE OBJECTIVES

- To introduce the different types of philosophies related to design of basic structural elements such as slabs, beams and columns with reference to Indian standard code of practice.
- To learn to design footings.

## Unit-I

Objectives of 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 alone: 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: 1987 and IS 13920: 1993.

### **Unit-III**

Shear – Shear stresses distribution in rectangular beams – Shear stress distribution in flanged beams – Shear stresses distribution in rectangular beams due to torsion – Design shear strength of concrete – Flexural shear code recommendations for rectangular and flanged sections – Problems. Bond – Factors affecting bond resistance as per IS 456:2000 – Check for development length – Check for crack width – Deflection computations – short term and long term. Design of one and two way concrete slabs – Circular slabs – Cantilever slabs – Dog legged staircase as per IS 456:2000 standards – Reinforcement detailing as per SP 34: 1987 and IS 13920: 1993.

### **Unit-IV**

Design of Short and Slender Columns as per IS 456:2000 standards – Design of Columns subjected to axial compression and uni – axial bending – Columns subjected to axial compression and biaxial bending – Axial load verses moment Interaction charts – Reinforcement detailing as per SP 34: 1987 and IS 13920: 1993.

### **Unit-V**

Design of Isolated rectangular footings with concentric column loads – Design of Isolated rectangular footings with eccentric column loads – Design of circular footings with concentric column loads – Design of combined footings – Reinforcement detailing as per SP 34: 1987 and IS 13920: 1993.

### **TEXT BOOKS**

1. Unnikrishna Pillai S. And Devdas Menon, Reinforced Concrete Design, Tata McGraw Hill Publications, 4<sup>th</sup> edition, 2021.
2. Krishnaraju N., Advanced R.C. Design, Tata McGraw Hill Publications, 3<sup>rd</sup> edition..

### **REFERENCES**

1. Shah. V.L. and Karve, Illustrated R.C. Design, Structures Publications, 2010.
2. Ramamrutham S. and Narayan. R., Design of R.C. Structures, Dhanpat Rai & Sons, 2016.
3. Mallick. S.K. and Gupta A.P., Reinforced Concrete, Oxford I B H, 2014
4. Punmia. B.C., et al., R.C. Structures – Vol. I & II, Laxmi Publications, 1<sup>st</sup> edition, 2007.

## STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
2. IS 13920: 1993, Code of Practice for 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.

## COURSE OUTCOMES

At the end of the course students will be able to

1. Understand the behaviour of Reinforced Concrete and its design philosophies.
2. Gain knowledge about the rudimentary principles of designing reinforced concrete structural elements as per the existing codes.
3. Learn the stress distribution and flexural shear for different elements
4. Develop the knowledge on designing the columns
5. Learn the designing the footing for various structures

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

22CECP508	ENVIRONMENTAL ENGINEERING LABORATORY	L	T	P	C
		0	0	3	1.5

## COURSE OBJECTIVES

- To quantify water and wastewater pollutants.
- To determine concentration of air pollutants.
- To analyze the characteristics of water, wastewater and ambient air.
- To study the growth of microorganisms and its quantification.

## LIST OF EXPERIMENTS

1. Determination of **Chloride** content in water sample.

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

## REFERENCES

1. AWWA, WEF, Standard Methods for the Examination of Water and Wastewater, APHA, 2005.
2. Sawyer, C.N., McCarty, P.L., and Parkin, G.F., Chemistry for Environmental Engineering, 4<sup>th</sup> Edition, Tata McGrawHill Publishing Company Limited, 2000.
3. Environmental Engineering Laboratory Manual by B. Kotain & Dr. N. Kumarswamy – NEERJ Laboratory Manual.
4. Droste, R.L. and Gehr, R.L., 2018. Theory and practice of water and wastewater treatment. John Wiley & Sons

## COURSE OUTCOMES

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

1. Quantify the pollutant concentration in water, wastewater and ambient air.
2. Recommend the degree of treatment required for water and wastewater.
3. Analyze the survival conditions for the microorganisms and their growth rate.
4. Recommend the quantity of chemicals required for water treatment
5. Give suggestion and remedy for water treatment

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

<b>22CECP509</b>	<b>SURVEYING LABORATORY – II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

### **COURSE OBJECTIVES**

- To conduct experiments on Theodolite Surveying
- To determine the height of the object by Trigonometric leveling
- To find out the tacheometric constant
- To find out the horizontal distance and elevation by tacheometric surveying

### **LIST OF EXPERIMENTS**

#### **I. Theodolite and Trigonometric Surveying**

Study of Transit theodolite, fundamentals of various accessories

Measurement of horizontal angle by repetition method

Measurement of horizontal angle by reiteration method

Trigonometric leveling – Single plane method – Base accessible

Trigonometric leveling – Single plane method – Base inaccessible

Trigonometric leveling – Double plane method – Base inaccessible

#### **II. Tacheometric Surveying**

Determination of tacheometric constants

Determination of Distance and elevation by stadia hair method

Determination of Distance and elevation by tangential method

Determination of Gradient of a line using stadia hair and tangential method

Determination of distances and heights using Subtense bar

#### **III. Demonstration**

Study of GPS

Study of Total Station

#### **IV. Survey Camp (One Week Mandatory)**

Longitudinal Section and Cross Section of Canal / Bund

Block Contouring

Hill Contouring

Setting out work – Simple Curves

Building Marking

### **TEXT BOOKS**

1. Agor, R., A text book on Advanced Surveying, Khanna Publishers, 4<sup>th</sup> Edition, New Delhi, 2007.

- Arora, K.R., A text book on Surveying Volume I and II, Standard Publishers New Delhi, 2006.

## REFERENCES

- Punmia, B.C., Ashok K. Jain and Arun K. Jain, Surveying Volume I & II, Laxmi Publications, 2005.
- Kanetkar, T.P. and Kulkarni, S.V., Surveying and Levelling, Pune Vidyarthi Griha Prakashan, 1988.
- Heribert Kahmen and Wolfgang Faig, Surveying, Walter de Gruyter, 1995.
- Clark D., Plane and Geodetic Surveying, Vols. I and II, C.B.S. Publishers and Distributors, Delhi, Sixth Edition

## COURSE OUTCOMES

At the end of the course students will be able to

- POssess the knowledge to find the horizontal and vertical angle by theodolite surveying
- To find out the inaccessible distance by theodolite surveying
- To find out the difference in elevation by tacheometric surveying
- To find out the gradient between the points
- Possesses the knowledge of GPS and Total Station

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

<b>22CECP510</b>	<b>SOIL MECHANICS LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

### **COURSE OBJECTIVES**

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

### **LIST OF EXPERIMENTS**

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"1983.
2. Taylor, John Wiley & Sons, "Fundamentals of Soil Engineering".2001.
3. Holtz R.D. and Kovacs, W.D., Prentice, "An Introduction to Geotechnical Engineering", Hall, NJ.1995.
4. Braja M. Das, Cengage Learning, "Principles of Geotechnical Engineering.1985.

5. Braja M. Das, Cengage Learning, “Principles of Foundation Engineering.1983.
6. David F. McCarthy, “Essentials of Soil Mechanics and Foundations: Basic Geotechnics”.2001.
7. Karl Terzaghi, Ralph B. Peck, and Gholamreza, “Soil Mechanics in Engineering Practice”1985.
8. V.N.S. Murthy, “Geotechnical Engineering: Principles and Practices of SoilMechanics and FoundationEngineering (Civil and Environmental Engineering)”.1983.

### **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 types for finding their properties.
4. To classify the soils by its size and type.
5. To know the consistency limits of soils and consolidation process for the usefulness of practical applications.

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

<b>22ETIT511</b>	<b>INDUSTRIAL TRAINING / RURAL INTERNSHIP/INNOVATION/ENTREPRENEURSHIP</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>TR</b>	<b>S</b>	<b>4</b>
		<b>1</b>	<b>2</b>		

### **COURSE OBJECTIVES**

- To expose students to the ‘real’ working environment and get acquainted with the organization structure, business operations and administrative functions.
- To have hands – on experience in the student’s related field so that they can relate and reinforce what has been taught at the university.

- To promote cooperation and to develop synergetic collaboration between industry and the university in promoting a knowledgeable society.
- To set the stage for future recruitment by potential employers

### **COURSE OUTCOMES**

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

1. Demonstrate the ability to identify, formulate and solve engineering problems.
2. Demonstrate the skills to use modern engineering tools, software's and equipment to analyze problems.
3. Demonstrate the knowledge of professional and ethical responsibilities.
4. Understand the impact of engineering solutions on the society and also will be aware of contemporary issues.
5. Develop confidence for self education and ability for life – long learning

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



## SIXTH SEMESTER

22CEPC601	HIGHWAY ENGINEERING	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To enable students to differentiate between road pavement structures, to analyze road pavement structures, to differentiate between the different types of materials used and to design road pavements.
- Maintenance of highways as per IRC standards, specifications and methods.
- To give the students the satisfaction of producing for themselves a full road pavement design, they are taken through one of the available methods and they perform examples so they can see how the principles and their application come together in a design

### Unit-I : Highway Planning and Alignment

Significance of highway planning – Modal limitations towards sustainability – History of road development in India – factors influencing highway alignment – Soil suitability analysis.

Road ecology – Engineering surveys for alignment, objectives, conventional and modern methods – Classification of highways – Locations and functions – Typical cross sections of Urban and Rural roads.

### Unit-II : Geometric Design of Highways

Cross sectional elements – Sight distances – Horizontal curves, Super elevation, transition curves, widening at curves – Vertical curves – Gradients, Special consideration for hill roads – Hairpin bends – Lateral and vertical clearance at underpasses.

### Unit-III : Design of Flexible and Rigid Pavements

Pavement components and their role – Design principles – Design practice for flexible and rigid Pavements (IRC methods only) – Embankments – Problems in Flexible pavement design.

### Unit-IV : Highway Construction Materials and Practice

Highway construction materials, properties, testing methods – CBR Test for subgrade – tests on aggregate & bitumen – Test on Bituminous mixes – Construction practice including modern materials and methods, Bituminous and Concrete road construction, Polymer modified bitumen, Recycling, Different materials – Glass, Fiber, Plastic, Geo – Textiles, Geo – Membrane (problem not included) – Quality control measures – Highway drainage – – Construction machineries.

### Unit-V : Evaluation and Maintenance of Pavements

Pavement distress in flexible and rigid pavements – Types of maintenance – Pavement Management Systems – Pavement evaluation, roughness, present serviceability index, skid resistance, structural evaluation, evaluation by deflection measurements – Strengthening of pavements – Highway Project formulation.

## TEXT BOOKS

1. Khanna.S. K., Justo C.E.G. and Veeraragavan A. “Highway Engineering”, New Chand Publishers,10<sup>th</sup> edition, 2018
2. Kadiyalil.R.,“Principles and Practice of Highway Engineering”, Khanna Technical Publications, 8<sup>th</sup>edition Delhi, 2018.

## REFERENCES

1. Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements,(Third Revision), IRC: 37 – 2012.
2. Indian Road Congress (IRC), Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, ( Third Revision), IRC: 58 – 2012.
3. Yang H. Huang, “Pavement Analysis and Design”, Pearson Education Inc, Ninth Impression, South Asia, 2012.
4. Ian D. Walsh, “ICE manual of highway design and management”, ICE Publishers, Ist Edition, USA, 2011.
5. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, “Principles of Highway Engineering and Traffic Analysis”, Wiley India Pvt. Ltd., New Delhi, 2011
6. Garber and Hoel, “Principles of Traffic and Highway Engineering”, CENGAGE Learning, New Delhi, 2010.
7. O’Flaherty.C.A “Highways, Butterworth – Heinemann, Oxford, 2006.
8. IRC – 37 – 2012,The Indian roads Congress, Guidelines for the Design of Flexible Pavements, New Delhi.
9. IRC 58 – 2012. The Indian Road Congress, Guideline for the Design of Rigid Pavements for Highways, New Delhi.
10. Subramanian K.P., “Highways, Railways, Airport and Harbour Engineering”, Scitech Publications (India), Chennai, 2018.

## WEB REFERENCE:

[https://onlinecourses.nptel.ac.in/noc22\\_ce94/preview](https://onlinecourses.nptel.ac.in/noc22_ce94/preview)

## CASE STUDIES

1. Pardeep Oad, Stephen L. Kajewski, Arun Kumar., Innovation in Road Construction Industry: An Analysis of Different, Case Studies Conference: The International Conference on Civil Infrastructure and Construction.
2. Rushikesh P. Dangar, DR. F.S.Umrigar, DR. L.B.Zala., Pavement Deterioration ‘A Case Study On National Highway 8b Section Rajkot-Bamanbore (Km 185/0-Km 216/8)’,., National Conference on Recent Trends in Engineering & Technology.

## COURSE OUTCOMES

Students will be able to

1. Get knowledge on planning and aligning of highway.
2. Geometric design of highways

3. Design flexible and rigid pavements.
4. Gain knowledge on Highway construction materials, properties, testing methods
5. Understand the concept of pavement management system, evaluation of distress and maintenance of pavements.

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

22CEPC602	STRUCTURAL STEEL DESIGN	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To design simple steel elements and the corresponding fastening systems are dealt with the course.
- To learn the design of steel structural elements along with advanced design concepts to enhance their design concepts with the relevant codal standards.

### Unit-I

Introduction to Structural steel and their types – Advantages of structural steel – Design mythology – Limit State Design – Stress – strain curve of structural steels – Partial safety factors for loads and Materials – Deflection Limits. Bolted connections – shear capacity – Tension capacity – Bearing Capacity – Bolts subjected to combined shear and tension – Design of connections as per IS 800 – 2007 provisions. Welded connections – Butt joint – Lap joint – weld subjected to combination of normal and shear stress – combination of bearing bending and shear – Design of connections as per IS 800 – 2007 provisions.

Wind on Industrial steel Buildings – Design wind speed and pressure – Internal and external wind pressure coefficients form codes – 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 and across wind.

### 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 IS 800 – 2007 provisions.

Compression members – Effective lengths – Slenderness ratios – Imperfection factor – Stress reduction factor – Buckling class of cross sections – Design details – Column Bases Angle Struts – Laced Columns – Battened columns – Design of compression members as per IS 800 – 2007 provisions.

### **Unit–III**

Industrial buildings – Types – Elements of an industrial building – Loads on industrial buildings – Roof trusses – Components of a roof truss – Loads on roofs – Analysis and Design of roof truss. Tubular Trusses, joint details, tubular scaffoldings. Analysis and design of hoarding structures under dead live and wind load conditions (SP 64 -2001).

### **Unit–IV**

Beams – Effective span of Beams – Design strength in Bending Torsional Buckling – Effective Length for simply supported beams – Shear – Beams of unsymmetrical sections – Plate girders – Elements of a plate girder Design of beams and plate girders as per IS 800 – 2007 provisions. Design of gantry girder – Braced industrial buildings – Un – braced industrial frames – Base plate with anchor bolt details – detailing as per IS standards.

### **Unit–V**

Plastic analysis and design – Advantages and disadvantages – Plastic bending of beams – 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 and frames.

Cold Form light gauge section – Type of cross section, Stiffened, multiple stiffened and un – stiffened element, Design of light gauge compression, tension and flexural members – Detailing as per IS: 802(Part 1 to part 3):1995.

### **TEXT BOOKS**

1. Duggal.S.K. , Limit state Design of Steel Structures, Tata McGraw Hill Education Private Ltd, 2017.
2. Sairam.K.S, Design Of Steel Structures, Pearson Publications, 2013.

### **REFERENCES**

1. Shiyekar, Limit state Design of Steel Structures, Phi Learning Pvt Ltd, 2017.
2. Subramanian.N, Design of Steel Structures, Oxford University Press, 2008.
3. Design of Steel Structures Textbook, Bhavikatti.S.S, I.K. International Publishing House Pvt. Ltd, 2013.
4. Lam, Dennis and Thien – Cheong Ang, Sing – Ping Chiew, —Structural steelwork; design to limit state theory, 4<sup>th</sup> edition., CRC Press. 2014.

### **WEB REFERENCE:**

[https://onlinecourses.nptel.ac.in/noc19\\_ce25/preview](https://onlinecourses.nptel.ac.in/noc19_ce25/preview)

### **STANDARDS**

1. IS: 800 – 2007, General Construction in Steel – Code of Practice.

2. IS: 875(Part3): Wind Loads on Buildings and Structures. Teaching resource materials by INSDAG, Kolkatta.
3. IS: 802(Part 1 to part 3):1995 Code of practice for use of cold formed light gauge steel structural members in general building construction.
4. IS: 806 – 1968 Code of practice for use of steel tubes in general building construction.
5. IS: 4014 – 1967(Part I and II) Code of practice for steel tubular scaffolding.
6. SP: 6 (2) – 1962 Steel beams and plate girders.
7. SP: 6 (5) – 1980 Structural use of light gauge steel.
8. IS codes for Aluminium Structures, IS:3908, 3909, 3921, 5384, 6445, 6476, 6475, 6449, 8152, Bureau of Indian Standards.
9. SP 64 (2001): Explanatory Handbook on Indian Standard Code of Practice for Design Loads (other than Earthquake).

### **COURSE OUTCOMES**

At the end of the course students will be able to

1. Get the fundamental knowledge about the different types of Steel sections available in the market.
2. Know the design of Connections and Different types of members which subjected to Various load conditions.
3. Design of industrial building components.
4. Design of girders and sections for various structural components.
5. Plastic analysis and design

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

<b>22CECP607</b>	<b>HIGHWAY ENGINEERING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>

### **COURSE OBJECTIVES**

- To learn the principles and procedures of testing of aggregates
- To learn the principles and procedures of testing of binding material.

### **LIST OF EXPERIMENTS**

#### **I. TEST ON AGGREGATES**

- Sieve Analysis
- Elongation and Flakiness Index Test
- Deval Abrasion Test
- Impact Value Test
- Crushing Value Test

#### **II. TEST ON BITUMEN**

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

#### **III. TESTS ON BITUMINOUS MIXES**

- Marshall Stability and Flow Values

### **REFERENCES**

1. Highway Materials and Pavement Testing, Nem Chand and Bros., Roorkee, Revised Fifth Edition, 2009
2. Methods for testing tar and bituminous materials, IS 1201 – 1978 to IS 1220 – 1978, Bureau of Indian Standards
3. Methods of test for aggregates, IS 2386 – 1978, Bureau of Indian Standards
4. Mix Design Methods Asphalt Institute Manual Series No. 2, Sixth Edition, 1997, Lexington, KY, USA.

### **COURSE OUTCOMES**

At the end of the course students will be able to

1. Understand the properties and test procedures of aggregate, bituminous materials, composites and recycled waste products.
2. Know the different types of bituminous pavement construction and its principles
3. Learn the properties of various aggregate used as pavement materials through relevant tests.
4. Know the principles and procedures of testing Concrete.
5. Arrive the stability value of bituminous mix.

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

22CECP608	STRUCTURAL DESIGN & DETAILING LABORATORY	L	T	P	C
		0	0	3	1.5

### COURSE OBJECTIVES

- To train the students to use latest drafting software available to draw the structural design and detailing
- To train the students to learn the documentation procedures regarding the structural detailing
- To train the students to know the steel elements and the corresponding fastening and to draw the detailing with the relevant codal standards.

### LIST OF EXPERIMENTS PART-A

Draw cross section, longitudinal sections of Concrete Beams with reinforcement details as per SP34: 1987, IS 13920: 1993.

1. Lintel cum sunshade
2. Singly and Doubly Reinforced Concrete Beams
3. Flanged beams: T and L shaped Reinforced Concrete Beams
4. Rectangular Continuous beams
5. Plinth beams
6. One way and Two way slabs
7. Dog legged staircase
8. Rectangular column with isolated footing
9. Circular column with isolated footing
10. Rectangular columns with combined footing

### LIST OF EXPERIMENTS PART-B

Draw cross section, longitudinal sections and connection details of steel structural element as per IS 800-2007

1. Welded and Bolted connections
2. Tension and Compression members
3. Cantilever roof truss

4. Simply supported & Fixed end roof trusses
5. Plate Girder
6. Gantry Girder
7. Bracings for Industrial buildings
8. Column bases & Angle struts
9. Laced columns & Battened columns
10. Cold form steel sections

### **TEXT BOOKS**

1. Krishnaraju N, Structural Design and Drawing, Universities Press, 2009.
2. Punmia B.C, Ashok Kumar Jain and Arun Kumar Jain, Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., 2003.
3. Duggal S.K, Limit state Design of Steel Structures, Tata McGraw Hill Education Private Ltd, 2000.
4. Sairam K.S, Design Of Steel Structures, Pearson Publications, 2013.

### **REFERENCES**

1. Krishnamurthy D, Structural Design and Drawing Vol I, II and III, CBS Publishers, 2010.
2. Shah V L and Veena Gore, Limit State Design of Steel Structures
3. IS 456(2000) Indian Standard Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards, New Delhi.
4. SP34 Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.
5. IS 800 (2007) Indian Standard General Construction In Steel—Code of Practice, Bureau of Indian Standards, New Delhi.
6. IS 875 Part 1 (2003) Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Code of Practice – Dead Load, Bureau of Indian Standards, New Delhi.
7. IS 875 Part 2 (2003) Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures, Code of Practice – Imposed Load, Bureau of Indian Standards, New Delhi.
8. Shiyekar, Limit state Design of Steel Structures, Phi Learning Pvt Ltd, 2010.
9. Design of Steel Structures, Subramanian. N, Oxford University Press, 2008.
10. Design of Steel Structures Textbook, Bhavikatti. S.S, I.K. International Publishing House Pvt. Ltd, 2012.
11. Krishnamachar B.S. and Ajitha Simha., Design of Steel Structures, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1985.
12. IS 800 – 2007, Code of Practice for use of Structural Steel in General Building Construction, Bureau of Indian Standards, New Delhi.
13. SP: 6 (2) – 1962 Steel beams and plate girders.
14. SP: 6 (5) – 1980 Structural use of light gauge steel.
15. IS codes for Aluminium Structures, IS: 3908, 3909, 3921, 5384, 6445, 6476, 6475, 6449, 8147, Bureau of Indian Standards.



16. SP 64 (2001): Explanatory Handbook on Indian Standard Code of Practice for Design Loads (other than Earthquake).

### COURSE OUTCOMES

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

1. Draw the reinforcement details after the design as per the relevant standards
2. Draw the steel design details and its connection details as per the codal standards
3. Present the drawings of the design details of concrete and steel structural members for the practicing engineers and as per norms
4. Use the latest drafting softwares for the drawings
5. Understand the details mentioned in the design drawings and explain the details to the labourers and contractors.

Mapping of COs with POs and PSOs															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PS03
CO1	3				3		2		2	3	1	1	3	2	2
CO2	3				3		2	3	3		1	1	3	2	2
CO3	3				3	3	2	3	2	1	1	1	3	2	2
CO4	3				3		2			1	1	1	3	2	2
CO5	3				1	3	2				1	1	3	2	2

## SEVENTH SEMESTER

22ETHS701	ENGINEERING ETHICS	L	T	P	C
		2	0	0	2

### COURSE OBJECTIVES

- To enable the students to create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty and to appreciate the rights of others.

#### Unit-I : Human Values

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management

#### Unit-II : Engineering Ethics

Senses of ‘Engineering Ethics’ – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg’s theory – Gilligan’s theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self – interest – Customs and Religion – Uses of Ethical Theories.

#### Unit-III : Engineering as Social Experimentation

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

#### Unit-IV : Safety, Responsibilities and Rights

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk

Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

#### Unit-V : Global Issues

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

### TEXT BOOKS

1. Mike W. Martin and Roland Schinzinger, Ethics in Engineering, Tata McGraw Hill, New Delhi, 4<sup>th</sup> edition, 2017.
2. Govindarajan M, Natarajan S, Senthil Kumar V.S., Engineering Ethics, Prentice Hall of India, New Delhi, 2004 .

### REFERENCES

1. Charles B. Fleddermann, Engineering Ethics, Pearson Prentice Hall, New Jersey, 2011.

2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, Engineering Ethics – Concepts and Cases, Cengage Learning, 2004.
3. John R Boatright, Ethics and the Conduct of Business, Pearson Education, New Delhi, 2017.
4. Edmund G Seebauer and Robert L Barry, Fundamentals of Ethics for Scientists and Engineers, Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, Business Ethics: Decision Making for Personal Integrity and Social Responsibility Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.
6. World Community Service Centre, Value Education, Vethathiri publications, Erode, 2011.

**WEB REFERENCE:**

[https://onlinecourses.nptel.ac.in/noc19\\_hs35/preview](https://onlinecourses.nptel.ac.in/noc19_hs35/preview)

**COURSE OUTCOMES**

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

1. Apply ethics in society
2. Discuss the ethical issues related to engineering
3. Realize the responsibilities and rights in the society.
4. Realize the safety and risk in engineering.
5. Understand the global issues in ethics.

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

22CEPC702	ESTIMATION, COSTING AND VALUATION ENGINEERING	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To equip the students with current practices in 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 complete civil engineer.
- To learn the tender procedure.

#### Unit-I

Introduction – Philosophy – Purpose – Types of estimates – UNITS of Measurements – Simple Problems in Approximate method of Estimates – Specifications – necessity – Type of Specifications – Writing Technical Specifications for Earth work excavation, PCC, Brick work, RCC, Plastering, Flooring, DPC, Painting, White washing.

#### Unit-II

Detailed estimates – Types – Estimate for Compound Wall – Simple Load Bearing and framed structures – Septic Tank – Water Sump – Estimates for Bituminous and Cement Concrete Roads – Retaining walls – culverts (Additional Practice in class room using computer softwares).

#### Unit-III

PurPOse – Requirements – Schedule of Rates and Standard Data Book – Observed Data – Market Rates – Standard Data for Man Hours and Machineries for Common Civil Works – Rate Analysis for different items of construction work – Mortar – Concrete – Brick and R.R Masonry – Plastering works – Pointing – DPC works – Canals and Roads – Preparation of Abstract(Additional Practice in class room using computer softwares) – Analysis of Rates for item work asked, the data recording labour, Rights of material and Rates of labour.

#### Unit-IV

Introduction – Types of Tenders – TTA Act 2000 – Drafting Model Tender Notice – Tender documents – Tender Procedure – E – Tendering – Digital signature certificates – Reverse actions – Contracts – Types of Contracts – Formation of contracts – Construction of Contract documents – Essentials of Contract conditions – Introduction to Arbitration and legal Requirements.

#### Unit-V

Introduction – Necessity – Types of Valuations – Introduction to Important terms like Market value, Scrap value, Guideline value, Earning value, Monopoly value, Distress value, Capital gain, free hold and Lease hold properties, Gift tax, Capitalized value, Depreciation – Valuations for Lands and Buildings – Fixation of Rent.

## TEXT BOOKS

1. Dutta B.N., Estimating and Costing in Civil Engineering, S.Dutta& Company, Lucknow, 2020

**Chakraborti M., Estimating and Costing Specifications in Civil Engineering, Kolkatta, 2006.**

## REFERENCE BOOKS

1. Rangwala S.C., Elements of Estimating and Costing in Civil Engineering, Charotar Publishing House, India.
2. Kohli D.D. and Kohli R.C., A Text Book of Estimating and Costing (Civil).
3. Banerjee D.N., Principles and Practices of Valuation, Eastern Law House, V Edition, 2017.
4. Vazirani, V.N. and Chandola S.P., Estimating and Costing, Khanna Publishers, New Delhi.
5. Rangwala S.C., Valuations of Real Properties.
6. Kanagasabapathy B., Practical Valuations.
7. Hand book of Consolidated Data – 8/2000, Volume I, TNPWD.
8. Tamil Nadu Transparencies in Tender Act, 2000.

## CASE STUDY

A Case Study Research on Software Cost Estimation Using Experts. Estimates, Wideband Delphi, and Planning Poker Technique

## WEB REFERENCE:

[https://onlinecourses.swayam2.ac.in/nou20\\_cs11/preview](https://onlinecourses.swayam2.ac.in/nou20_cs11/preview)

## COURSE OUTCOMES

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

1. Know the different types of rough estimates.
2. Know the different methods of detailed estimates.
3. Work out the rate for different construction works.
4. Understand the procedure of tenders and contract acts.
5. Gain the knowledge of valuation on lands and buildings.

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

22CECP706	ESTIMATION, COSTING AND VALUATION ENGINEERING LABORATORY	L	T	P	C
		0	0	3	1.5

### COURSE OBJECTIVES

- To equip the students with current practices in cost and material estimates in the field.
- To estimate the quantity of materials for different structural components .
- To impart knowledge on hands on practice with valuation practices necessary to make the student a complete civil engineer.

### EXERCISE

Quantity Estimation of different materials used in the following structures Residential Buildings

1. Pipeline Projects, Industrial Infrastructures, Road works
2. Use of Software for Quantity Surveying
3. Use of Expert Systems for Cost Evaluation
4. Case Studies on E – Tender and Global Tender

### SOFTWARE

1. Vector snape software.
2. QSPIW International.
3. Win QS.
4. PRISM.

### TEXT BOOKS:

1. Dutta B.N., Estimating and Costing in Civil Engineering, S.Dutta& Company, Lucknow, 2020.
2. Chakraborti M., Estimating and Costing Specifications in Civil Engineering, Kolkatta,2006.

### REFERENCE BOOKS

1. Banerjee D.N., Principles and Practices of Valuation, Eastern Law House, V Edition, 2017.
2. Kanagasabapathy B., Practical Valuations.
3. Hand book of Consolidated Data – 8/2000, Volume I, TNPWD.
4. Tamil Nadu Transparencies in Tender Act, 2000.

### COURSE OUTCOMES

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

1. Know the different methods of detailed estimates.
2. Work out the rate for different construction works.
3. Understand the procedure of tenders and contract acts.

4. Gain the knowledge of valuation on lands and buildings.
5. Have a practice of quantity estimation and valuation on site.

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

22ETIT707	INDUSTRIAL TRAINING / RURAL INTERNSHIP/INNOVATION/ENTREPRENEURSHIP	L	T	P	C
		0	TR	S	2
			1	2	

### COURSE OBJECTIVES

- To expose students to the ‘real’ working environment and get acquainted with the organization structure, business operations and administrative functions.
- To have hands – on experience in the student’s related field so that they can relate and reinforce what has been taught at the university.
- To promote cooperation and to develop synergetic collaboration between industry and the university in promoting a knowledgeable society.
- To set the stage for future recruitment by potential employers

### COURSE OUTCOMES

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

6. Demonstrate the ability to identify, formulate and solve engineering problems.
7. Demonstrate the skills to use modern engineering tools, software’s and equipment to analyze problems.
8. Demonstrate the knowledge of professional and ethical responsibilities.
9. Understand the impact of engineering solutions on the society and also will be aware of contemporary issues.
10. Develop confidence for self education and ability for life – long learning

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

### EIGHTH SEMESTER

22CEPV803	PROJECT WORK AND VIVAVOCE	L	T	P	C
		0	PR	S	6
			6	4	

#### COURSE OBJECTIVES

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

#### COURSE OUTCOMES

1. On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology
2. Carrying out any experimental works on construction planning, water resource planning & management and environmental aspects
3. Understand the modeling, analysis and design concepts related to civil engineering applications.

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



## PROFESSIONAL ELECTIVES

22CEPESCN	ENGINEERING GEOLOGY	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- Characterize and classify various minerals and rocks based on their physical properties
- To know various rocks and minerals as building stones.
- To Gain knowledge on different geological structures and their impact on engineering projects.
- To learn geological hazards and the mitigation measure.
- To Apply geological thinking to engineering construction problems.

### UNIT I: Mineralogy

Introduction to geology – chief branches of geology – the relationship between geology and civil engineering. Role of geological studies in various civil engineering projects. The origin of the Earth and its internal structure. Mineralogy – definition, physical properties of minerals, rock-forming minerals, physical properties of the following minerals: quartz, feldspars, amphiboles, micas, olivine, garnet, calcite, pyroxenes, calcite, graphite and diamond.

### UNIT II: Petrology

Rock definition – rock forming processes. Major rock types – igneous, sedimentary and metamorphic rocks. Origin of igneous rocks. Forms of igneous rocks – Structures of igneous rocks. Description of some important igneous rocks; granite, syenite, diorite, gabbro, basalt, pegmatite and pumice. Sedimentary petrology – origin of sedimentary rocks – classification of sedimentary rocks. Description of some important sedimentary rocks; sandstone, conglomerates, breccias, shale, limestone, gypsum and coal. Metamorphic petrology – agents and types of metamorphism, metamorphic grades, structures and textures in metamorphic rocks. Description of some important metamorphic rocks; phyllite, schist, gneiss, quartzite, slate and marble. Rocks and construction materials.

### UNIT III: Geomorphology and structural geology

Weathering of rocks, types of weathering, factors affecting weathering and product of weathering. Geomorphic processes. Dynamics of fluvial, glacial, Aeolian, marine and karst processes and resulting landforms complexities in geomorphologic processes.

Strength Behavior of Rocks – stress and strain in rocks. Concept of rock deformation and Tectonics. Dip and strike. Fold – types and nomenclature, criteria for their recognition in fields. Faults: Classification, recognition in fields, effects on outcrops. Joints and unconformity; types. Inliers and outliers. Importance of structural geology in civil engineering.

### UNIT IV: Geological Hazards

Introduction of geological hazards. Classification of major geologic hazards. Earthquake: causes, classification, magnitude and intensity of earthquakes, seismic waves, records of earthquakes, world distribution of earthquakes and earthquakes resisting structures. Seismic zone in India. Tsunami – causes, characteristics, types, effects and tsunami disaster management. Volcanoes – Formation, types, volcanic products and volcanic minerals. Measure of volcanic

eruptions and distribution of volcanoes in the world. Landslides (mass wasting) – causes, types and prevention of landslides.

### UNIT V: Engineering geology

Geology of dam and reservoir site – required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favourable and unfavourable conditions in different types of rocks in presence of various structural features. Investigations for tunnels and underground excavations and geological problems. Geological factors in the design of buildings and bridges. Outline of rock engineering and rock mechanics.

### TEXTBOOKS

1. Engineering and General Geology, Parbin Singh, 8<sup>th</sup> Edition (2010), SK Kataria & Sons.
2. Text Book of Engineering Geology, N.Chenna Kesavulu, 2<sup>nd</sup> Edition (2009), Macmillan Publishers India.
3. Engineering Geology. (2011) D Venkat Reddy, Vikas Publishing House Pvt. Ltd.
4. MT. Maruthesha Reddy, 2008, Applied Engineering geology Practicals 2<sup>nd</sup> Ed, New Age Publications.
5. H.F.Legget, 1962, Geology and Engineering, , Mc Graw Hill Book co.
6. D.P.Krynine and W.R.Judd, 1998, Principles of Engineering and Geotechniques, Mc Graw Hill Book co.

### REFERENCE

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 data using standards 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 soil sand fluids and their influence on settlement, liquefaction, and soil slope stability

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

22CEPESCN	IRRIGATION ENGINEERING	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To impart knowledge about utilization of water for irrigation and idea about irrigation system.
- The student is exposed to different phases in irrigation practices and Planning and management of irrigation.
- Student will be imparted required knowledge on Irrigation storage and distribution canal system and Irrigation management.

#### Unit-I : Crop Water Requirement

Need and classification of irrigation – historical development and merits and demerits of irrigation – types of crops – crop season – duty, delta and base period – consumptive use of crops – estimation of Evapotranspiration using experimental and theoretical methods.

#### Unit-II : Irrigation Methods

Tank irrigation – Well irrigation – Irrigation methods: Surface and Sub – Surface and Micro Irrigation – design of drip and sprinkler irrigation – ridge and furrow irrigation – Irrigation scheduling – Water distribution system – Irrigation efficiencies.

#### Unit-III : Diversion and Impounding Structures

Types of Impounding structures – Gravity dam – Forces on a dam – Design of Gravity dams; Earth dams, Arch dams – Diversion Head works – Weirs and Barrages.

#### Unit-IV : Canal Irrigation

Canal regulations – direct sluice – Canal drop – Cross drainage works – Canal outlets – Design of prismatic canal – canal alignments – Canal lining – Kennedy’s and Lacey’s Regime theory – Design of unlined canal.

#### Unit-V : Water Management in Irrigation

Modernization techniques – Rehabilitation – Optimization of water use – Minimizing water losses – On farm development works – Participatory irrigation management – Water resources associations – Changing paradigms in water management – Performance evaluation – Economic aspects of irrigation.

#### Field work

An irrigation tour can be conducted for the students to gain knowledge on various surface irrigation layouts. **(Field work Equal to 5 lecture hours)**

#### TEXT BOOKS

1. Dilip Kumar Majumdar, Irrigation Water Management, PrenticeHall of India, New Delhi, 2008.

- Garg, S.K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers, 23<sup>rd</sup>, Revised Edition, New Delhi, 2009

## REFERENCES

- Punmia B.C., et al., Irrigation and water power Engineering, Laxmi Publications, 16<sup>th</sup> Edition, New Delhi, 2021
- Duggal, K.N. and Soni, J.P., Elements of Water Resources Engineering, New Age International Publishers, 2005.
- Linsley R.K. and Franzini J.B., Water Resources Engineering, McGrawHill Inc, 2000.
- Chaturvedi M.C., Water Resources Systems Planning and Management, Tata McGrawHill Inc., New Delhi, 1997.

## COURSE OUTCOMES

Students will be able to

- Have knowledge and skills on crop water requirements.
- Understand the methods and management of irrigation.
- Gain knowledge on types of Impounding structures
- Understand methods of irrigation including canal irrigation.
- Get knowledge on water management on optimization of water use.

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

22CEPESCN	INTEGRATED WATER RESOURCES MANAGEMENT	L	T	P	C
		3	0	0	3

## COURSE OBJECTIVES

- To introduce the students to the interdisciplinary analysis of water and conceptual design of intervention strategies.
- To develop knowledge – base on capacity building on IWRM.
- To develop the ability among students to synthesis data and technical concepts for application in Integrated Water Resources Management.

### **Unit-I : IWRM Framework**

Definition – Objectives – Principles – Evolution of IWRM – IWRM relevance in water resources management – Paradigm shift: Processes and prospective outcomes.

### **Unit-II : Contextualizing IWRM**

UN formulations – SDG goals – IWRM in Global, Regional and Local water partnership – Institutional transformation – Bureaucratic reforms – Inclusive development.

### **Unit-III : Emerging Issues in Water Management**

Emerging Issues – Drinking water management in the context of climate change – IWRM and irrigation – Flood – Drought – Pollution – Linkages between water, health and poverty.

### **Unit-IV : IWRM and Water Resources Development in India**

Rural Development – Ecological sustainability– Watershed development and conservation – Ecosystem regeneration – Wastewater reuse – Sustainable livelihood – Food security

### **Unit-V : Aspects of Integrated Development**

Capacity building – Conceptual framework of IWRM – Problems and policy issues – Solutions for effective integrated water management – Case studies.

### **TEXT BOOKS**

1. Mollinga P. *et al.*, Integrated Water Resources Management, Water in South Asia, Volume I, Sage Publications, 2006.
2. Sithamparanathan, Rangasamy, A., and Arunachalam, N., Ecosystem Principles and Sustainable Agriculture, Sci tech Publications (India) Pvt.Lt, Chennai, 2021.

### **REFERENCES**

1. Cech Thomas V., Principles of Water Resources: History, Development, Management and Policy. John Wiley and Sons Inc., New York. 2003.
2. Murthy, J.V.S., Watershed Management in India, Wiley Eastern Ltd., New York, 1995.
3. Dalte, S.J.C., Soil Conservation and Land Management, International Book Distribution, India, 1986.
4. Mollinga P., Integrated Water Resources Management, Water in South Asia Volume I, Sage Publications, 2006.

### **COURSE OUTCOMES**

The students will be able to

1. Understand objectives, principles and evolution of integrated water resources management.
2. Have an idea of contextualizing IWRM
3. Gain knowledge in emerging issues in water management, flood, drought, pollution and poverty.

4. Understand the water resources development in India and wastewater reuse.
5. Gain knowledge on integrated development of water management.

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

22CEPESCN	TRANSPORTATION ENGINEERING	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To give an overview of transportation engineering with respect to the development, planning and design.
- To impart knowledge on transportation economics and the public transportation system
- To expose students to the basics of global view of transportation system and intelligent system

### Unit-I : Introduction to transportation engineering

History and development – Transportation system, Major disciplines and other important disciplines – Role of transportation in society – Economic role, Social role, Political role, Environmental role – Factors affecting transportation – Human factor, Vehicle factor, Road user and Road factors.

### Unit-II : Transportation Planning

Introduction, System approach and Stages – Transportation surveys – Zoning and types of surveys – Trip generation and trip distribution – Modal split, Evaluation techniques and Land use transport models – Lowry derivative models – Quick response techniques – Transportation planning for small and medium sized cities.

### Unit-III : Transportation Economics

Introductory Concepts – Economic evaluation of transportation plans – Need, Cost and benefits of transportation projects and Methods; Benefit – cost ratio, First year rate of return, Net present value and internal rate of return – Vehicle operating cost – Value of travel time – Accidents cost – Economics of traffic congestion – Financing of road projects – methods – Private Public Partnership (PPP) – Toll collection – Economic viability of Design – Build – Operate – Transfer Schemes

#### **Unit–IV : Public Transportation Systems**

Public Transport: Definitions, modes of public transport and comparison – road, rail, rapid transit systems – Design of Facilities: Design of bus stops, design of terminals – Promotion of public transport – Present difficulties in urban traffic condition

#### **Unit–V : Intelligent Transportation Systems**

Introduction to Intelligent Transportation Systems (ITS) – Telecommunications in ITS – ITS functional areas – ITS User Needs and Services Automated Highway Systems – Global ITS Programs – Logistics in transportation

#### **TEXT BOOKS**

1. Kadiyali.L.R., Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, 2013.
2. Khanna.S.K.and Justo. C.E.G., Highway Engineering, NemChand & Brothers, Roorkee, 2005.

#### **REFERENCES**

1. Bindra S.P., Course in Highway Engineering, Dhanpat Rai & Sons, New Delhi,2008.
2. Vazirani V.N. and Chandola S.P., Transportation Engineering Volume I & II, Khanna, Publishers, New Delhi, 2000.
3. Kadiyali L.R. and Lal N.B., Principles and Practices of Highway Engineering, Khanna Publishers, New Delhi, 2019.
4. Paul K. Wright and Karen K. Dixon, Highway Engineering, Replica Press Limited, Kundli, Seventh Edition.Indian Roads Congress (IRC) Specifications, Guidelines and Special Publications on Traffic Planning and Management, 2009.
5. Papacostas C.S. and Prevedouros P.D., Transportation Engineering & Planning, Prentice Hall of India, Third Edition, 2015.
6. Rao G.V., Principles of Transportation and Highway Engineering, Tata McGraw Hill Company, 2004.
7. Chakraborty and Das, Principles of Transportation Engineering, Prentice Hall of India, 2012.
8. Narasimha Murthy. A.S. and Henry R. Mohle, Transportation Engineering Basics, ASCE Press, 2001.

#### **COURSE OUTCOMES**

At the end of the course students will be able to

1. Classify the different types of transportation systems
2. Plan a transport system for urban and rural system
3. Understand the economic evaluation of transportation
4. Plan various public transportation systems
5. Demonstrate various application of intelligent transport system.

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

22CEPESCN	TRAFFIC ENGINEERING & MANAGEMENT	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To give an overview of traffic engineering characteristics, traffic control and design.
- To understand the techniques of traffic survey and traffic regulation.
- To expose students to traffic management and traffic safety with integrated approach in traffic planning.
- To learn the environmental impact of traffic.

### Unit-I : Introduction to Traffic Engineering

Introduction – Objectives and scope of traffic engineering – Components of road traffic: vehicle, driver and road – Road user and vehicle characteristics and their effect on road traffic – Fundamentals of Traffic Flow – Urban Traffic problems in India and Sustainable approach.

### Unit-II : Traffic Surveys

Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including non – motorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses – Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance.

### Unit-III : Geometric Design of Traffic Engineering

Control of traffic movements through time sharing and space sharing concepts – Intersection Design – channelization – Rotary intersection design – Signal design – Coordination of signals – Grade separation – Traffic signs including VMS and road markings – Significant roles of traffic control personnel – Bus stop location and bus bay design – Road lighting – Regulations on vehicles – drivers and traffic.



#### **Unit–IV : Traffic Studies**

Concept and significance of traffic safety – Road accidents – Causes, effect, prevention, and cost – Road traffic accidents scenario in India – Engineering measures of traffic safety – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non – motorized transport.

#### **Unit–V : Traffic Management System Application**

Nature of traffic problems in cities – Area Traffic Management System – Traffic System Management (TSM) with IRC standards – Traffic Regulatory Measures – Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods – Coordination among different agencies – Intelligent Transportation Systems: applications in traffic management and control.

#### **TEXT BOOKS**

1. Kadiyali L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2013.
2. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management.

#### **REFERENCES**

1. Pignataro L., Traffic Engineering – Theory and Practice, John Wiley, 1973
2. Salter. R.I. and Hounsell N.B., Highway Traffic Analysis and Design, Macmillan Press Limited, 1996.
3. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Private Limited, New Delhi, 2011.
4. Garber and Hoel, Principles of Traffic and Highway Engineering, Cengage Learning, New Delhi, 2010.
5. SP: 43 – 1994, Guidelines on Low-cost Traffic Management Techniques for Urban Areas, IRC Specifications, 1994.
6. Institute of Transportation Engineers, Transportation and Traffic Engineering Hand Book, Prentice Hall, 1982.
7. John E. Tyworth, Traffic Management Planning – Operations and Control, Addison Wesley Publishing Company, 1997.
8. Hobbs F.D., Traffic Planning and Engineering, University of Birmingham, Pergamon Press Limited, 2005.
9. Taylor M.A.P. and Young W., Traffic Analysis – New Technology and New Solutions, Hargreen Publishing Company, 1998.

#### **WEB REFERENCE:**

**[https://onlinecourses.nptel.ac.in/noc23\\_ce29/preview](https://onlinecourses.nptel.ac.in/noc23_ce29/preview)**

## COURSE OUTCOMES

At the end of the course students will be able to

1. Understand the concepts of traffic engineering and its characteristics.
2. Perform traffic studies
3. Explain traffic control and design.
4. Realize the importance of traffic management.
5. Identify the specification of traffic facilities.

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

22CEPESCN	ADVANCED CONSTRUCTION TECHNIQUES	L	T	P	C
		3	0	0	3

## COURSE OBJECTIVES

- To demonstrate the major changes that have occurred in the representation and construction of buildings between the modern and pre – modern eras
- To study and understand the latest construction techniques applied to engineering construction for sub structures, super structures and special structures .
- To learn about rehabilitation and strengthening techniques and demolition techniques.

### Unit-I

Box jacking – Pipe jacking – Under water construction of diaphragm walls and basement – Tunneling techniques – Piling techniques – Driving well and caisson – sinking cofferdam – cable anchoring and grouting – Driving diaphragm walls, Sheet piles – Laying operations for built up offshore system – Shoring for deep cutting – Large reservoir construction – well points – Dewatering for underground open excavation.

### Unit-II

Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying

sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in – situ pre – stressing in high rise structures, POst tensioning of slab – aerial transporting – Handling and erecting lightweight components on tall structures.

### **Unit–III**

Erection of lattice towers – Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, sky scrapers – Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks.

### **Unit–IV**

Seismic retrofitting – Strengthening of beams – Strengthening of columns – Strengthening of slab – Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile – Sub grade water proofing, Soil Stabilization techniques.

### **Unit–V**

Demolition Techniques, Demolition by Machines, Demolition by Explosives (implosion), Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precautions in Demolition and Dismantling.

### **TEXT BOOKS**

1. Jerry Irvine, Advanced Construction Techniques, CA Rocketr, 1984.
2. Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 1992.

### **REFERENCES**

1. Peter H. Emmons, Concrete repair and maintenance illustrated, Galgotia Publications Pvt. Ltd., 2002.
2. Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 2<sup>nd</sup> edition.
3. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008.
4. JhaJ.& Sinha S.K., Building Construction Khanna Publishers.

### **COURSE OUTCOMES**

At the end of the course students will be able to

1. Know the modern construction techniques to be used in the construction of buildings and special structures
2. Understand rehabilitation and strengthening techniques and demolition.
3. Aware of safety precautions in Demolition and Dismantling.

4. Gain a knowledge on retrofitting of structural elements and sub grade water proofing and soil stabilization
5. Understand the demolition techniques by using advanced demolition machines and explosion.

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

22CEPESCN	<b>CONSTRUCTION PLANNING &amp; MANAGEMENT</b>	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To introduce the practices of various stages of construction.
- To learn elements of management, project planning and cost analysis.
- To acquire knowledge on PERT and CPM.

### Unit-I

Introduction – Classification of Construction work – Stages in Construction – Construction Team – Resources for construction – Objectives and Functions of Construction Management and its Applications.

### Unit-II

Types of organisation – principles – site organization – Scrutiny of site documents – Job layout – principles of storing materials – Organisation of labour – Construction labour – Organization of PWD and related departments – Functions – Method of executing work – Miscellaneous Topics.

### Unit-III

Project planning – Contract Planning, Scheduling and Control – Material Handling – Constructional practices – Contract – types of contract – contract document – specification – important conditions of contract – tender and tender document – DePOSits by the contractor – Arbitration – Negotiation – M.Book – Muster roll – stores – Lab components: Introduction to Microsoft projects and Primavera – Preparation of schedule for a project by using Microsoft projects and Primavera.

## **Unit–IV**

Project management – Bar charts and Milestone charts – Network methods – PERT – CPM – Comparison of PERT and CPM – Cost and Time optimization – development and elements of network – Activity time – estimate events times – concept of floats – critical activities and critical path – Cost analysis – direct and indirect cost – normal and crash duration – cost slope – cost optimisation– updating – resources smoothing – resources leveling.

## **Unit–V**

Construction quality – inspection, quality control and quality assurance – total quality management and their techniques – cost of quality – ISO standards – audit – evaluation of safety – accident causation theories – foundation of a major injury – health and safety act and regulations – cost of accidents – principles of safety – safety and health management systems.

## **TEXT BOOKS**

1. Harpal Singh, Construction Management and Accounts, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2007.
2. Vazirani, V.N. and Chandola, S.P., Construction Management and Accounts, Khanna Publishers, New Delhi, 2011.

## **REFERENCES**

1. Subramanya, K., Construction Management, Tata McGraw Hill Publishing Company Ltd., New Delhi, 4<sup>th</sup> edition.
2. Punmia, B.C. and Khandelwal, K.K., Project Planning and Control with PERT and CPM, Laxmi Publications (P) Ltd., New Delhi, 2009.
3. Sharma, S.C., Construction Engineering and Management, Khanna Publishers, New Delhi, 2008.
4. Murugesan G., Total Quality Management, Laxmi Publications, New Delhi, 2013.
5. CADD Centre Manual, Project planning and management by using MS Project, CADD Centre Training Services Pvt. Ltd., 2010.
6. CADD Centre Manual, Primavera Training Manual, CADD Centre Training Services Pvt. Ltd., 2010.

## **COURSE OUTCOMES**

At the end of the course students will be able to

1. Develop the ability to influence project design and to manage pre – construction activities.
2. Understand method of control of project schedule, cost, quality and risks.
3. Realize ethics of project management.
4. Acquire knowledge on Tenders and related procedures.
5. Recognize the significance of safety and health management.

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

22CEPESCN	INDUSTRIAL WASTEWATER ENGINEERING	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To make the students conversant with basic principles of wastewater engineering.
- To impart knowledge on sources and characteristics of various industrial wastes and strategies for its prevention and control
- To learn about collection, conveyance, characterization, treatment and disposal of domestic wastewater.

#### Unit-I

Definitions: Sewage, Sewer and Sewerage – Collection & Conveyance of sewage – Classification of sewerage systems – Quantity of sewage – Fluctuation of sewage flow – Hydraulics of sewers – Self cleaning velocity – Shapes of sewers – Hydraulic design of sewers – Hydraulic design of storm water drains.

#### Unit-II

Materials for sewers – Joints in sewers – Laying & testing of sewers – Ventilation – Cleaning of sewers – Sewer appurtenances – Pumps – Types of pumps – Pumping station. Principles and layout of house drainage systems – Sanitary fixtures and fittings – one pipe systems and two pipe systems.

#### Unit-III

Characteristics and composition of wastewater – Analysis of physical, chemical and biological characteristics – B.O.D. and its significance – Population Equivalent – Domestic, Municipal and Industrial wastewater – Objectives of wastewater disposal – Methods of disposal – discharge into bodies of water – Hydraulic of sewers: Self cleansing velocity, Decomposition cycles.

#### Unit-IV

Septic tanks and disposal arrangements – Imhoff tank – Intermittent sand filters – Oxidation Pond & Ditch – Aerobic, Anaerobic and combinations of processes – Primary &

Secondary Treatment – UNIT operation & processes in wastewater treatment: Screens, Grit chamber, Skimming tank and Settling tanks.

**Unit–V**

Aerobic Methods: Activated Sludge Process – Methods of Aeration – Trickling Filters – Anaerobic Methods: Digesters – Disinfection for reuse – Sludge treatment – Sludge digesters – Methods of sludge disposal – Operation and maintenance aspects.

**TEXT BOOKS**

1. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain, Environmental Engineering-II – Wastewater Engineering, Laxmi Publications, 2016.
2. Rangwala, S.C., Water Supply and Sanitary Engineering, Charotar Publication House Pvt. Ltd., Gujarat, 30<sup>th</sup> Edition 2022.

**REFERENCES**

1. Garg, S.K., Sanitary Engineering, Khanna Publishers, 2005.
2. Duggal, K.N., Environmental Engineering, S.Chand & Company, 2004.
3. Metcalf, L. and Eddy, H.P., Wastewater Engineering, Collection, Treatment, and Disposal, McGraw Hill Publishers, 4<sup>th</sup> Edition, 2003.
4. Davis & Corwell, Introduction to Environmental Engineering, McGraw Hill Series in Civil and Environmental Engineering, 2022.
5. Gerald Kiely, Environmental Engineering, Tata McGraw Hill Education, 2007.

**COURSE OUTCOMES**

At the end of the course students will be able to

1. Apply the main procedures and methods of treatment for wastewater.
2. Develop on Environmental Management Systems.
3. Explain different methodologies for collection and conveyance of wastewater.
4. Examine the physical, chemical and biological characteristics of wastewater.
5. Suggest suitable methods for treatment and disposal.

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

<b>22CEPESCN</b>	<b>REMOTE SENSING &amp; GIS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **COURSE OBJECTIVES**

- To introduce the basic concepts of remote sensing.
- To learn the fundamentals of photogrammetric and image interpretation.
- To understand the techniques involved in cartography and GPS.
- To impart knowledge on applications of RS and GIS in resource mapping.

#### **Unit-I**

Definition of RS and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan – Boltzman and Wein’s Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts – typical spectral reflective characteristics of water, vegetation and soil – types of platforms – orbit types – Sun – synchronous and Geosynchronous – Passive and Active RS – Parameters of Sensors.

#### **Unit-II**

Types of data products – types of image interpretation – basic elements of image interpretation – visual interpretation keys – Digital Image Processing – Pre – processing – image enhancement techniques – image classification – Supervised and Unsupervised.

#### **Unit-III**

Maps – Definitions – Map coordinate systems – Map projections – types of map projections – Fundamentals of GPS – components of GPS – GPS data collection methods – application of GPS – GIS definition – basic components of GIS – standard GIS software – Data type – Spatial and non – spatial (attribute) data – measurement scales – Types of files – Data Base Management Systems (DBMS) types.

#### **Unit-IV**

IS Data models – vector and raster data – Raster data compression – data input by digitization and scanning – GIS data errors and remedial measures – attribute data analysis – integrated data analysis.

#### **Unit-V**

Modeling in GIS: Highway alignment studies – Land Information System – Change Detection – Land use/ Land cover mapping – Watershed management – Water quality mapping – surface and groundwater resources mapping.

### **TEXT BOOKS**

1. Lillesand, T.M., Kiefer, R.W. and Chipman, J.W., Remote Sensing and Image Interpretation, John Wiley and Sons (Asia) Private Limited, New York, 2015.



2. Kang – tsung Chang, Introduction to Geographical Information System, Tata McGraw Hill Edition, 2018.

## REFERENCES

1. Basudeb Bhatta, Remote Sensing and GIS, Third Edition, Oxford University Press, 2021.
2. Agarwal. C.S. and Garg. P.K., Remote Sensing in Natural Resources Monitoring and Management, Wheeler Publishing Company, 2000.
3. Peter A. Burrough and Rachael A. McDonnell, Principles of Geographical Information systems for land resource assessment, Clarendon Press, Oxford University Press, 2015.
4. Anji Reddy. M., Textbook of Remote Sensing and Geographical Information System, 4<sup>th</sup> Edition, BS Publications, Hyderabad, 2019.
5. Ian Heywood, Sarah Cornelius, Steve Carver and Srinivasa Raju, An Introduction to Geographical Information Systems, Pearson Education, 2<sup>nd</sup> Edition, 2007.
6. Wolf Paul, Elements of Photogrammetry, McGraw Hill Edition, New Delhi, 1998.
7. Clarke Parks and Crane, Geographical Information Systems and Environmental Modelling, Prentice Hall of India, 2005.

## COURSE OUTCOMES

At the end of the course students will be able to

1. Identify the concepts and characteristics of Remote Sensing.
2. Acquire knowledge of appropriate map projection and coordinate systems.
3. Understand GIS, its structure, quality and standards.
4. Get exposure to several applications of RS and GIS in the various fields of Civil engineering especially resource mapping.
5. Apply GIS and LIS techniques to highway alignment, watershed management, Water quality mapping and surface & groundwater resources.

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

22CEPE SCN	SURFACE & GROUNDWATER HYDROLOGY	L	T	P	C
		3	0	0	3

## OBJECTIVES

- To introduce the student to principles of Hydrologic cycle and precipitation.
- To understand the observation and estimation of Rainfall and Runoff.
- To impart knowledge on characteristics of aquifers and well hydraulics.
- To expose students to investigation, RWH and artificial recharge of groundwater

## UNIT I

Introduction – Hydrologic cycle – The Global water budget- Scope and applications of hydrology – Hydrometeorology – Constituents and Structure of atmosphere – The General circulation – Meteorological observations – Climate and weather seasons of India- Precipitation – Formation – Forms – Types – Measurement – Optimum Rain Gauge Network – Analysis and Interpretation of Rainfall Data – Rainfall Intensity – Rainfall Hyetograph – Average Depth of Precipitation – Estimation of Missing Rainfall Data

## UNIT II

Hydrologic Abstractions – Evaporation – Factors Affecting – Measurement – Estimation – Reducing Evaporation – Evapotranspiration – Methods of Estimation – Penman Method – Infiltration – Factors Influencing – Measurement – Equations – Infiltration Indices – Effective Rainfall

## UNIT III

Runoff – Components – Factors Influencing – Catchment Characterisation – Stream Order and Drainage Density – Basin Yield – Rainfall – Runoff Relationship – Strange Tables and Curves-Flow Duration Curve-Flow Mass Curve-Stream Flow Measurement-Stage Discharge Relationship – Velocity Distribution – Stream Gauge Site Selection – Hydrograph – Introduction to Unit Hydrograph

## UNIT IV

Groundwater in Hydrologic cycle – vertical distribution of groundwater – rock properties affecting ground water – types of aquifers- water level fluctuations – Groundwater in India Storage coefficient- specific yield – Darcy's law- coefficient of permeability – laboratory measurement of permeability – field measurement of permeability – general flow equation – steady unidirectional flow – steady radial flow to a well both in confined and unconfined aquifer – steady flow with uniform recharge.

## UNIT V

Construction of wells – constructing shallow wells and drilling deep wells – well completion. Surface and sub – surface investigations of ground water – geophysical exploration – electrical methods – seismic refractions methods – subsurface investigation – test drilling and resistivity- Artificial recharge of groundwater – Rainwater Harvesting- sea water intrusion

## TEXT BOOKS

1. Jayarami Reddy, “Hydrology”, Tata McGraw Hill, 2016.
2. David Keith Todd, “Groundwater Hydrology”, John Wiley and Sons, 2005.
3. S.P. Garg, “Groundwater and Tube Wells”, Oxford & IBH Publishing Co.,1993

## REFERENCE BOOKS

1. Chow, V.T. and Maidment D.R., “Applied Hydrology”, McGraw- Hill Education, 2017
2. Linsley R.K., “Hydrology for Engineers”, McGraw-Hill Inc., Ltd.,2014.
3. K. Subramanya, “Engineering hydrology”- New age international,2017
4. Raghunath H.M., “Ground Water”, New Age International (P) Limited, New Delhi, 2021
5. Walton C., “Groundwater Resource Evaluation”, McGraw-Hill Publications,2000.
6. Fitts R Charles, “Groundwater Science”, Elsevier Academic Press, 2012.
7. Ramakrishnan S., “Groundwater”, K.J. Graph arts, Chennai, 1998.

## WEB REFERENCES

1. Ground water hydrology and management by Prof. Pennan Chinnasamy, IIT Bombay,([https://onlinecourses.nptel.ac.in/noc23\\_ge13/preview](https://onlinecourses.nptel.ac.in/noc23_ge13/preview)).
2. Surface water hydrology by Prof. Rajib Maity, IIT Kharagpur, ([https://onlinecourses.nptel.ac.in/noc23\\_ce38/preview](https://onlinecourses.nptel.ac.in/noc23_ce38/preview))

## COURSE OUTCOMES

At the end of the course students will be able to

1. Understand Hydrologic cycle and precipitation.
2. Realize the importance of hydrologic abstractions and their estimation
3. Comprehend the Rainfall-Runoff relationship and stream flow.
4. Understand aquifer properties and its dynamics.
5. Acquire knowledge of well construction and the importance of artificial recharge of groundwater.

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

<b>22CEPESCN</b>	<b>MEMBRANE TECHNOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **COURSE OBJECTIVES**

- Necessity and advantages of membrane technology in place of conventional systems for water and wastewater treatment
- Membrane Types, Proprietary data and Expert systems for planning and designing of Membrane based treatment plants
- Operation and maintenance of membrane based plants.

#### **Unit-I**

Solids removal suspended solids and dissolved solids – organic, inorganic and inert solids – membrane processes – principle and theory – materials of membranes – proprietary products – selectivity modules – concentration polarization – membrane fouling and cleaning – applications.

#### **Unit-II**

Mechanism of membrane transport – RO/UF transport – solution diffusion model – dual sorption model – free volume theory – pore flow model – resistance model – boundary layer film model – Membrane modules; flat cartridge, spiral wound, tubular hollow fibre – Design equations – Expert systems of proprietary products.

#### **Unit-III**

Membrane preparation techniques – isotropic membranes anisotropic membranes metal membranes, ceramic membranes liquid membranes and biomembranes.

#### **Unit-IV**

Hierarchy of Membranes – Landscape of Membrane – MF, UF, NF and RO – Proprietary products – specific applications and limitations – Applications.

#### **Unit-V**

Engineering aspects of membranes; Hybrid membrane techniques; membrane reactor, membrane distillation membrane extraction and osmotic distillation – Design equations – Applications.

### **TEXT BOOKS**

1. Mihir K. Purkait, Randeep Singh, Membrane technology in separation science 1<sup>st</sup> edition, CRC Press.
2. Richard W.Naker, Membrane Technology and Applications. John Wiley and Sons, 2004.

### **REFERENCES**

1. Christie J. Geankoplis,, Transport Process and UNIT Operations, 3<sup>rd</sup>Edn., Prentice Hall of India Pvt. Ltd.

2. Sun, Tak, Hwang and Karl Kammermayer, Membranes in separations, John Wiley and Sons, New York.
3. Richard W.Naker, Membrane Technology and Applications. John Wiley and Sons, 2004.
4. Separation Process Principles by J.D. Seader and Ernest J.Henley, John John Wiley and Sons, 2000.
5. Coulson J.M and Richardson, Chemical Engineering – Particle Technology and Separation Process Vol.2 th edition. Asian Books Pvt. Ltd. New Delhi 1998.
6. Warren L.McCabe, Julian Smith and Peter Harriot, UNIT Operations of Chemical Engineering, th edition. 2004.
7. Judson King .C Separation Process, McGraw Hill Inc., 1980.
8. Hoffman E.J, Membrane separations Technology Single stage, multi stage and Differential permeation, Gulf Professional Publishing.

#### WEB REFERENCE

[https://onlinecourses.nptel.ac.in?noc23\\_ch08/preview](https://onlinecourses.nptel.ac.in?noc23_ch08/preview)

#### COURSE OUTCOMES

At the end of the course students will be able to

1. Understand the principles of different membrane manufacturing methods.
2. Ability to know which materials are most suitable for membrane separation/purification of various liquid streams depending on the liquid composition and selected process parameters such as temperature and pressure.
3. Gain knowledge of membrane capabilities and constraints in the aspects of engineering.
4. Develop skills to choose appropriate membrane process for a specific application.
5. Understand the principles and application of reverse osmosis microfiltration and ultra filtration.

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

22CEPESCN	RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To introduce the students about Railways planning, design, construction and maintenance.
- Planning design principles of airport and harbour.

#### Unit-I : Railway Planning and Construction

Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges – Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods – – Geometric design of railway, gradient, super elevation, widening of gauge on curves – Level Crossings.

#### Unit-II : Railway Construction and Maintenance

Earthwork – Stabilization of track on poor soil – Track drainage – Calculation of Materials required for track laying – Construction and maintenance of tracks – Railway Station and yards and passenger amenities – Signaling

#### Unit-III : Airport Planning

Air transport characteristics – airport classification – ICAO – airport planning: Site selection typical Airport Layouts, Case Studies, parking and Circulation Area

#### Unit-IV : Airport Design

Runway Design: Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design – Elements of Taxiway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings.

#### Unit-V : Harbour Engineering

Definition of Basic Terms: Harbour, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbours: Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage – Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works

### TEXTBOOKS

1. Subramanian K.P., Railways, Airport and Harbour Engineering, V Scitech Publications (India), Chennai, 2018
2. Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand and Bros, Roorkee, 1999

## REFERENCES

1. Saxena Subhash, C.and Satyapal Arora, A Text Book of Railway Engineering, Dhanapat Rai Publications, Delhi, 2013
2. Venkatramaiah. C., Transportation Engineering – Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels.,Universities Press (India) Private Limited, Hyderabad, 2016.
3. Mundrey J.S., Railway Track Engineering, McGraw Hill Education (India) Private Ltd, New Delhi, 2017.
4. Srinivasan R. Harbour, Dock and Tunnel Engineering, 28<sup>th</sup> Edition 2016.

## COURSE OUTCOMES

Students who successfully complete this course will be able to:

1. Understand the methods of route alignment and design elements in Railway Planning and Constructions.
2. Understand the Construction techniques and Maintenance of Track laying and Railway stations.
3. Gain an insight on the planning and site selection of airport planning and design.
4. Analyze and design the elements for orientation of runways and passenger facility systems.
5. Understand the various features in harbours and ports, their construction, coastal protection works and coastal Regulations to be adopted.

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

22CEPESCN	<b>CLIMATE CHANGE ADAPTATION &amp; MITIGATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
22CEMESCN		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **COURSE OBJECTIVES**

- To understand the earth's climate change and its system classification.
- To introduce the observed changes in the climate and concept of modeling and Institutional arrangements existing for monitoring this phenomenon.
- To understand Climate Change Adaptation and Mitigation Measures.

#### **Unit-I : Earth's Climate System**

Introduction – Climate in the spotlight – The Earth's Climate Machine – Climate Classification – Global wind systems – Trade Wind Systems – Trade Winds and the Hadley Cell – The Westerlies – Cloud formation and Monsoon Rains – Storms and Hurricanes – The Hydrological Cycle – Global Ocean Circulation – El Nino and its Effect – Solar Radiation – The Earth's Natural Green House Effect – Green House Gases and Global Warming – Carbon Cycle.

#### **Unit-II : Observed Changes and Its Causes**

Observation of Climate Change – Changes in pattern of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large Scale Variability – Drivers of Climate Change – Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India – Climate Change modeling.

#### **Unit-III : Impacts Of Climate Change**

Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for different regions – Uncertainties in the Projected Impacts of Climate Change – Risk of irreversible changes.

#### **Unit-IV : Climate Change Adaptation and Mitigation Measures**

Adaptation Strategy/options in various sectors – Water – Agriculture – Infrastructure and Settlement including coastal zones. Human Health – Tourism – Transport – Energy – Key Mitigation Technologies and practices – Energy supply – Transport – Buildings – Industry – Agriculture – Forestry – Carbon sequestration – Carbon Capture and Storage (CCS) – Waste (MSW & Biowaste, Biomedical, Industrial waste – International and Regional Co-operation.

#### **Unit-V : Clean Technology and Energy**

Clean Development Mechanism – Carbon Trading – Examples of future Clean Technology – Biodiesel – Natural Compost – Eco-friendly Plastic – Alternate Energy – Hydrogen – Bio – fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding



## TEXT BOOKS

1. Mridula Ramesh, The climate solution, Hachette India Publisher.
2. Alka Sen, Global Warming and Climate Change Academic Publication.

## REFERENCES

1. Al core Inconvenient Truth – video form.
2. Dash Sushil Kumar, Climate Change – An Indian Perspective, Cambridge University Press India Pvt. Ltd, 2007.
3. IPCC Fifth Assessment Report – www.ipcc.ch
4. Jan C. van Dam, Impacts of Climate Change and Climate Variability on Hydrological Regimes, Cambridge University Press, 2003.

## COURSE OUTCOMES

At the end of the course students will be able to

1. Understand the earth's climate change and its system classification.
2. Introduce the observed changes in the climate and concept of modeling and Institutional arrangements existing for monitoring the phenomenon.
3. Show the impact of climate change on various sectors and its irreversibility.
4. Prepare the adaptation and mitigation measures of climate change on various sectors.
5. Choose the clean Technology for the fuel and energy through natural and eco friendly techniques.

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

22CEPESCN	PRE FABRICATED STRUCTURES	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To impart knowledge to students on modular construction, industrialized construction.
- To learn to design prefabricated elements and their construction methods.
- To gain Knowledge on construction methods using prefabricated elements.

#### Unit-I

Need for prefabrication – Principles – Materials – Modular coordination – Modules/UNITs – Standardization of Systems – Production – Transportation – Erection Equipments – Erection Techniques.

#### Unit-II

Structural Systems: Skeletal Frame System – Large Panel System – Cell System. Systems for Lateral Load Resistance: Low – rise Portals and Frames – Multi – Storied Frames – Wall System. Roof and Floor Systems: Roof System – Floor System. Precast Concrete Components: Beams – Columns – Roof UNITs – Floor UNITs – Wall UNITs – Foundation UNITs – UNITs for Miscellaneous Applications.

#### Unit-III

Introduction – Materials – Loads: Dead Load – Live Load – Wind Load – Seismic Load – Equivalent Seismic Load Method – Response Spectrum Method – Time History – Abnormal Loads – Fire Resistance. Load Factor: Load Combinations. Analysis of Precast Frames: Skeletal Frames – Inverted U Shaped Frame – L Shaped Frame – H – Shaped Frame. Analysis of Frames with Stability Elements: Shear Walls to Resist Lateral Loads – Details of Typical Example Building – Seismic Parameters of Analysis – Modelling and Analysis. Analysis of Voided Slab Floor Elements: Method of Analysis – Analysis of Typical Voided Slab using Grillage Analogy – Calculation of Member Properties – Loading – Longitudinal Analysis – Transverse Analysis.

#### Unit-IV

Design Consideration: Moment Resistance of Slabs – Moment Resistance of Rectangular Beams – Moment Resistance of T Beams – Moment Resistance of Inverted T Beams – Moment Resistance of L Beams – Axial Load Capacities of Short and Slender Columns. Joints and Connections in Precast Buildings: Introduction – Scope – Details of Connections: Column to Foundation Connections – Wall to Foundation Connection – Beam to Column Connection – Column to Column Connection – Floor to Beam Connection – Wall Panel to Wall Panel Connection. Tolerances. Connection Materials – Mechanical Couplers – Dowels – Welded Head Studs – Bolted and Threaded Connections – Inserts – Expansion Inserts – Bearing Pads – Connecting Elements – Other Load Transfer Materials.

## **Unit–V**

Production, Handling and Erection of Precast Elements: Production, Planning and Set up. Types of Precast Concrete Products: Foundations – Structural Elements. Moulds – Column Mould – Beam Mould – Wall Mould – Slab Mould – Other Moulds. Mould Tolerances, Production, Demoulding Techniques, Concrete and Vibrations, Precast Concrete Products Tolerances, Curing and Storage, Transportation, Handling Equipments for Precast Components, Handling Devices for Lifting, Erection Schemes and Supports, Other Accessories for Erection Works, Safety, Installation of Precast Element: Installation of vertical Members – Installation of Beams – Installation of Slabs – Installation of Special element. Common Defects and Acceptance Criteria: Hollow Core Slabs – Pre – stressed Planks/Slabs – RCC Products – Non – Conforming Products – Quality Assessment.

### **TEXT BOOKS**

1. Indian Concrete Institute (ICI), Handbook on Precast Concrete for Buildings, 1<sup>st</sup> Edition, 2016.
2. Gerostiza, C.Z., Hendrikson, C. and Rehat, D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 2019.

### **REFERENCES**

1. CBRI, Building materials and components, India, 1990.
2. Koncz, T., Manual of precast concrete construction, Vol.I,II andIII, Bauverlag, GMBH, 1976.
3. Society for the studies in the use of precast concrete, Structural design manual, Precast concrete connection details, Netherland Betor Verlag, 2009.
4. Glover.C.W., Structural Precast Concrete, Asia Publishing House, Bombay, 1967.

### **COURSE OUTCOMES**

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

- Realize the need for prefabrication in construction.
- Design some of the prefabricated elements
- Understand the construction techniques involved in building framed structures.
- Insist on Quality in precast construction.
- Understand the production, Handling and Erection of Precast Element

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

22CEPESCN	ARCHITECTURE	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To introduce various Architectural aspects.
- To understand the history of Architecture.
- To realize the impact of climate on Architecture Buildings.

### Unit-I

Review of History of Architecture – Egyptian Mesopotamia classical and Indian Buddhist Architecture – Evolution of Hindu temple Architecture – Islamic and Mughal Architecture – Influences of Architecture on Nature, Climate, Topography and Materials – Represented plan – Growth of mass from plan – Space organization – Principles of composition, contrast, proportion, scale, balance, UNITY, character of composition.

### Unit-II

Shelter or form – Climate and thermal comfort in India – Passive heating and cooling strategies – settlement patterns and site planning – Openings in hot climates – Wind, Sun and Shading – Day lighting – Natural ventilation of buildings in India – Appropriate Technology for a Climatically Responsive Energy Architecture – Projects and Case studies.

### Unit-III

Planning of residential buildings – Space UNITS of Living, Dining, Sleeping areas, Kitchens and Bathrooms – Single storied, double storied Residential buildings with different roofing systems – Multiple accommodations – Apartments – Group Housing – Housing for Handicapped – Housing for Elders – Youth Hostels.

#### **Unit–IV**

Planning concept of commercial buildings – Requirements of Spaces – Parking standards – Shopping centre – Banks – Super Markets – Hotel / Motel – Planning concept of Health Structures – requirements of spaces depends on specialty of disease – Medical Centres – Sub Health Centres – Laboratories – Medical Institutions – Concept Line Drawings – Projects.

#### **Unit–V**

Planning concept of Institutional Structures – Planning Concept of Play way / Kinder Garden Schools, Elementary, Secondary and Senior Secondary Schools, Library buildings – Technical Institutions – Institutions for Humanities Studies – Gymnasium and Swimming Pools – Planning concepts of Industrial Structures – General – Workshop – Ware Houses – Machine Housings.

#### **TEXT BOOKS**

1. Pramod V.S., Design fundamental in Architecture, Somaiya Publications Pvt. Ltd., New Delhi, 1997.
2. Arvind Krishnan, Nick Baker, Simos Yannas, Szokolay S.V., Climate Responsive Architecture., A Design Hand Book for Energy Efficient Building, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017.
3. Ernest Pickering, Architecture Design, John Wiley & Sons.
4. Muthu Shoba Mohan.G., Principles of Architecture, Oxford University Press., New Delhi, 2006.
5. M. Pratap Rao, Architectural Design – Theory & Design.
6. National Building Code of India., SP7 (Group 1) Bureau of Indian Standards, New Delhi, 2016.

#### **COURSE OUTCOMES:**

1. Recognize the different qualities of Architecture.
2. Understand that Architecture can enhance the building in terms of appearance and utility.
3. Realize that Architectural design can improve comfort in living conditions of buildings.
4. Apply Architectural concept and design buildings according specific requirements.
5. Concept of Institutional Structures.

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

22CEPESCN 22CEMESCN	URBAN PLANNING & DEVELOPMENT	L	T	P	C
		3	0	0	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 neighborhood 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 – Replanning of the existing towns – Objects of replanning – Necessity of Replanning – Advantages of Master plan – Data and Maps – Features of Master plan – Implementation of Master Plan – Planning law and Legislation in India – Building Bye laws –

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. Rangwala. S.C., Town Planning, Charotar Publications House Pvt. Ltd., Gujarat, 26<sup>th</sup> Edition, 2017.
2. Thooyavan. K.R., Human Settlements – A Planning Guide to Beginners, M.A. Publications, Chennai, 2005.

### **REFERENCES**

1. Chennai Metropolitan Development Authority, —Second Master Plan for Chennai, Government of Tamil Nadu, Chennai, 2008.
2. Tamil Nadu Town and Country Planning Act 1971, Government of Tamil Nadu, Chennai, 1971.
3. Goel S.L., Urban Development and Management, Deep and Deep Publications, New Delhi, 2003.
4. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005.

### **COURSE OUTCOMES**

At the end of the course students will be able to

- Describe basic issues in urban planning.
- Formulate plans for Urban and rural development.
- Plan and analyze socio – economic aspects of Urban and rural planning.
- Understand functions of local authority with a clear idea of control rules.
- Understand the concept of rural planning and sanitation.

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

22CEPESCN	PRE-STRESSED CONCRETE	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

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

### UNIT I

Pre-stress basic concepts–Advantages–Tendons, strands, concrete, end anchorages –Systems and methods of pre-stressing–Analysis of sections–Stress concept–Strength concept–Load balancing concept–Effect of loading on the tensile stresses in tendons– Losses of Pre stress–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 for pre-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 deflection so fun – 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 linear transformation



## UNIT V

Design of concrete pipes – Circular tanks – poles – Railway sleepers – Partial Pre stressing  
– Applications.

### TEXTBOOKS

1. Krishna Raju N, “*Pre stressed concrete*”, Fifth Edition, Tata Mc Graw Hill Company, New Delhi, 2012.
2. Pandit.G.S.and Gupta.S.P., “*Prestressed Concrete*”, CBS Publishers and Distributers Pvt.Ltd, New Delhi, 201

### 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. IS1343:1980, Code of Practice for Pre-stressed Concrete, Bureau of Indian Standards, New Delhi, 2012.
5. IS3370-1:2009 Concrete structures for storage of Liquids. Bureau of Indian 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 pre-stressing and also to design the concrete pipes, circular tanks, railway sleepers, etc.

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

22CEPESCN	REHABILITATION STRUCTURES	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To understand the mechanism of deterioration of concrete, damage assessment, repair materials and rehabilitation techniques.

### UNIT-I

Introduction – Mechanics of deterioration of concrete – Physical Causes – Freeze and Thaw – Water evaporation – Crystallization of salts in pores – Permeation of water and gases–Chemical Causes – Hydrolysis & Leaching – Sulphate attack – Chloride attack – Salt attack.

### UNIT-II

Effect of Steel chemistry – Effect of Concrete micro structure – Effect of internal stress levels – Effect of steel bar design – Effect of imposed forces – Effect of environments – Corrosion process in RC structures – Corrosion protection techniques.

### UNIT-III

Investigations – Visual inspection – Inspection by records – Inspection with instruments:– Surface Hardness Methods – Penetration Techniques (Simbi Hammer, Spit Pins, Windsor Probe, PNR Tester) – Pull Out Tests (Lok Test, TNS Tester, Internal Fracture Test, Epoxy Grouted Bolt)– Core Drilling – Resonant Frequency Method – Ultrasonic Pulse Velocity Method–Pulse Attenuation Method – Pulse Echo Method – Radio Active Method – Nuclear Methods –Magnetic Methods – Electrical Methods – Acoustic Emission Technique – Insitu Permeability Test.

### UNIT-IV

Introduction – Repair materials – Guniting – Grouting – Cement Grouting – Epoxy Grouting – Polymer Grouting – Epoxy Coating – Epoxy Mortar Coating – Sand Blasting – Grinding – Stitching – Dry Pack – Prepacked Concrete – Resurfacing – Acidetching– Caulking.

### UNIT-V

Methodology for repair materials – Mortar Replacement–Concrete Replacement– Total Replacement–Preplaced aggregate concrete–Jacketing technique–Plate Bonding technique–Fibre Sheet Bonding Technique

### TEXTBOOKS

- Peter H. Emmons, *Concrete Repair and Maintenance*, Galgotia Publishers, New Delhi, 2002.
- Vidivelli.B, *Rehabilitation of Concrete Structures*, Standard Publishers Distributors, New Delhi,2007

### REFERENCES

- TedKay, *Assessment and Renovation of Concrete Structures*, Longman Scientific & Technical, New York, 1992.
- 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 there pairs 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 and PSOs															
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2		3	2	2		2	3	3	2
CO2	3		2	2	2		3	3		2	1	2	3	3	2
CO3	3	2		3	3	2	3		2	2	1	2	3	3	2
CO4		3	3					3	2		1				
CO5	3		2	2	3		2		2	2	2	2	3	3	2

22CEPESCN	GREEN BUILDINGS	L	T	P	C
		3	0	0	3

## COURSE OBJECTIVES

To Impart Knowledge On Eco Friendly Building Concepts And Building Certification Systems As Per Indian And International Standards.

### UNIT-I Introduction to Green Buildings

Definition of green buildings and sustainable development, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.

### UNIT- II Site selection and planning

Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, etc. Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.

### UNIT-III Energy Efficiency

Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy. Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting energy metering and monitoring, concept of net zero buildings.

#### **UNIT-IV Building materials**

Methods to reduce embodied energy in building materials: (a) Use of local building materials (b) Use of natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks, (c) use of materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. (d) reuse of waste and salvaged materials

Waste Management: Handling of construction waste materials, separation of household waste, on-site and off-site organic waste management

#### **UNIT-V Indoor Environmental Quality for Occupant Comfort and Wellbeing**

Day lighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics. Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc.

#### **TEXT BOOKS**

1. Abe Kruger, "Green Building: Principles and Practices In Residential Construction", 1<sup>st</sup> Edition, Cengage Learning India Pvt. Ltd., New Delhi, 2012.
2. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
3. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
4. Alternative building materials and technologies by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao, New Age International (P) Ltd., 2015
5. Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers. 2015

#### **REFERENCES**

1. Dru Meadows, "Preparing a Building Service Life Plan for Green Buildings", 1st Edition, McGraw-Hill Publications, United States, 2014.
2. Linda Reeder, "Guide to green building rating systems", 3rd Edition, John Wiley & Sons, New Jersey, 2010.
3. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
4. Mike Montoya, Green Building Fundamentals, Pearson, USA, 2010.
5. Charles J. Kibert, Sustainable Construction – Green Building Design and Delivery, John Wiley & Sons, New York, 2008.
6. Regina Leffers, Sustainable Construction and Design, Pearson / Prentice Hall, USA, 2009.

#### **COURSE OUTCOMES**

At the end of the course students will be able to

1. Summarize the concepts of green building
2. Interpret site selection and planning for green building concept
3. Gain knowledge on energy efficiency in building constructions and application of energy saving
4. Reduce embodied energy in the usage of building materials
5. Re-frame the codes for certification of green construction and indoor environmental quality

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

## OPEN ELECTIVES

22CEOESCN	AIR POLLUTION MONITORING & CONTROL	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To impart knowledge on air quality measurement in compliance with the standards.
- To enable students to learn about various air pollution control systems, related theory, working principles, engineering design and management.
- To impart knowledge on the principles and design of control of indoor / particulate / gaseous air pollutant and its emerging trends
- Composition and structure of atmosphere – Definition – Air Pollution – Sources – Classification – Types – On meteorological conditions – Ozone layer disturbance, green house effects.

### Unit-I : INTRODUCTION

Standards – ambient air quality standards – emission standards – Air sampling methods – Modern air pollution measurement sensors – working principle – Emission inventory – Air quality index – Measurement – ambient and source sampling – pressure – gas flow rate – relative humidity – Sample train – determination particle size distribution – Gas stream calculations and conditioning.

### Unit-II : AIR POLLUTION CONTROL

General – Gravitational settling chambers – Inertial separators – Cyclone – introduction – industrial application – multiple cyclone – Fabric filtration – introduction – principle and theory – application – engineering design – operation. Electro static precipitation – introduction – principles of operation – design methodology and considerations – application – problems and corrections – Dry and wet Scrubbing – introduction – dry scrubbers – wet scrubbers.

### Unit-III : CONDENSATION

Introduction – pre and post treatment – engineering consideration and design – management .Flare process – introduction – pretreatment – engineering consideration and design – management. Thermal and Catalytic oxidation – introduction – pretreatment and engineering consideration – supplementary fuel requirements – design and operation – management. Gas – phase activated carbon adsorption – introduction and definitions – adsorption theory – carbon adsorption pretreatment – design and operation.

### Unit-IV : GAS PHASE BIO-FILTRATION

Introduction – types of air treatment systems – operational consideration – design consideration/parameters – case studies – process control and monitoring – limitations of the technology. Emerging air Pollution Control Technologies – introduction – process modification – vehicle air pollution and its control – mechanical particulate collectors – Entrainment

separation – IC engines – Membrane process – UV photolysis – High efficiency particulate air filters – Technical and economical feasibility of selected emerging technologies.

### **Unit–V: INDOOR AIR QUALITY MANAGEMENT**

Measurement, control and preventive measures of indoor air quality measures and management. Control Measures for Industrial Applications: Control methods – Processes based control mechanisms – mineral products – asphaltic concrete, cement plants and glass manufacturing plants; Thermal power plants, Petroleum refining and storage plants, Fertilizers, Pharmaceuticals and wood processing industry.

#### **TEXT BOOKS**

1. Anjaneyulu Y., Air Pollution: Prevention & Control Technologies, Allied Publishers (P) Ltd., India, 2019.
2. David H.F. Liu, Bela G. Liptak, Air Pollution, Lweis Publishers, 2000.

#### **REFERENCES**

1. Lawrence K.Wang, Norman C.Pereira and Yung – Tse Hung, Air Pollution Control Engineering, Humana Press, New Jersey, 2004.
2. Noel De Nevers, Air Pollution Control Engineering, McGraw Hill International Edition, Civil Engineering Series, Singapore, 2016.
3. Arthur C. Stern, Air Pollution, Volume – III, Academic Press, New Delhi, 2006.
4. Wayne T. Davis, Air Pollution Engineering Manual, John Wiley & Sons Inc., New Delhi, 2000.
5. J.R.Mudakavi, Principles and Practices of Air Pollution Control and Analysis, I.K.International Publishing House Pvt. Ltd., New Delhi, 2020.
6. Louis Theodore, Air Pollution Control Equipment Calculation, John Wiley & Sons Inc, New Delhi, 2008.
7. Programme Objective Series (PROBES), Open Source of Central Pollution Control Board, Ministry of Environment, Forest and Climate Change, Govt. of India ([www.cpcb.nic.in](http://www.cpcb.nic.in)).

#### **WEB REFERENCE**

Air Pollution Control by Prof. Bhola Ram Gurjar, IIT Roorkee ([https://onlinecourses.nptel.ac.in/noc23\\_ce14/preview](https://onlinecourses.nptel.ac.in/noc23_ce14/preview)).

#### **COURSE OUTCOMES**

At the end of the course students will be able to

1. Conduct air quality monitoring programme for routine or site specific air quality parameters with conventional as well as modern sensors.
2. Design air pollution control systems.
3. Select the appropriate cost effective control system with high efficiency to be adopted in any type of air polluting industry.

4. Gain the knowledge on air pollution control techniques.
5. Understand the indoor air quality management system.

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

22CEOESCN	MUNICIPAL SOLID WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To gain an insight regarding sources, characteristics and composition of solid waste.
- To understand the rate of generation of solid waste and its present status in india.
- To know the method of collection, transfer, and transport of municipal solid waste.
- To Understand the role and applicability of physical, chemical, thermal and biological processing techniques.
- To acquire substantial knowledge in the field of resource recovery, waste – to – energy and on composting facility.

### UNIT-I

Introduction – goals and objectives of solid waste management – social aspects – legal aspects health factors – generation of solid wastes – sampling – characterization – method of disposal as a factor dependent upon the quality of refuse.

### UNIT-II

Storage system – dust bins at the streets – collection facility – frequency of collection – method of transport – transfer stations – types – design requirements.

Volume reduction – methods – compaction and balling – grinding of garbage – disposal methods.

Incinerators – design and operation – dust and air pollution problems – use – cost considerations



### **UNIT–III**

Sanitary land fill – methods – machineries involved – site selection – Geoenvironmental investigations – Design and operation – liners and covers – phases of waste digestion – leachate control and treatment, gas recovery and control, landfill post closure monitoring – cost consideration – environmental factors such as odours, flies and vectors and leachate and groundwater pollution.

### **UNIT–IV**

Recovery and Reuse – ocean disposal – impact assessment – precautions required for the operation of the project – cost considerations.

### **UNIT–V**

Composting – types – methods – factors influencing composting – recommended procedures – impact assessment – cost consideration – disposal of industrial solid waste and hazardous refuse – – types – sources – characteristics – precautions needs – treatment and disposal.

### **TEXT BOOKS**

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, Integrated Solid Waste Management, McGraw Hill, New York, 1993.
2. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2016.

### **REFERENCES**

1. Handbook of Solid Waste Management by Frank Kreith , George Tchobanoglous McGraw Hill Publication.
2. Solid Waste Management – Haggerty, D.J., Von Nostrand Renihold company, New York, 1973.
3. Municipal Refuse Disposal – by American Public Works Association, 2022.
4. Refuse Collection Practice – by American Public Works Association, 1967.
5. Management of Solid Wastes in Developing Countries – Flintoff, F., WHO Publication, 1984.

### **COURSE OUTCOMES**

At the end of the course students will be able to

1. Apply the procedures and methods for MSW Collection, segregation, processing and disposal
2. Develop an Environmental Management System.
3. Explain different methodologies for Environmentally sound solutions
4. Examine the process by which legal systems are adopted and enforced.
5. Gain knowledge on composting methods of municipal solid waste.

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

22CEOESCN	ECONOMICS & FINANCE FOR CIVIL ENGINEERING											L	T	P	C
												3	0	0	3

### COURSE OBJECTIVES

- To enable the Civil Engineering student to become an entrepreneur by understanding the basics and law of economics.
- To ensure the students to apply different methods of appraisal of projects and pricing techniques apart from knowing about various Macroeconomics Model.
- To ensure the students to understand the accounting & concepts in finance and finance planning

### UNIT –I INTRODUCTION AND DEMAND & SUPPLY ANALYSIS

The Scope and Method of Managerial economics - Fundamental Economics concepts – Managerial Economics with other subjects - Objectives of the Firm. Meaning, Types and Determinants - Demand estimation - Demand elasticities for decision making - Business and Economic forecasting: Qualitative and Quantitative methods - Supply analysis: Meaning, elasticities and determinants.

### UNIT –II PRODUCTION ECONOMICS

Production and Production function - Types - Estimation - Returns to Scale - Economies and Diseconomies of Scale and Economies of Scope. Factor Inputs - Input-Output Analysis.

### UNIT –III INFRASTRUCTURE ECONOMICS

Land and construction economics – Urban land use and values – Construction development in housing, transport and other infrastructures – Economics of ecology, environment, energy resources, local material selection, form and functional designs – Construction workers – Urban problems: Poverty – Unemployment – Migration.

## **UNIT –IV PRICING STRUCTURE AND INTRODUCTION TO MACROECONOMICS**

Pricing Practices: Objectives - Determinants - Pricing Methods - Government Policies and Pricing.

Circular Flow of Income and Expenditures - Components of National Income and its significance - Measuring Gross Domestic Product (GDP) - Inflation and Business Cycles - Government Fiscal and Monetary Policy - Balance of payments - Foreign exchange markets.

## **UNIT –V ACCOUNTING AND FINANCE**

Accounting & Concepts in Finance: definitions, objectives, characteristics, limitations, basic terms Systems of accounting, cash book, bank book, depreciation, provisions, reserves, accounting equation, journal & ledger entries (trial balance, profit & loss account, balance sheet, cash flow statement).

Financial planning- Definition, financial planning options and objectives, time value of money Simple and compound interest, rule of 72, methods of capital budgeting - payback period.

## **TEXT BOOKS**

1. Theusen G.J., Fabrycky W.J., Engineering Economy, 9th Edition, Prentice-Hall, Inc., New Delhi, India, 2001.
2. Crundwell F.K., Finance for Engineers-Evaluation and Funding of Capital Projects, Springer, London, UK, 2008. (ISBN 978-1-84800-032-2).
3. Jha K.N., Construction Project Management- Theory and practice, 2nd Edition, Pearson India Education Services Pvt. Ltd., UP, India 2015.
4. Peterson, S. J., “Construction Accounting and Financial Management”, Pearson Education, Upper Saddle River, New Jersey, (2015).

## **REFERENCES**

1. Alan A.Smith, Ernest Hinton and Roland W. Lewis, Civil Engineering Systems Analysis and Design, John Wiley and Sons, UK, 1983.
2. Charles S. Revelle, E.Earl Whitlach and Jeff.R.Wright, Civil and Environmental Systems Engineering, Pearson Prentice Hall Inc., New Jersey, USA, 2004.
3. Jha, K. N., “Construction Project Management, Theory and Practice”, Pearson, New Delhi, (2011).
4. Mitchel, Robert L., Engineering Economics, John Wiley & Sons, UK, 1980.
5. Newnan, D. G., Eschenbach, T. G. and Lavelle, J. P., “Engineering Economic Analysis”, Indian Edition, Oxford University Press, (2010).

## COURSE OUTCOMES

At the end of the course students will be able to

1. Perceive the power of economics techniques, demand and supply analysis.
2. Demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.
3. Analyze the infrastructure economics and urban problems
4. Understand the Pricing structure & methods and government fiscal and policies.
5. Perceive knowledge on accounting methods applied in Civil Engineering and understand the financial concept.

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

22CEOESCN	ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

## COURSE OBJECTIVES

- To understand the evolution, role, application and the general procedure for EIA
- To impart the concept of Environmental Management Systems (EMS).
- To impart/inculcate the knowledge of Environmental Auditing, Life cycle Assessment (LCA).
- To introduce the concept and role of Cleaner Production, Sustainable Development and ISO 14000 series.
- To understand the rules and regulations governing EIA and EIA case studies.

### Unit-I

Evolution of EIA – Concepts – Methodologies – Screening – Scoping – Base line Studies – mitigation – Matrices – Checklist.

## **Unit–II**

Rapid EIA – Comprehensive EIA – Legislative and Environmental Clearance procedure in India – prediction tools for EIA.

## **Unit–III**

Assessment of Impact on Air – Soil – Water – Noise – Biological – Socio – Cultural Environment. Public participation – Resettlement and Rehabilitation procedures – Sustainable Development.

## **Unit–IV**

Documentation of EIA – EMP – POst project Monitoring – EIA case studies.

Environmental Auditing – Various types of Audit – Philosophy – concepts – rules and relevant methodologies.

## **Unit–V**

Concept of Cleaner production – Role of ISO and ISO 14000 in Environmental Management.

## **TEXT BOOKS**

1. Canter R.L., Environmental Impact Assessment, McGraw Hill Inc., New Delhi, 1997.
2. Anjaneyalu Y., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2021.

## **REFERENCES**

1. Lohani B., Evans J.W., Ludwig H., Everitt R.R., Richard A. Carpenter and Tu S.L., Environmental Impact Assessment for Developing countries in Asia, Volume 1 – Overview, Asian Development Bank, 1997.
2. Peter Morris and Riki Therivel, Methods of Environmental Impact Assessment, Routledge Publishers, 2009.
3. Barry Sadler and Mary McCabe, Environmental Impact Assessment Training Resource Manual, UNITED Nations Environment Programme, 2002.
4. Judith Petts, Handbook of Environmental Impact Assessment Volume I and II, Blackwell Science, New York, 1999.
5. Ministry of Environment and Forests, EIA Notification and Sectoral Guides, Government of India, New Delhi, 2020.
6. The World Bank, Environmental Impact Assessment Source book, Volume I, II and III, Washington D.C., 2011.

## **COURSE OUTCOMES**

At the end of the course students will be able to

1. Apply the main procedures and methods which are adopted at different stages in EIA process.
2. Develop on Environmental Management Systems.

3. Explain different methodologies for Environmental Impact prediction and assessment.
4. Evaluate EIA reports
5. Examine the process by which legal systems are adopted and enforced.

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

22CEOESCN	COASTAL ENGINEERING	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To develop an understanding of basic concepts in coastal engineering such as the linear wave theory, energy propagation in waves, shoaling, refraction, diffraction, and breaking.
- To help the student develop an intuitive feeling about design concepts in coastal engineering based on wave spectra, prediction of waves in fetch limited seas, wave forces on piles and wall type structures.
- The students to the diverse topics as wave mechanics, wave climate, shoreline protection methods and laboratory investigations using model studies.

### Unit-I

Indian Scenario – Classification of Harbours. Introduction – wind and waves – Sea and Swell – Introduction to small amplitude wave theory – use of wave tables – Mechanics of water waves – Linear (Airy) wave theory, Introduction to Tsunami.

### Unit-II

Behaviour of waves in shallow waters, Introduction to non – linear waves and their properties – Waves in shallow waters – Wave Refraction, Diffraction and Shoaling – Hindcast wave generation models, wave shoaling; wave refraction; wave breaking; wave diffraction random and 3D waves – Short term wave analysis – wave spectra and its utilities – Long term wave analysis – Statistics analysis of grouped wave data.

### **Unit–III**

Dynamic beach profile; cross – shore transport; along shore transport (Littoral transport), sediment movement.

### **UNIT-IV**

Field measurement; models, groins, sea walls, offshore breakwaters, artificial nourishment – planning of coast protection works – Design of shore defense structures.

### **UNIT-V**

Physical modeling in Coastal Engineering – Limitations and advantages – Role of physical modeling in coastal engineering – Numerical modeling – Modeling aspects – limitations – Tsunami mitigation measures.

### **TEXT BOOKS**

1. Coastal Engineering Process, theory and design practices. Dominic Reeve, Andrew Chadwick and Chris Fleming, CRC Press.
2. Basic Coastal Engineering. Robert M. Sorensen, 3<sup>rd</sup> Edition, Springer Publisher(2005).

### **REFERENCES**

1. Mani J.S., Coastal Hydrodynamics. PHI Pvt. Ltd. New Delhi – 2012.
2. Dean, R.G. and Dalrymple, R.A., Water wave mechanics for Engineers and Scientists, Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1994.
3. Ippen, A.T., Estuary and Coastline Hydrodynamics, McGraw – Hill, Inc., New York, 1978.
4. Sorenson, R.M., Basic Coastal Engineering, A Wiley – Interscience Pub. New York, 2013.
5. Coastal Engineering Manual, Vol. I – VI, Coastal Engineering Research Centre, Dept. of the Army, US Army Corps of Engineers, Washington DC, 2012.

### **COURSE OUTCOMES**

The students will be able to

1. Understand coastal engineering aspects of harbors methods to improve navigation
2. Understand the wave properties and analysis of wave.
3. Understand the concepts of sediment transport.
4. Design of shore defense structures.
5. Gain knowledge in modeling in coastal engineering.

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

22CEOESCN	TOTAL QUALITY MANAGEMENT	L	T	P	C
22CEMESCN		3	0	0	3

### COURSE OBJECTIVES

- To evaluate the principles of quality management and to explain how these principles can be applied within quality management systems.
- To appraise the organisational, communication and teamwork requirements for effective quality management.
- Critically analyse the strategic issues in quality management, including current issues and developments and to devise and evaluate quality implementation plans.

#### Unit-I

Introduction – Need for quality – Evolution of quality – Definitions of quality – Dimensions of product and service quality – Basic concepts of TQM – TQM Framework – Contributions of Deming, Juran and Crosby – Barriers to TQM – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

#### Unit-II

Leadership – Quality Statements, Strategic quality planning, Quality Councils – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal – Continuous process improvement – PDCA cycle, 5S, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating.

#### Unit-III

The seven traditional tools of quality – New management tools – Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.



## **Unit–IV**

Quality Circles – Cost of Quality – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures.

## **Unit–V**

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector – Specific Standards—AS 9100, TS16949 and TL 9000 – ISO 9001 Requirements – Implementation—Documentation—Internal Audits—Registration – Environmental management System: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

## **TEXT BOOKS**

1. Dale H.Besterfield, Carol B.Michna, Glen H. Besterfield, Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

## **REFERENCES**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8<sup>th</sup> Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. ISO9001 – 2015 standards
4. Dale H. Besterfield et al., Total Quality Management, Fourth edition, Pearson Education (2015).

## **COURSE OUTCOMES**

The student would be able to

1. Apply the tools and techniques of quality management.
2. Gather a leadership quality and strategic planning and management.
3. Apply manufacturing and services processes in quality management.
4. Understand the quality measuring techniques.
5. To know the ISO certification process and internal auditing system.

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

22CEOESCN	COMPUTER AIDED DESIGN OF STRUCTURES	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To understand the need and concepts of design optimization.
- To introduce the students about computer graphics, structural analysis, design and optimization and expert systems, applications in analysis.
- To use conventional and modern optimization methods in structural applications.

#### Unit-I

Fundamental reason for implementing CAD – Software requirements – Hardware components in CAD system – Design process – Applications and benefits.

#### Unit-II

Graphic Software – Graphic primitives – Transformations – 2 Dimensional and 3 Dimensional transformations – Concatenation – Wire frame modeling – Solid modeling – Graphic standards – Drafting packages .

#### Unit-III

Principles of structural analysis – Fundamentals of finite element analysis – Concepts of finite elements – Stiffness matrix formulation – Variational Method – Weighted residual method – Problems – Convergence criteria – Analysis packages and applications.

#### Unit-IV

Principles of design of steel and RC structures – Beams and Columns – Applications to simple design problems – Optimization techniques – Algorithms – Linear programming – Simplex Method

## **Unit–V**

Introduction to artificial intelligence – Knowledge based expert systems – Applications of Knowledge Based Expert Systems – Rules and decision tables – Inference mechanisms – simple applications

### **TEXTBOOKS**

1. Groover M.P. and Zimmers E.W. Jr., CAD/CAM, Computer Aided Design and Manufacturing, Prentice Hall of India Ltd, New Delhi, 2014.
2. Krishnamoorthy C.S.Rajeev S., Computer Aided Design, Narosa Publishing House, New Delhi, 2005

### **REFERENCES**

1. Harrison H.B., Structural Analysis and Design, Part I and II Pergamon Press, Oxford,2014.
2. Rao S.S., Engineering Optimization Theory and Practice, Wiley Eastern Limited, New Delhi, 2019.
3. Richard Forsyth (Ed), Expert System Principles and Case Studies, Chapman and Hall, London, 1989.
4. Anupam Saxena Computer Aided Engineering Design. Anamaya Publishers, New Delhi, India, 2010.

### **COURSE OUTCOMES**

On successful completion of this course, students will be able to:

1. Understand the concepts of Computer – Aided Design, Software requirements and Hardware components in CAD system.
2. Acquire the knowledge in Computer Graphics and Computer aided drafting using Auto CAD software.
3. Understand the fundamentals of finite element analysis and be able use software for modeling, analysis and design of structures.
4. Understand the concepts of Optimization techniques and its practical applications to structural engineering.
5. Acquire the knowledge in Artificial Intelligence and Knowledge based expert systems.

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

22CEOESCN	SUSTAINABLE CONSTRUCTION METHODS	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To impart the knowledge on Sustainable construction methods incorporating site and climatic zone-specific sustainability features.
- Demonstrate an ability to evaluate and /or design whole or parts of projects, taking into account not only the financial and economic issues but also the social and environmental impacts affecting the sustainability of infrastructure.
- Promote an approach to project evaluation that is based on an appreciation of the needs of society, the potential for sustainable development and recognition of the problems that may result from poorly conceived or poorly implemented projects and programs.

### UNIT – I INTRODUCTION TO SUSTAINABLE ENGINEERING:

Definitions of Sustainability - Need for Sustainability - Concept of Sustainable Development - Three Pillar Basic Model - Engg of Sustainability Model - Atkisson's Pyramid Model -Prism Model - Principles of Sustainable Development - Threats for Sustainability.

### UNIT – II ENVIRONMENTAL ISSUES:

Zero Waste Concept - 3R Concept - Waste to Energy Technology - Climate Change and Global Warming - Ozone Layer Depletion - Resource Degradation - Carbon Footprint.

### UNIT – III TOOLS FOR SUSTAINABILITY:

Environmental Management System (EMS) - Concept of ISO 14000 - Life Cycle Assessment (LCA) - Basic Concepts - EIA Process in India - Environmental Auditing - Case Studies.

#### **UNIT – IV SUSTAINABLE HABITAT:**

Introduction - Necessity - Concept of Green Building - Principles of Green Building -Green Building Certification and Rating - Sustainable Cities - Sustainable Transport - Sustainable Pavements - Case Studies.

#### **UNIT – V SUSTAINABLE INDUSTRIALIZATION AND URBANIZATION:**

Need - Pollution Prevention - Industrial Ecology - Green Business - Green Technology -Green Construction - Green Energy - Green Transportation.

#### **TEXT BOOK**

1. Rag R.L. & Remesh Lekshmi Dinachandran, "Introduction to Sustainable engineering", 2st Edition, PHI Learning Pvt. Ltd., New Delhi, 2016

#### **REFERENCE BOOKS**

1. Bill Reed, "The Integrative Design Guide to Green Building: Redefining the Practice of Sustainability", 1 st Edition, Wiley India Pvt. Ltd., New Delhi, 2009.
2. Rogers Peter P., "An Introduction to Sustainable Development", 1st Edition, Glen Educational Foundation Inc., USA, 2012.

#### **COURSE OUTCOMES**

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

1. Assimilate the concept of sustainability for future understanding
2. Examine the local and global environmental issues to overcome the challenges in implementing sustainability applying
3. Use sustainable tools for construction applying
4. Implement green building practices in a building applying
5. Carry out sustainable industrialization and urbanization process applying

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

22CEOESCN	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

### **COURSE OBJECTIVE.**

- To get idea about the various natural hazards like earthquakes, slope stability, floods, droughts and Tsunami and the mitigation measures.
- To provide basic conceptual understanding of disasters and its relationships with development.
- To gain understand approaches of disaster risk reduction (DDR) and the relationship between vulnerability, disasters, disaster prevention and risk reduction.

### **UNIT– I: INTRODUCTION TO DISASTERS**

Definition - Disaster, Hazard, Vulnerability, Resilience, Risks - Disasters: Types of disasters - Earthquake, Landslide, Flood, Drought, Fire, Forest Fire, Industrial and Technological Disasters, Climate Change- Classification, Causes, Impacts — Do's and Don'ts during disaster – Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change.

### **UNIT– II: PRE AND POST DISASTER RISK REDUCTION STRATEGIES**

Disaster cycle - Phases of Disaster - Disaster Mapping - Predictability, forecasting and Warning - Disaster Preparedness Plan - Land-use Zoning for Disaster Management - Preparing Community through IEC - Disaster Mitigation - Disaster Relief: Search, Rescue and Evacuation- Shelter for Victims – Live stock and Relief Measures - Clearance of Debris and Disposal of the Dead – Control of Situation - Damage Assessment-Rehabilitation: Social and economic Aspects – Reconstruction and Rehabilitation as means of Development.

### **UNIT– III: INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT**

Factors affecting Vulnerabilities, differential impacts, impact of development projects such as dams, embankments, changes in Land use etc.- Climate Change Adaptation-IPCC Scenario and Scenarios in the context of India.

### **UNIT– IV: DISASTER MANAGEMENT IN INDIA**

Disaster Management Act 2005-Hazard and Vulnerability profile of India, Roles and responsibilities of community, Panchayat Raj Institutions/ Urban Local Bodies (PRIs/ULBs), NGO's States, Centre – Disasters of India and Lesson learnt from it.

### **UNIT– V: APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT**

Geo-informatics in Disaster Management (RS, GIS & GPS)-Early Warning and Its Dissemination – Land Use Planning and Development

Regulations – Disaster Safe Designs and Constructions-Structural and Non Structural Mitigation of Disasters – Institutions for Disaster Management in India.

## TEXTBOOK

1. SinghalJ.P., "DisasterManagement", 1<sup>st</sup>Edition, Laxmi Publications, India, 2007.

## REFERENCES

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

## COURSEOUTCOMES

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

1. Diagnose the different forms of disaster and their causes
2. Construct a disaster management cycle with disaster risk reduction measures
3. Interpret the various effects of development projects
4. Identify the agencies involved to manage the disaster in india
5. Summarize the role of technology in disaster

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

22CEOESCN	INTRODUCTION TO SMART CITIES	L	T	P	C
		3	0	0	3

### Course objectives:

- To gain knowledge on national smart city mission of India, components, policies, challenges and future of smart city in India.
- To promote the cities that provide core infrastructure, clean and sustainable environment.
- To provide a decent Quality of life to their citizens through emerging Technologies in ICT.

### UNIT – I : Smart city planning and development.

Definitions – Evolution – Features and strategies – Challenges – India 100 smart cities policy and mission, smart city planning and development, Dimension of smart cities, global standards and performance benchmarks, practice codes, smart city planning and development, financing smart cities development. Governance of smart cities – case studies in India.

## **Unit - II :Smart Urban Mobility and Smart Energy**

Need for urban mobility – multiple perspectives – objectives – components – emerging concepts and strategies – ICT supported smart mobility systems – policy priorities. Introduction to smart energy – urban density and energy use – objectives – elements of smart energy management system – strategies – smart grid – challenges..

## **Unit - III :Water and Waste Management**

Smart water management – definitions – water resource and cycle – functions and objectives – steps in implementation – benefits – policy challenges. Smart waste management – approaches and implementation – existing systems – strategies – challenges and polices.

## **Unit – IV : Smart Environment and Smart Buildings**

Global background of environmental concerns – concept of environmental resources - basic environmental challenges – smart environment – stakeholders – ICT framework for environmental management. Intelligent buildings – objectives – components – systems of smart building – benefits, challenges.

## **Unit - V : E- Governance and ICT**

Governance challenges in new era – history of smart governance – functions and objectives – ICT in governance – system infrastructure – benefits, challenges and future vision. Taxonomy of layers of ICT architecture – major technology areas – components – emerging technologies in ICT – challenges and concerns in ICT .

## **TEXT BOOK**

1. Anilkumar P.P, "Introduction to Smart Cities", 1st Edition, Pearson India Education Service Pvt Ltd, Noida,Uttar Pradesh, India, 2019.

## **REFERENCES**

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

## **COURSE OUTCOMES**

On completion of the course,

The students will be able to BT Mapped (Highest Level)

1. explain the concepts of smart city development and design Understanding (K2)
2. describe mobility and energy in smart city Understanding (K2)
3. explain water and waste management techniques in smart city Understanding (K2)
4. model smart environment and smart buildings Applying (K3)
5. plan e-governance and ICT in smart city Applying (K3)



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

22CEOESCN	NCC STUDIES (ARMY WING/ NAVAL WING)	L	T	P	C
		2	0	2	3

### COURSE OBJECTIVES

This course is designed especially for NCC Cadets. This course will help develop character, camaraderie, discipline, and 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 – IV (LECTURE)**

##### **SPECIALIZED SUBJECT (NAVY WING)**

Naval Orientation - Naval Communication - Navigation - Seamanship - Fire Fighting Flooding & Damage Control - Ship and Boat Modeling-Swimming Basics.

#### **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.

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

## HONOR ELECTIVES

22CEHESCN	SPECIAL CONCRETE STRUCTURES	L	T	P	C
22CEMESCN		4	0	0	4

### COURSE OBJECTIVES

- To expose the students to the design practices of complicated RCC structures like Deep beams, R.C.poles, storage containers and elevated water tanks.
- To understand the significance of various code specifications in design of special concrete structures.
- To introduce the different types of philosophies related to design of special concrete structures.

#### Unit-I

Analysis and Design of Building frames – Analysis for vertical and horizontal loads – Method of substitute frames – Portal method – Cantilever method – Factor method. Design of portal frames with vertical loads – Design of gable frames with vertical loads – Design of deep beams using strut and tie concept – Design of Concrete Corbels for crane loads – Design of Grid floors – Detailing of reinforcement as per relevant standards.

#### Unit-II

Design of Concrete Poles as per IS 785: 1965 – Design of Concrete Hume Pipes as per IS 458:1971 – Design of R.C. Chimneys as per IS 4998 (Part I): 1992-Design of Portal frames as per SP 43: 1987 – Detailing of reinforcement as per relevant standards.

#### Unit-III

Design of Concrete Bunkers as per IS 4995 ( Part I,II): 1974 – Design of Concrete Silos as per IS 5503 (Part I) :1969 – Detailing of reinforcement as per relevant standards.

#### Unit-IV

Design of Elevated Concrete water tanks – Circular tanks – Rectangular tanks – Intze type tanks – Design of staggering – Design of Underground Rectangular and Circular Water tanks – Design of Domes – Detailing of reinforcement as per IS 11992: 1995, IS 3370 (Part IV): 1967 and IS 3370 (Part I): 2009.

#### Unit-V

Design of Bridge deck Slab – I.R.C.loadings – Design of solid slab bridges – Pigeaud's curves – General design requirements as per IRC: 6 – 2014 and IRC 21: 2000.

### TEXT BOOKS

1. Krishnaraju N., Advanced R.C.Design, CBS Publishers & Distributors Pvt. Ltd., 2012.
2. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, R.C.Structures – Vol. I & II, Laxmi Publications (P) Ltd., 1992.

## REFERENCES

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

## STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
2. IS 13920: 1993, Ductile Detailing of Reinforced Concrete structures subjected to Seismic Forces – Code of Practice.
3. SP 34: 1987, Handbook on Concrete Reinforcement and Detailing.
4. IRC: 6 – 2014, Standard Specifications and Code of Practice for Road Bridges Section: (Loads And Stresses).
5. IRC 21: 2000, Standard Specifications and Code of Practice for Road Bridges Section: [Cement Concrete (Plain And Reinforced)].
6. IS 1343:1980, 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).
8. IS 2974 (Part II):1980, Code of Practice for Design and Construction of Machine Foundations [Foundations for Impact Type Machines (Hammer Foundations)].
9. IS 2974 (Part III): 1992, Design and Construction of Machine Foundations – Code of Practice [Foundations for Rotary Type Machines (Medium and High Frequency)].
10. IS 2974 (Part IV):1979, Code of Practice for Design and Construction of Machine Foundations (Foundations for Rotary Type Machines of Low Frequency).
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).
12. IS 4995 (Part II):1974, Criteria for Design of Reinforced Concrete Bins for Storage of Granular and Powdery Materials (Design Criteria).
13. IS 9178 (Part II):1979, Criteria for Design of Steel Bins for Storage of Bulk Materials (Design Criteria).
14. IS 5503 (Part I) :1969, General Requirements for Silos for grain storage (Construction requirements)
15. IS 4998 (Part I): 1992, Criteria for Design of Reinforced (Assessment of Loads).
16. IS 3370 (Part IV): 1967, Code Of Practice for Concrete Structures for the Storage of Liquids.

17. IS 11992: 1995, Criteria for Design Of RCC Staging For Overhead Water Tanks.
18. IS 3370 (PART I): 2009, Concrete Structures for Storage of Liquids – Code of Practice.
19. IRC: 6 – 2014, Standard Specifications and Code of Practice for Road Bridges Section: (Loads And Stresses).
20. IRC 21: 2000, Standard Specifications and Code of Practice for Road Bridges Section [Cement Concrete (Plain And Reinforced)].

## COURSE OUTCOMES

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

1. Develop basic knowledge about various complicated structural elements.
2. Get knowledge on the concepts of R C pipes and chimneys.
3. Gain adequate familiarity in the design of Bunkers and silos.
4. Understand the design of tanks with relevant to standard specifications.
5. Analyze with standard specification the concepts of bridge slabs.

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

22CEHESCN	EARTHQUAKE ENGINEERING	L	T	P	C
		3	0	0	3

## COURSE OBJECTIVES

- To provide a coherent development to the students for the courses in sector of earthquake engineering.
- To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.
- To understand that these loadings will enable design engineers 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, Richter scale, MM scale, Earthquake recording instruments, and Seismic resistant design guidelines

## **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 band width method, and simple problems.

## **Unit-III**

Forced Vibration Analysis (Harmonic loading) of Single Degree of freedom systems with and without damping under harmonic excitations, Forced vibration response to harmonic base excitation. Formulation of Response Spectrum, Design Response spectrum as per IS:1893, simple problems using the above response spectrums. Forced vibration analysis of multi Degrees of freedom systems (restricted to two degrees of freedom only) using modal superposition technique.

## **Unit-IV**

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 Resistant design – Strength and Stiffness, Ductility Design and Detailing (IS:13920), Concept of Energy Absorbing Devices, Concepts of Seismic Base isolation technique and Seismic Active control methods. Lessons learnt from the Past Earthquakes – Case studies of important Indian Earthquakes, Major world Earthquakes.

## **TEXT BOOKS**

1. Dowrick, D.J., Earthquake Resistant Design, John Wiley & Sons, Winchester, U.K., 1977.
2. Paulay, T. and Priestley, M.J.N., Seismic Design of Reinforced and Masonry Buildings, John Wiley & Sons, Inc., New York, 1992.

## REFERENCES

1. Anil K. Chopra, Dynamics of Structures, McGraw Hill International Edition, 1998.
2. Clough, R.W. and Penzien, J., Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1993.
3. Kiyoshi Muto, Earthquake Resistant Design of Tall Buildings in Japan, University of California, 1973.
4. Beskos. D.E., Computer Analysis & Design of Earthquake Resistant Structures – A Handbook of Advances in Earthquake Engineering, Computational Mechanics Inc, 1997.
5. Hiroshi Akiyama, Earthquake Resistant Limit State Design for Buildings, University of Tokyo Press, 1985.
6. Paz, M. and Leigh W., Structural Dynamics – Theory & Computations, 4<sup>th</sup> Edition,
7. CBS Publishers & Distributors, New Delhi, 2006.

## LIST OF CODES

1. IS 1893: 2002 — 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 of Buildings, Bureau of Indian Standards, New Delhi.
3. IS 13920: 1993 — Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces — Code of Practice, Bureau of Indian Standards, New Delhi.
4. Explanatory Handbook on Codes for Earthquake Engineering, Special Publication SP 22, Bureau of Indian Standards, New Delhi.
5. IS 13827: 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Earthen Buildings.
6. IS 13828: 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings.
7. IS 13935: 1993, Indian Standard Guidelines for Repair and Seismic Strengthening of Buildings.
8. IS 456: 2000, Explanatory Handbook on Indian Standard Code of Practice for Plain and Reinforced Concrete, Special Publication SP: 24, Bureau of Indian Standards, New Delhi.

## COURSE OUTCOMES

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

1. Understand the basic concepts about the basics, effects and phenomenon of earthquake.
2. Acquire adequate knowledge on the dynamics of earthquake.
3. Understand and analyze the concept of forced vibrations and its response.
4. Apply skills in the design and modeling of various building frames.



5. Develop information on the concept and principles of earthquake resistant design and energy absorbing devices.

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

22CEHESCN	<b>ADVANCED WATER TREATMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
22CEMESCN		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

### COURSE OBJECTIVES

- To realize the principle and concept of physico-chemical treatment.
- To understand the concept of conventional water treatment system.
- To design the advanced water treatment system.

### UNIT-I : PHYSICAL TREATMENT PRINCIPLES

Principles of screening – mixing, equalizations – sedimentation – filtration – modeling – backwashing – evaporation – incineration – gas transfer – mass transfer coefficients. Adsorption – isotherms – principles, equilibrates and kinetics, reactors, regeneration, membrane separation, reverse osmosis, nano filtration ,ultra filtration and hyper filtration – electro dialysis, distillation – stripping and crystallization – recent advances.

### UNIT-II : CHEMICAL TREATMENT PRINCIPLES

Principles of chemical treatment – coagulation flocculation – precipitation – floatation, solidification and stabilization – disinfection ion exchange, electrolytic methods – Solvent extraction – advanced oxidation / reduction – recent advances.

### UNIT-III : WATER TREATMENT

UNIT operations and processes – Principles, functions design and drawing of Chemical feeding, Flash mixers, flocculators, sedimentation tanks and sand filters – Disinfection – Residue Management – Construction and Operation & Maintenance aspects of Water Treatment Plants.

#### UNIT-IV : ADVANCED WATER TREATMENT

Principles and functions of Aeration – Iron and manganese removal, Defluoridation and demineralization – Water softening – Desalination – Membrane Systems – Recent advances.

#### UNIT-V : DESIGN OF CONVENTIONAL TREATMENT PLANTS

Selection of UNIT operation and processes – design of conventional water treatment plant UNITS – aerators – chemical feeding – flocculation – clarifier – filters – rapid sand filter, slow sand filter, pressure filter – chlorinators. Displacement and gaseous types and layouts – flowcharts – hydraulic profile – O & M aspects – case studies , residue management – up gradation of existing plants – recent advances.

#### TEXT BOOKS

1. Modi, P.N. "Water Supply Engineering", Vol. I Standard Book House, New Delhi, 2005.
2. Bhole A.G., Design of water treatment plants. Indian Water Works Association Publisher.

#### REFERENCES

1. David W. Hand, Kerry J. Howe, Water Treatment Principles and Design, John C.Crittenden, R.Rhodes Trussell, George Techo banoglous. Third Edition.
2. Rangwala.S.C.,Water supply and sanitary Engineering.
3. David.G. Stevensan.,Water treatment UNIT Process.
4. Santhosh kumar Garg, Water supply Engineering.

#### COURSE OUTCOMES

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

1. Have the necessary understanding on the various physical treatment methods.
2. Gain adequate familiarity on the concepts of chemical treatment principles.
3. Acquire knowledge on design, operation and maintenance of treatment plants.
4. Get knowledge on the principles of advanced treatment methods.
5. Understand the concept of operation, process and design of conventional treatment plants

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

<b>22CEHESCN</b>	<b>WATERSHED MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **COURSE OBJECTIVES**

- To understand different watershed behaviour.
- To be able to interpret runoff data and quantify erosion by using various modelling methods
- To emphasize the need for water conservation.

#### **Unit-I**

Watershed – Concept – Classification – Characteristics – Watershed Programmes – Need for Watershed Management – Factors affecting watershed management Planning of Watershed Works – Watershed Management Practices

#### **Unit-II**

Erosion – History and Types – Erosion Problems in India – Soil Erosion – Types of Soil Erosion – Controlling Soil Erosion – Soil Erosion by Wind and Water – Soil Conservation Practices – Structural and Non – Structural Measures – Soil loss estimation models

#### **Unit-III**

Need for Water Conservation – Water Conservation Measures – Water Harvesting – Principles and Techniques – Flood Water Harvesting

#### **Unit-IV**

Joint forest Management – Grassland Farming and Management – Range and Pastures – Grazing Practices – Waste Land Development – Drought Management – Integrated Watershed Management

#### **Unit-V**

Watershed Modelling – Standard Modelling Approaches and Classification, System Concept for Watershed Modelling, Rainfall – Runoff modeling – Applications of Remote Sensing and Geographical Information System

### **TEXT BOOKS**

1. Suresh, R., Soil and Water Conservation Engineering, Standard Publishers & Distributors, New Delhi, 2000.
2. Ghanshyam Das, Hydrology and Soil conservation Engineering , Prentice Hall India, New Delhi, 2000.

### **REFERENCES**

1. Tideman, E.M., Watershed Management – Guidelines for Indian Conditions, Omega Scientific Publishers, New Delhi, 1996.
2. Murty, J.V.S., Watershed Management New Age International, 1998.

3. Madan Mohan Das and Mimi Das Saikia, Watershed Management PHI Learning Pvt. Ltd.
4. Ranga Reddy A., Watershed Management for Sustainable Development Published by Mittal, New Delhi, 2005.

### **COURSE OUTCOMES**

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

1. Develop adequate knowledge on various watershed management practices.
2. Understand the basics of erosion, its control and conservation practice.
3. Gain acquaintance on the perception of water conservation and harvesting methods.
4. Have the essential understanding on integrated water shed management.
5. Get knowledge on the concept of watershed modelling and the application of RS and GIS.

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

<b>22CEHESCN</b>	<b>GEOENVIRONMENTAL ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **COURSE OBJECTIVES**

- The student acquires the knowledge on the Geotechnical engineering problems.
- To acquire knowledge on soil contamination and safe disposal of waste.
- Student to give remediation for the contaminated soils by different techniques.

### **Unit-I**

Introduction to Geoenvironmental engineering – Environmental cycle – Sources, production and classification of waste – Causes of soil pollution – Factors governing soil pollution interaction clay minerals – Failures of foundation due to waste movement.

## **Unit-II**

Safe disposal of waste – Site selection for landfills – Characterization of land fill sites and waste – Risk assessment – Stability of landfills – Current practice of waste disposal – Monitoring facilities – Passive containment system – Application of geosynthetics in solid waste management – Rigid or flexible liners.

## **Unit-III**

Contaminant transport in sub surface – Advection, Diffusion, Dispersion – Governing equations – Contaminant transformation – Sorption – Biodegradation – Ion exchange – Precipitation – Hydrological consideration in land fill design – Ground water pollution.

## **Unit-IV**

Stabilization – Solidification of wastes – Micro and macro encapsulation – Absorption, Adsorption, Precipitation – Detoxification – Mechanism of stabilization – Organic and inorganic stabilization – Utilization of solid waste for soil improvement – case studies.

## **Unit-V**

Exsitu and Insitu remediation – Solidification, bio – remediation, incineration, soil washing, phyto remediation, soil heating, vetrification, bio – venting.

## **TEXT BOOKS**

1. Hari D. Sharma and Krishna R. Reddy, Geo-Environmental Engineering – John Wiley and Sons, INC, USA, 2004.
2. Daniel B.E., Geotechnical Practice for waste disposal, Chapman & Hall, London, 1993.

## **REFERENCES**

1. Westlake, K., Landfill Waste pollution and Control, Albion Publishing Ltd., England, 1995.
2. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989.
3. Manoj Datta, Waste Disposal in Engineered landfills, Narosa Publishing House, 1997.
4. Manoj Datta, B.P. Parida, B.K. Guha, Industrial Solid Waste Management and Landfilling Practice, Narosa Publishing House, 1999.

## **COURSE OUTCOMES**

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

1. Gain perception on the basics of Geoenvironmental Engineering, causes and failures due to soil pollution.
2. Develop knowledge on characterization, risk assessment and stability of landfills.
3. Get facts about contaminant transportation, dispersion and diffusion of waste in soil.
4. Understand the concept of stabilization, solidification and utilization of solid waste for soil improvement.
5. Have the thorough knowledge on the concept of remediation of soil.

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

22CEHESCN	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

### COURSE OBJECTIVES

- To give an idea about IPR, registration and its enforcement.
- To understand the basic concepts and need for Intellectual Property.
- To understand IP Laws, Enforcement Measures and Emerging issues.

#### Unit-I

Introduction to IPRs, Basic concepts and need for Intellectual Property – Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO – TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

#### Unit-II

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

#### Unit-III

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

#### Unit-IV

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

#### Unit-V

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

## TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012.
2. S.V. Satakar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002

## REFERENCES

1. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets, Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy, McGraw Hill Education, 2011.
3. Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.
4. Ahuja V.K., Law Relating to Intellectual Property Rights.

## COURSE OUTCOMES

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

1. Understand the fundamentals and standards of IPR
2. Develop knowledge on the methods of copy right and patents
3. Familiarize with various agreements, treaties and act regarding IPR.
4. Get perception on digital innovations and IP laws.
5. Have adequate understanding on the concept of enforcement measures and emerging issues.

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

<b>22CEHESCN</b>	<b>SUSTAINABLE ENGINEERING AND TECHNOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CEMESCN</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **COURSE OBJECTIVES**

- To have an increased awareness among students on issues in areas of sustainability
- To know the methods, tools, and incentives for sustainable product – service system development
- To establish a clear understanding of the role and impact of various aspects of engineering and engineering decisions on environmental, societal, and economic problems.

#### **Unit-I**

Sustainability – Introduction, Need and concept of sustainability, Social environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols – Clean Development Mechanism (CDM), Environmental legislations in India – Water Act, Air Act

#### **Unit-II**

Air Pollution, Effects of Air Pollution; Water pollution – sources, Sustainable wastewater treatment, Solid waste – sources, impacts of solid waste, Zero waste concept, 3 R concept. Global environmental issues – Resource degradation, Climate change, Global warming, Ozone layer depletion, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print.

#### **Unit-III**

Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) – Scope and Goal, Bio – mimicking, Environment Impact Assessment (EIA) – Procedures of EIA in India

#### **Unit-IV**

Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification, Methods for increasing energy efficiency of buildings. Sustainable cities, Sustainable transport.

#### **Unit-V**

Energy sources: Basic concepts – Conventional and non – conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio – fuels, Energy derived from oceans, Geothermal energy Green Engineering, Sustainable Urbanisation, industrialisation and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis.



## TEXT BOOKS

1. Purohit, S.S., Green Technology – An approach for sustainable environment, Agrobios publication.
2. Peter P. Rogers, Kazi F. Jalal, John A. Boyd, An Introduction To Sustainable development, Glen Educational Foundation, 2008.

## REFERENCES

1. Allen, D.T. and Shonnard, D.R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
2. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
3. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
4. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.
5. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications – Rating System, TERI Publications – GRIHA Rating System.
6. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw – Hill Professional.
7. Twidell, J.W. and Weir, A.D., Renewable Energy Resources, English Language Book Society (ELBS).

## COURSE OUTCOMES

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

1. Develop knowledge on the fundamentals of sustainable development.
2. Get perception about pollution, global environmental issues and carbon footprint.
3. Understand the concept of environmental management and EIA.
4. Develop familiarity on sustainable habitat and green buildings.
5. Attain adequate knowledge about the various energy sources

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

<b>22CEHESCN</b>	<b>TOTAL STATION AND GPS SURVEYING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CEMESCN</b>		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

### **COURSE OBJECTIVES**

- To understand the working of Total Station and GPS
- To ensure the students to solve the surveying problems with the application of Total Station.
- To ensure the students to understand the GPS applications and data processing

### **UNIT I FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES**

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying. Classification - applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies

### **UNIT II DISTANCE AND ATMOSPHERIC CORRECTION**

Refractive index (RI) - factors affecting RI-Computation of group for light and near infrared waves at standard and ambient conditions-Computation of RI for microwaves at ambient condition - Reference refractive index- Real time application of first velocity correction. Measurement of atmospheric parameters- Mean refractive index- Second velocity correction - Total atmospheric correction- Use of temperature and pressure transducers.

### **UNIT III ELECTRO OPTICAL AND MICRO WAVE SYSTEM**

Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments – Traversing and Trilateration-COGO functions, offsets and stake out-land survey applications.

### **UNIT IV GPS SATELLITE SYSTEM**

Basic concepts of GPS - Historical perspective and development - applications - Geoid and Ellipsoid- satellite orbital motion - Keplerian motion – Kepler’s Law - Perturbing forces – Geodetic satellite - Doppler effect - Positioning concept –GNSS, IRNSS and GAGAN - Different segments - space, control and user segments - satellite configuration – GPS signal structure – Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - GPS receivers.

### **UNIT V GPS DATA PROCESSING**

GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation – downloading the data RINEX Format –

Differential data processing – software modules -solutions of cycle slips, ambiguities, Concepts of rapid, static methods with GPS - semi Kinematic and pure Kinematic methods -satellite geometry & accuracy measures - applications- long baseline processing- use of different softwares.

### TEXT BOOKS

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th Edition,1996.
2. Satheesh Gopi, Rasathishkumar, N.Madhu, — Advanced Surveying , Total Station GPS and Remote Sensing — Pearson education , 2nd Edition,2017. ISBN: 978-81317 00679100

### REFERENCES

1. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983.
3. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin,3<sup>rd</sup> Edition,2016.
4. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 4th Edition, 2015.
5. Seeber G, Satellite Geodesy, Walter De Gruyter, Berlin,2nd Edition,2003.

### Course Outcomes

On completion of the course, the student is expected to be able to

1. Learn the fundamentals of Total station.
2. Provides knowledge about electromagnetic waves and its usage in Total station and GPS.
3. Understand the measuring and working principle of electro optical and Microwave Total station and GPS
4. Learn the basic concepts of GPS
5. Gains knowledge about Total station and GPS data downloading and processing

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

<b>22CEOESCN</b>	<b>INTELLIGENT TRANSPORT SYSTEM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>22CEMESCN</b>		<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

### **COURSE OBJECTIVES**

- To enable the student to understand the ITS and ATMS
- To ensure the students to apply ITS knowledge on field application in various transportation sectors.
- To ensure the students to understand the ITS strategies, ITS planning and architecture

#### **UNIT-I**

Introduction to ITS, including where ITS fits; roles and responsibilities Advanced Traveller Information Systems (ATIS), including functionality; business models; field trip to Smart Route Systems

#### **UNIT-II**

Advanced Transportation Management Systems (ATMS), including network operations; incident detection; congestion pricing, tolling, HOT lanes, example deployments

#### **UNIT-III**

Fleet-oriented ITS services, including Advanced Public Transportation Systems (APTS); BRT; Commercial Vehicle Operations (CVO); Intermodal Freight, including International Operations and Supply Chains ITS and Technology, including automated highway systems (AHS); sensors, electronic toll collection (ETC); dedicated short range communication, and standards

#### **UNIT-IV**

Regionally-scaled ITS deployment, including regional architecture; organizational and institutional issues; standards; developed vs. developing countries; ITS and strategic regional transportation planning; Integrating infrastructure and operations planning

#### **UNIT-V**

Critical ITS Issues, including (as time permits) ITS and security; safety; human factors; privacy; sustainability; funding (as contrasted with conventional infrastructure); technology deployment/R &D/policy; other institutional issues Conclusion, including regional ITS planning and architecture presentation; the future of ITS; International ITS Programs Case Studies: applications in bus transport, metro and highways; Emerging Issues.

### **TEXT BOOKS**

1. Ghosh, S., Lee, T.S. Intelligent Transportation Systems: New Principles and Architectures, CRC Press, 2000.
2. Mashrur A. Chowdhury, and Adel Sadek, Fundamentals of Intelligent Transportation Systems Planning, Artech House, Inc., 2003.
3. R.P Roess, E.S. Prassas, W.R. McShane. Traffic Engineering, Pearson Educational International, Third Edition, 2004.

- Pradip Kumar Sarkar and Amit Kumar Jain, Intelligent Transportation Systems, PHI Learning publications, 2018

#### REFERENCES

- Sussman, J.M. Perspectives on Intelligent Transportation Systems, Springer, Berlin, 2010.
- Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US, 2001
- Sumit Ghosh and Tony S. Lee, Intelligent Transportation Systems - Smart and Green Infrastructure design, Second Edition, CRC Press, 2010.

#### Course Outcomes

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

- Understand the concept of ITS & ATIS
- Advanced Transportation Management System
- Know about APTS, CVO, new technology and ETC
- Details about regional architecture, integration of infrastructure and operational planning
- Summarizes about ITS issues in terms of various factors and emerging issues.

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

22CEHESCN	PARTICIPATORY WATER RESOURCES MANAGEMENT	L	T	P	C
22CEMESCN		4	0	0	4

#### COURSE OBJECTIVES

- To impart knowledge on Sociological concepts and Social stratification
- To enable the students to understand the regional and global experiences of participatory ideology in irrigation water management
- To help students acquire knowledge on paradigms shifts and reorientations with regard to stakeholder participation in water management in general and in irrigation management in particular.

## **UNIT I FUNDAMENTALS OF SOCIOLOGY AND PARTICIPATORY APPROACH**

Basic Sociological concepts and Definitions - Objectives – Perspectives- Social stratification – Sociological understanding - Irrigation as a Sociotechnical Process - paradigm shift and Participatory approach

## **UNIT II UNDERSTANDING FARMERS PARTICIPATION**

Need of farmers participation –Benefits of farmers participation – Comparisons of cost and benefit – Water User Association – Membership - Kinds of participation – National and International Experiences -Activities on Water towards Organization and Structure - Context of participation- factors in the environment.

## **UNIT III ROLE OF STAKEHOLDERS AND THE UNDERLYING ISSUES**

Multiple use of water – Issues in sectoral Water Allocation - Domestic, Irrigation, Industrial sectors – Woman as a water user – Constraints and Opportunities. Role of Community Organisers – Constraints in Organising farmers Organisation.

## **UNIT IV IMPROVING AGENCY RELATIONS AND INSTITUTIONAL REFORMS**

Supporting farmer organization and participation -Decision Making- Leadership and responsibilities – Development strategy – Channels for implementation – Equity and Equality - Agency Incentives - Technical co-operation – Special roles – Agency Roles- Institutional Reforms

## **UNIT V POLICY CONSIDERATIONS AND EMERGING CHALLENGES**

Water Policy - Irrigation Governance - Building from Below - Non-political Associations –Bureaucratic Reorientation - Policy options and Alternatives and Sustainability.

## **TEXTBOOKS**

1. Desai A.R., Rural sociology in India, Popular Prakashan, Bombay, 1969.
2. Michael C.M., Putting people first, Sociology variables in Rural Development, Oxford Universitypress, London 1985.
3. Uphoff. N., Improving International Irrigation management with Farmer Participation – Getting the process Right–Studies in water Policy and management, New West–View press, Boulderand London, 1986.
4. Chambers R., Managing canal irrigation, Oxford IBM publishing Co.Pvt.Ltd.,New Delhi, 1998.
5. Kortzen F.F and Robert Y.Siy,Jr. Transforming a Bureaucracy–The experience of the Philippines National Irrigation Administration, Ateneo De Manila University Press, Manila, 1989.

## **REFERENCE BOOK**

1. Sivasubramaniam K., Water Management SIMRES Publication,Chennai2009.

## **WEB REFERENCES**

1. <http://irapindia.org/IMTInIndia-Pa>
2. <http://mowr.gov.in/writereaddata/mainlinkFile/File421.pdf>

## COURSE OUTCOMES

On completion of the course, the student's expected to be able to

1. Capture to fundamental concepts and terms which are to be applied and understood all through the study.
2. Acquire a clear insight in to the subject matter of participatory ideology with its rudiments under the light of both national and international illustrative cases.
3. Comprehend the roles of different players as stakeholders with the ground reality of the underlying issues infarm community.
4. Articulate a show reform scan help buildup institutional and irrigation agencies with the support obtained from the existing farm network in irrigation Management
5. Gain an over arching understanding of recommendation for improved irrigation management with a vision to transform the existing governance and policies with the novel approach of sustainability.

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

## ONE CREDIT COURSES

22CEOCSCN	DRONE SURVEYING AND MAPPING	L	T	P	C
		0	1	0	1

### Course Objective:

To impart knowledge on

- Understand the basics of land surveying using drones, on-site and off-site flight planning along with the practical training on various software's used for remote sensing

### Course Outcome:

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

- Carry out flight planning and Post process the drone data using various softwares.

### Unit I INTRODUCTION TO DRONE TECHNOLOGY

Introduction to Drones - Types of Drones – Payloads – Multirotor Components, Introduction to Land Surveying-Remote Sensing- Land Surveying – Drones in Land Surveying - Survey Accuracy - Ground Sample Distance – Workflow – Surveying Outputs, Application of Drones in Civil Engineering

### Unit II BENTLEY CONTEXT CAPTURE

Software Installation- Drone Deploy, Google Earth Pro, GPS Essentials, Bentley Context Capture, QGIS, Post Processing- Image Processing – Introduction to Bentley-processing of data- Aero triangulation –Production- 3D Mesh, Scale Constraints- Processing in Bentley Context Capture using Scale Constraints

### Unit III DRONE FLIGHT PLANNING AND DATA ACQUISITION

Introduction to Flight Planning - Computation of Drone Flight Height – Forward Overlap – Side Overlap – light Lines – Calculation of No. of Images per project – Memory Requirement, Geo-tagged Images- Types of Geo-tagged images-On Site Planning – Off Site Planning- GPS Waypoints of Site Boundaries – Creating KML file from excel- Multiple Flight Plans



## References:

1. Daniel Tal, Asla, Jon Altschuld, RLA ., Drone Technology in Architecture, Engineering and Construction, 1<sup>st</sup> Edition 2021, ISBN-13:978-1119545880, ISBN-10: 1119545889
2. James Lgoe Walsh, Marcus Schulzke., Drones and Support for use of Force, University of Michigan Press, 2018

22CEOCSCN	REVIT ARCHITECTURE	L	T	P	C
		0	1	0	1

## Course Objective:

To impart knowledge on

- This course covers the feature of Revit Architecture 2013, from schematic design through construction documents. You will be introduced to the concept of Building information modelling (BIM) and the tools for parametric building design and documentation.

## Course Outcome:

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

- To enable the students to create full 3D architectural projects and set them up in working drawings.

## Unit I INTRODUCTION TO REVIT

Building model information - About Revit Architecture - Parametric Relationships  
- Understanding Revit Terms -Element behaviour in parametric modeller -  
Element Properties - User interface.

## Unit II PRELIMINARY DESIGN & ARCHITECTURAL MODELLING

Site Settings - Top surfaces - Property Lines - Building Pads - Parking  
Components - Site Components - Contour Line labels - Conceptual design  
environment Walls - Doors and Windows - Components - Architectural Columns -  
Roofs -Ceilings - Floors - Openings - Model text - Model Lines - Compound  
structure - Sloped Surfaces - Circulation - Stairs -Ramps - Railings - Curtain  
elements - Rooms and areas - Revit families - Design options.

### **Unit III STRUCTURAL MODELLING**

Beam system - Braces - Trusses - Openings in structural Beam - Brace or Structural columns - Structural walls - Wall foundations - Isolated foundation - Structural floors - Foundation slabs - Shape editing for structural floors, and Floors - Concrete modelling concepts.

#### **Reference:**

1. Linkan Sagar and Srishty Rawal., Revit 2019 Architecture Step by step, BPB Publishers, New Delhi
2. Prof. Sham Tickoo, Revit Architecture 2020 Workbook, BPB Publishers, New Delhi

22CEOCSCN	STAAD PRO	L	T	P	C
		0	1	0	1

**Course Objective:**

To impart knowledge on

- The course objective is to train the students in structural Modeling, Designing and Analysis, Integrated Design and Finite Element Analysis. This course will help the students to familiarize on the analysis and design of different kinds of structures.

**Course Outcome:**

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

- Analyze different kinds of structures for various combination of loading conditions as per codal provisions.

**Unit I MODELLING**

Introduction to STAAD - Starting a project - Modeling a structure Creating Nodes & Members Geometry wizard -Property definition - Material definition - Support definition - Specifications.

**Unit II LOADING**

Nodal load - Member loads - Uniform Force and Moment - Concentrated Force and Moment - Linear Varying Load -Trapezoidal Load - Hydrostatic Load - Area load - Floor load. Wind load - Creating Load Combination - Automatic Load Combination - Edit Auto Load Rules - Moving load -Seismic load.

**Unit III ANALYSIS AND DESIGN**

Frame Analysis - Truss Analysis - Concrete Design - Steel Design.

**Software needed**

STAAD Pro V8i

**References:**

1. T.S.Sarma, STAAD Pro V8i for Beginners with Indian Examples, Notion Press 2014.
2. CAD DESK: Training – Placement – Software – Consultancy , CAD DESK 2020.

22CEOCSCN	SURVEYING USING TOTAL STATION	L	T	P	C
		0	1	0	1

**Course Objective:**

To impart knowledge on

Enable the students to prepare layout of buildings, roads and carry setting out operations.

**Course Outcome:**

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

Prepare topographical map and carry out all kinds of setting out operations for various kinds of real time projects.

**Unit I INTRODUCTION TO TOTAL STATION**

About Total station - components– functions – difference from conventional instruments – Electronic display and data reading - Tripod setting – Bubble setting and Tilt setting – Focussing - optical prism handling.

**Unit II PRELIMINARY OPERATIONS**

Creating New Job/File, Station setting, orientation – angle, coordinates - Back Sight, Fore Sight – change point -measuring and storing points

**Unit III APPLICATIONS**

Data collect – Missing line measurements - Resection – Set out – Area & Volume – Remote elevation – Road Stake out.

**References:**

- i) Satheesh Gopi, , R.Sathikumar, N. Madhu, Advanced Surveying: Total Station, GPS, GIS and Remote Sensing, Dorling Kindersley, Pearson Education in South Asia.

## **VALUE ADDED COURSE**

### **ECIVVAC01 - SUSTAINABLE WATER RESOURCES MANAGEMENT**

#### **Learning Objectives**

- To know and understand the importance of water quality.
- To know the salient features of Ground water resources
- To know the role of watershed in water resources management.

#### **COURSE OUTCOMES**

At the end students can

- Understand the importance of Water resources
- Understand the importance of Water resources Development
- Understand the concept of Watershed practices.
- Understand the Occurrence of Ground water
- Experimental practice according to the present water issues.

#### **UNIT I (4HRS)**

Water resources survey – Water resources of India andTamilnadu – Description of water resources planning –National Water Policy- Properties of water - Water quality standards-WHO& APHA Standards.

#### **UNIT II (4HRS)**

Water resources development - Scope and aims of master plan for irrigation tanks– Farm ponds and percolation ponds –Rain water harvesting.

#### **UNIT III (5HRS)**

Watershed – Concept – Classification – Characteristics – Watershed Programmes – Watershed Management Practices.

#### **UNIT IV (5HRS)**

Occurrence of Ground water –Utilization of Ground water- Aquifer and its types – Ground water recharge- Ground water status atState and National level.

#### **UNIT V (12HRS)**

Sample Collection-Processing Preservations –Testing Kit -Determination of pH- Acidity and Alkalinity – Turbidity - Total Solids- Total volatile solids- Total suspended solids- Water level indicator at different location demonstration- Safety precautions in the Laboratory.

## **TEXTBOOKS**

1. Suresh, R. “Soil and Water Conversation”, Standard Publication, New Delhi, 1982.
2. Duggal K.N., “Elements of Environmental Engineering” S.Chand and Co. Ltd., New Delhi, 2014.
3. Raghunath,H.m., “Groundwater”, 2<sup>nd</sup> edition, Wiley Eastern Ltd., NewDelhi,1987.
4. Santhosh Kumar Garg.,“Textbook of Environmental Engineering” Vol II, Khanna Publishers, New Delhi,2017.

## **REFERENCES**

1. Manual on Sewerage and Sewage Treatment Systems Part A, B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.