ACADEMIC REGULATIONS
AND
COURSE STRUCTURE
(R19 Regulations)

CIVIL ENGINEERING

FOR
B.Tech., FOUR YEAR DEGREE COURSE
(Applicable for the batches admitted from 2019-20)

VVIT
VASIREDDY VENKATADRI
INSTITUTE OF TECHNOLOGY

VASIREDDY VENKATADRI INSTITUTE OF TECHNOLOGY

NAMBUR, PEDA KAKANI MANDAL, GUNTUR-522508
An Autonomous Institution, Approved by AICTE,
All Courses Accredited by NBA & NAAC with 'A' Grade, Permanently Affiliated to JNTUK University

ACADEMIC REGULATIONS (R19) FOR B. TECH. (REGULAR)

Applicable for the students of B. Tech. (Regular) from the Academic Year 2019-20 onwards

The B.Tech Degree of Jawaharlal Nehru Technological University Kakinada, Kakinada shall be conferred on candidates who are admitted to the programme and who fulfill all the requirements for the award of the Degree.

VISION

To impart quality education through exploration and experimentation and generate socially-conscious engineers, embedding ethics and values, for the advancement in science and technology.

MISSION

- To educate students with a practical approach to dovetail them to industry-needs.
- To govern the institution with a proactive and professional management with passionate teaching faculty.
- To provide holistic and integrated education and achieve over all development of students by imparting scientific and technical, social and cognitive, managerial and organizational skills.
- To compete with the best and be the most preferred institution of the studious and the scholarly.
- To forge strong relationships and linkage with the industry.

OBJECTIVES

- Equip the institute with state-of-the-art infrastructure comparable to the best in the industry.
- Tap the resources of the best minds in the field as faculty and visiting faculty.
- Groom students to become global entrepreneurs and responsible citizens.
- Provide financial assistance to meritorious students.
- Requisition the services of the best HR managers to place our students in reputed industries.
- Provide conducive atmosphere to the faculty for Research & Development and ensure active participation of the students.

Department Vision

To provide globally competitive and socially responsible Civil Engineering professionals, who can contribute to the organization and nation-building through their innovative ideas and to create knowledge pool of Civil Engineering through quality research.

Department Mission

1. To develop and implement qualitative teaching and learning practices to impart quality education to the students to dovetail them to industry needs
2. To develop engineers with good scientific and engineering knowledge so as to comprehend, analyze, design and apply knowledge to the fast-changing needs in the field of Civil Engineering.
3. To provide hands-on experience and knowledge to the students to make them engineers of excellence.
4. To promote innovative and original thinking in the minds of budding engineers to face the Challenges of future by shaping the department into a center of academic and research excellence.
5. To inculcate the value of discipline and encourage the student to become a responsible and worthy citizen of the nation.

1. Admission Criteria

The eligibility criteria for admission into UG Engineering programmes are as per the norms approved by Government of Andhra Pradesh from time to time.

The sanctioned seats in each programme in the college are classified into CATEGORY-A, and CATEGORY-B at 1st year level and only CATEGORY-A at Lateral Entry 2nd year level.

The percentages of Category–A, Category-B and Lateral Entry Seats are decided from time to time by the Government of Andhra Pradesh.

- CATEGORY – A (70%): These seats are filled through Convener, EAMCET as per the norms approved by the Government of Andhra Pradesh.
- CATEGORY – B (30%): These seats are filled by the College as per the norms approved by the Government of Andhra Pradesh.
- Lateral Entry: Lateral entry candidates shall be admitted into the Third semester directly as per the norms approved by the Convener, ECET, and Government of Andhra Pradesh.

2. Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

- A student after securing admission shall complete the B.Tech programme in a minimum of four academic years (8 Semesters), and a maximum period of eight academic years starting from the date of commencement of first year first semester, failing which student shall forfeit seat in B.Tech Course. Each student shall secure 160 credits (with CGPA>=4) required for the completion of the under graduate programme and award of B.Tech Degree.

3. Courses of Study

The following courses of study are offered at present as specializations for the B. Tech. Courses

S. No	Branch	Branch Code	Intake
1	Civil Engineering	01	120
2	Electrical and Electronics Engineering	02	180
3	Mechanical Engineering	03	180
4	Electronics and Communication Engineering	04	180
5	Computer Science and Engineering	05	240
6	Information Technology	12	180

4. Distribution and Weightage of Marks

i) The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for theory subject and 75 marks for practical subject. The Mini project work shall be evaluated for 50 marks and the Major Project work shall be evaluated for 150 Marks.

ii) For theory subjects the distribution shall be 40 marks for Internal Evaluation and 60 marks for the Semester End Examinations.

iii) For theory subjects, during the semester there shall be two internal Mid Examinations. The weightage of internal marks for 40 consists of Descriptive Test – 15 Marks, Assignment Test- 10 Marks (Open book system with questions in accordance with BLOOMS taxonomy), and Objective Test -10 Marks and Subject Seminar 5 marks.

- The Descriptive Test is for 90 minutes duration conducted for 30 marks and will be scaled down to 15 Marks. Each Descriptive test question paper shall contain 3 questions, one question from each unit and all questions need to be answered. All the questions should be prepared in accordance with BLOOMS Taxonomy.
- The Assignment Test conducted for 20 Marks and will be scaled down to 10 Marks. The test is open book system and the duration of the exam is 60 minutes. The assignment question paper contains 3 questions given by the subject teacher concerned and all questions should be answered. Students can bring a maximum of three printed text books related to that subject. (Soft copies of the text books will not be allowed.) The assignments have to provide broadened exposure to the course. The questions shall include problem solving approach, problem analysis & design, implementation, case studies etc.
- The objective examination is for 20 minutes duration. (Conducted with 20 multiple choice question with a weightage of ½ Mark each)
- For the subject seminar, marks of each student shall be evaluated based on the presentation on any topic of his/her choice in the subject duly approved by the faculty member concerned.
- Internal Marks shall be calculated with 70% weightage for better of the two Mid Exams and 30% weightage for other.

iv) The Semester end examination shall be conducted for 3 hours duration. The question paper shall be given in the following pattern:

The question paper contains one question from each unit with internal choice. Each question carries 12 marks. Each course shall consist of five units of syllabus. The questions shall be framed in line with the Course Outcomes defined and cognitive levels.

v) For practical subjects there shall be continuous internal evaluation during the semester for 25 marks and 50 Marks for Semester end examination. The internal 25 marks shall be awarded as follows: day to day work - 05 marks, Record-05 marks and the remaining 15 marks are to be awarded by conducting an internal laboratory test of 3 hours duration.

The semester end examination for laboratory courses shall be conducted for three hour duration at the end of semester for 50 marks as follows: Procedure - 10 marks, Experiment/Program execution – 15 Marks, Results-10 Marks and Viva-voice -15 Marks. For laboratory course in English 30 marks for written exam which includes listening comprehension and 20 marks for viva which includes JAM and Group Discussion.

vi) For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 40 marks for internal evaluation (20 marks for day –to– day work, and 20 marks for internal tests) and 60 marks for end examination. There shall be two internal tests in a Semester and the Marks for 20 can be calculated with 70% weightage for better of the two performances and 30% weightage for other and these are to be added to the marks obtained in day-to-day work.

vii) For Engineering Project on Community services / Mini Project, there shall be continuous evaluation during the semester for 20 marks and semester end evaluation for 30 marks. The distribution of continuous evaluation marks is as follows: Day to Day Assessment- 05 Marks and average of two reviews of 15 Marks each.

The distribution of semester end examination marks for Engineering Project on Community services/Mini Project is as follows: Report -10 Marks and Presentation and Viva Voce – 20 Marks.

vii) For Major Project, there shall be continuous evaluation during the semester for 50 marks and semester end evaluation for 100 marks

The distribution of continuous evaluation marks is as follows: Day-to-day Assessment- 30 Marks and average of at least two reviews of 20 Marks each. The Departmental review committee consists of HoD, two senior Faculty and supervisor concerned.

The semester end examination for Major Project work shall be conducted at the end of VIII Semester. It is evaluated by the Committee consisting of an external examiner, Head of the Department, Senior Faculty and Supervisor of the Project.

viii) Laboratory marks and the internal marks awarded by the faculty are final. However, any grievance regarding marks will be addressed by the result committee if necessary. The recommendations of the committee are final and binding.

ix) MOOCS Courses: All students are eligible to register and complete MOOCS courses relevant to their professional electives listed by the respective departments in the curriculum.

However, if any student fails to complete a MOOCS course or the course is not offered by the agency concerned, that student is eligible to attend the examination following the same syllabus and pattern of examination in the VIII semester.

The MOOCS grades awarded to the student by the agency are converted to the course grades based on the percentage of marks obtained. The duration for course registered under MOOCS should range between 8 to 12 Weeks.

x) A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to Industrial Oriented Mini Project/Summer Internship/practical training, if the student secures not less than 40% of marks (i.e., 40 out of 100 allotted marks) in each of them. The student is deemed to have failed, if he/she (i) does not submit a report on Industrial Oriented Mini Project/Summer Internship, or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) does not present the seminar as required, or (iii) secures less than 40% of marks in Industrial Oriented Mini Project/Summer Internship and project seminar evaluations.

A student may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such 'one reappearance' evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

5. Attendance Requirements

- Students shall put in a minimum average attendance of 75% in the semester.
- Condonation of shortage in attendance may be recommended by the respective Head of the Department on genuine medical grounds, provided the student puts in at least 65% attendance and the Principal is satisfied with the genuineness of the reasons and the conduct of the student.
- Students, having more than 65% and less than 75% of attendance, shall have to pay requisite fee towards condonation.
- Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled. They will not be promoted to the next semester. They may rejoin in that semester in which the student is detained by getting approval from the principal.
- If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible to readmit into the same class.

6. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item No.5

- A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each theory/practical design/drawing subject/project and secures not less than 35% of marks in the end semester exam, and minimum 40% of marks in the sum total of the internal marks and end semester examination marks.
- A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement.
- A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of the credits up to II B.Tech II semester from all the examinations, whether or not the candidate takes the examinations and secure prescribed minimum attendance in II Year II Semester.
- A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to III year II semester from all the examinations, whether or not the candidate takes the examinations and secure prescribed minimum attendance in III Year II Semester.
- A student shall register and put up minimum attendance in all 160 credits and earn all 160 credits.

- Break in Study: Student, who discontinues the studies for whatever may be the reason, can get readmission into appropriate semester of B. Tech programme after break in study, with the prior permission of the Principal and following the transitory regulations applicable to each batch in which he/she joins. A student may utilize this break in study (Maximum of Two years for Regular Students and Maximum of One Year for Lateral Entry Students) only once in the entire period of B. Tech program.

7. Course Pattern

- The entire course of study is for four academic years, all the years are on semester pattern and the medium of instruction is English.
- A student who eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.
- When a student is detained for lack of credits/shortage of attendance, he may be readmitted into the same semester in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

8. CGPA

The grade points and letter grade will be awarded to each course based on students' performance as per the grading system shown in the following Table.

Range of Marks (Theory)	Range of Marks (Lab)	Letter Grade	Level	Grade Points
≥ 90	≥ 67	**O**	Outstanding	10
≥80 to <90	≥60 to <67	**S**	Excellent	9
≥70 to <80	≥52 to <60	**A**	Very Good	8
≥60 to <70	≥45 to <52	**B**	Good	7
≥50 to <60	≥37 to <45	**C**	Fair	6
≥40 to <50	≥30 to <37	**D**	Satisfactory	5
<40	<30	**F**	Fail	0
ABSENT	ABSENT	**AB**	Absent	0

- **Computation of Semester Grade Point Average (SGPA)**

The performance of each student at the end of each semester is indicated in terms of Semester Grade Point Average (SGPA)calculated as shown in below equation (1).

$$\mathbf{SGPA\ (Si) = \sum (Ci\ X\ Gi) / \sum Ci} \quad \text{---------- (1)}$$

Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

- **Computation of Cumulative Grade Point Average (CGPA)**

The Cumulative Performance of each student at the end of each semester is indicated in terms of CGPA and it is calculated as shown in equation (2).

$$\mathbf{CGPA = \sum (C_i\ X\ S_i) / \sum C_i} \quad \text{---------- (2)}$$

Where Si is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester.

- The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
- The approximate equivalence of marks to a given CGPA is calculated by using the formula:

Percentage Equivalence of CGPA = [CGPA – 0.5] x 10

9. Award of Class

The criterion for the award of division, after successful completion of the program is as shown in the following table.

Class Awarded	CGPA to be secured	
First Class with distinction*	≥7.75	**From the CGPA secured from 160 credits**
First Class	≥6.5 - <7.75	
Second Class	≥5.5 - <6.5	
Pass Class	≥4 - <5.5	
Fail	<4	

* Awarded only if all the credit courses prescribed are cleared within four years for regular candidates and three years for lateral entry candidates
* The students who are approved for break in study for entrepreneurships/start-ups will also be considered for award of first class with distinction
* For the purpose of awarding First, Second and Pass Class, CGPA obtained in the examinations appeared within the maximum period allowed for the completion of the program shall be considered.

10. Minimum Days of Instructions

Each semester consists of a minimum of 90 instruction days excluding examination days.

11. Transfer of Branch

There shall be no branch transfer after the completion of the first year admission process.

12. Withholding of results

If the student has not paid any dues to the college or if any case of indiscipline is pending against him/her, the result of the student will be withheld. His/her degree will be withheld in such cases.

13. Transitory Regulations

A candidate who is detained or discontinued a semester, on re-admission, he shall be required to pass all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently. Also the academic regulations be applicable to him/her which are in force at the time of his/her admission. However, exemption will be given to those candidates who have already passed in such courses in the earlier semester(s) and additional courses are to be studied as approved by the Board of Studies and ratified by the Academic Council.

14. Amendments to Regulations

Revisions of Regulations, Curriculum and Syllabi

The college may from time-to-time revise, amend or change the Regulations, Curriculum, Syllabus and Scheme of examinations through the Board of Studies with the approval of Academic Council and Governing Body of the college.

15. Transferred Students

The students seeking transfer to VVIT from various Universities/ Institutions have to obtain the credits of any equivalent subjects as prescribed by the Academic Council. Only the internal marks obtained in the previous institution will be considered for the evaluation of failed subjects.

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ACADEMIC REGULATIONS (R19) FOR B. Tech.

(LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. from the Academic Year 2020-21 onwards

1. Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

- A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course of study in not less than three academic years and not more than six academic years.
- The candidate shall register for 121 credits and secure all the 121 credits.

2. The attendance regulations of B. Tech. (Regular) shall be applicable to B.Tech Lateral Entry Students.

3. Promotion Rule

- A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.
- A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

4. Award of Class

After a student has satisfied the requirement prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured	
First Class with distinction	≥7.75	**From the CGPA secured from 121 credits from II Year to IV Year**
First Class	≥6.5 - <7.75	
Second Class	≥5.5 - <6.5	
Pass Class	≥4 - <5.5	
Fail	<4	

5. All the other regulations as applicable to B. Tech. 4-year degree course (Regular) will hold good for B. Tech Lateral Entry Scheme.

MALPRACTICE RULES

DISCIPLINARY ACTION FOR IMPROPER CONDUCT IN EXAMINATIONS

S.No.	Nature of Malpractices/Improper conduct	Punishment
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the

		examination (including practical and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent /Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical

		examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Controller o Examinations for further action to award suitable punishment.	

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- Ragging within or outside any educational institution is prohibited.
- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student

	Imprisonment upto		Fine Upto
Teasing, Embarrassing and Humiliation	6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing hurt	2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	10 Months	+	Rs. 50,000/-

In case any emergency call Toll Free No. 1800 425 1288

LET US MAKE VVIT A RAGGING FREE CAMPUS

ABSOLUTELY NO TO RAGGING

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1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.
2. Ragging entails heavy fines and/or imprisonment.
3. Ragging invokes suspension and dismissal from the College.
4. Outsiders are prohibited from entering the College and Hostel without permission.
5. Girl students must be in their hostel rooms by 7.00 p.m.
6. All the students must carry their Identity Cards and show them when demanded
7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.

In case any emergency call Toll Free No. 1800 425 1288

LET US MAKE VVIT A RAGGING FREE CAMPUS

COURSE STRUCTURE

I Year I Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	19SHT101	Communicative English (Common to ALL)	3	-	-	3
2	19SHT102	Mathematics – I (Common to ALL)	3	-	-	3
3	19SHT103	Engineering Chemistry	3	-	-	3
4	19CST101	Problem Solving and Programming in C (Common to ALL)	3	-	-	3
5	19MEL101	Engineering Workshop (Common to CE, CSE & IT)	-	-	3	1.5
6	19SHL101	Communicative English Lab-I (Common to ALL)	-	-	3	1.5
7	19SHL102	Engineering Chemistry Lab	-	-	3	1.5
8	19CSL101	Programming for Problem Solving Using C Lab (Common to ALL)	-	-	3	1.5
9	19SHN101	Environmental Studies (Common to CE, CSE & IT)	3	-	-	-
Total Credits						**18**

I Year II Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	19SHT201	Mathematics - II (Common to ALL)	3	0	0	3
2	19SHT202	Mathematics - III (Common to ALL)	3	0	0	3
3	19SHT206	Engineering Physics	3	0	0	3
4	19MET201	Engineering Mechanics (Common to CE & ME)	3	0	0	3
5	19EET202	Basics of Electrical & Electronics Engineering	2	1	0	3
6	19SHL201	Communicative English Lab - II (Common to ALL)	0	0	3	1.5
7	19SHL202	Engineering Physics Lab	0	0	3	1.5
8	19EEL201	Basics of Electrical & Electronics Engineering Lab	0	0	3	1.5
9	19MEL202	Engineering Graphics and Design	1	0	3	2.5
10	19SHN201	Indian Constitution (Common to CE, CSE & IT)	3	0	0	0
Total Credits						**22**

II Year I Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	19SHT301	Complex Variables and Statistical Methods (Common to CE, EEE, ME & ECE)	2	1	0	3
2	19CET301	Strength of Materials-I	3	0	0	3
3	19CET302	Surveying	3	0	0	3
4	19CET303	Fluid Mechanics	3	0	0	3
5	19CET304	Building Materials and Construction	2	0	0	2
6	19CST303	Scientific Computing using Python	3	0	0	3
7	19CEL301	Survey Field Work	0	0	3	1.5
8	19CEL302	Strength of Materials Lab	0	0	3	1.5
9	19CSL303	Scientific Computing using Python Lab	0	0	3	1.5
10	19SHN301	Essence of Indian Traditional Knowledge (Common to ALL)	2	0	0	0
Total Credits						**21.5**

II Year II Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	19CET401	Strength of Materials-II	3	0	0	3
2	19CET402	Hydraulics & Hydraulic Machinery	3	0	0	3
3	19CET403	Structural Analysis - I	3	1	0	4
4	19CET404	Transportation Engineering	3	0	0	3
5	19CET405	Concrete Technology	3	0	0	3
6	19CEL401	Building Planning & Drawing Lab	0	0	3	1.5
7	19CEL402	Engineering Geology Lab	0	0	3	1.5
8	19CEL403	FM & HM Lab	0	0	3	1.5
9	19SHN401	Professional Ethics and Human Values (Common to CE, CSE & IT)	2	0	0	0
10	19CER401	Social Relevant Project	0	0	2	1
Total Credits						**21.5**

III Year I Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	PC3101	Structural Analysis -II	3	0	0	3
2	PC3102	Design & Drawing of Reinforced Concrete Structures	3	0	0	3
3	PC3103	Soil Mechanics	3	0	0	3
4	PC3104	Environmental Engineering	3	0	0	3
5	PE3101	Professional Elective- I	3	0	0	3
6	SH3101	Managerial Economics and Financial Analysis (Common to CE, CSE & IT)	2	0	0	2
7	PC3101L	Transportation Engineering Lab	0	0	3	1.5
8	PC3102L	Concrete Technology Lab	0	0	3	1.5
Total Credits						**20**

III Year II Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	PC3201	Design & Drawing of Steel Structures	3	0	0	3
2	SH3201	Management Science (Common to CE & ECE)	2	0	0	2
3	PE3201	Professional Elective- II	3	0	0	3
4	OE3201	Open Elective- I	3	0	0	3
5	OE3202	Open Elective- II	3	0	0	3
6	PC3201L	Environmental Engineering Lab	0	0	3	1.5
7	PC3202L	Geotechnical Engineering Lab	0	0	3	1.5
8	PROJ3201	Mini Project	0	0	3	1.5
9	MC3201	Employability Skills-I	2	0	0	0
Total Credits						**18.5**

IV Year I Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	19CET701	Construction Technology & Management	3	0	0	3
2	19CET702	Estimation Specification & Contracts	3	0	0	3
3	19CET703	Water Resource Engineering	3	0	0	3
4	OE-3	Open Elective -III	3	0	0	3
5	PE-3	Professional Elective- III	3	0	0	3
6	19CEL701	GIS & CAD Lab	0	0	3	1.5
7	19CER701	Project - I	0	0	6	3
8	19CSN701	Employability Skills-II	2	0	0	0
9	19SHN701	IPR and Patents (Common to CE, CSE & IT)	2	0	0	0
Total Credits						**19.5**

IV Year II Semester						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	OE-4	Open Elective -IV	3	0	0	3
2	PE-4	Professional Elective- IV	3	0	0	3
3	PE-5	Professional Elective- V	3	0	0	3
4	PE-6	Professional Elective- VI	3	0	0	3
5	19CER801	Project - II	0	0	14	7
Total Credits						**19**

PROFESSIONAL ELECTIVES OFFERED BY DEPARTMENT OF CIVIL ENGINEERING

Professional Elective- I	Professional Elective- II	Professional Elective- III	Professional Elective- IV	Professional Elective- V	Professional Elective- VI
Repair and Rehabilitation of Buildings	Earthquake Resistant Design of Structures	Bridge Engineering	Prestressed Concrete Structures	Finite Element Analysis	Advanced Structural Analysis
Reinforced Soil Structures	Earth Retaining Structures	Foundation Engineering	Advanced Foundation Engineering	Special Geotechnical Construction	Ground Improvement Techniques
Air pollution and control	Industrial Waste and Waste water Engineering	Environmental and Industrial Hygiene	Water and Air Quality Modelling	Solid Waste Management	Environmental Impact Assessment
Airport Planning and Design	Road Safety Engineering	Intelligent Transportation Systems	Pavement Analysis and Design	Transportation Economics	Urban Transportation Planning
Water Shed Management	Ground Water Development and Management	Water Resources System Planning and Management	Urban Hydrology	Stochastic Hydrology	Design of Irrigation Structures

OPEN ELECTIVES OFFERED BY DEPARTMENT OF CIVIL ENGINEERING

Open Elective- I	Open Elective- II	Open Elective- III	Open Elective- IV
Building Services	Green Technologies	Green Buildings	Safety Engineering
Disaster Management	Alternative Energy Sources	Low cost Housing	Remote Sensing & GIS
Traffic Safety	Element of Civil Engineering (Other than Civil Engineering)	Environmental Pollution and Control	Smart Cities
Project Management	Geo-Spatial Technologies	Forensic of Civil Engineering	Architecture and Town Planning

I Year – I SEMESTER

L	T	P	C
3	0	0	3

COMMUNICATIVE ENGLISH
(Common to All Branches)

Course Objectives

1. Adopt activity based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions.
2. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
3. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
4. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
5. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
6. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Course Outcomes

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

CO1. identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English (L3)
CO2. formulate sentences using proper grammatical structures and correct word forms (L3)
CO3. speak clearly on a specific topic using suitable discourse markers in informal discussions (L3)
CO4. write summaries based on global comprehension of reading/listening texts (L3)
CO5. produce a coherent paragraph interpreting a figure/graph/chart/table (L4)
CO6. take notes while listening to a talk/lecture to answer questions (L3)

Syllabus Blueprint

Contents	Learning Outcomes	Bloom's Level	No of Hrs
Unit-1			
Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for	1. Identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English 2. ask &answer general questions on familiar topics 3. employ suitable strategies for skimming &scanning to get the general idea of a text and	L3 L2 L3	

specific pieces of information. **Reading for Writing:** Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.	specific information 4. recognize paragraph structure with beginnings/endings 5. form sentences using proper grammatical structures and correct word forms	L3 L3	10
Unit-2 **Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/ small groups on specific topics followed by short structured talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters. **Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.	1. comprehend short talks on general topics 2. speak clearly on a specific topic using suitable discourse markers in informal discussions 3. understand the use of cohesive devices for better reading comprehension 4. write well-structured paragraphs on specific topics 5. make necessary grammatical corrections in short texts	L2 L3 L2 L3 L3	10
Unit-3 **Listening:** Listening for global comprehension and summarizing what is listened to. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed	1. summarize the content with clarity &precision from short talks 2. report what is discussed in informal discussions 3. infer meanings of unfamiliar words using contextual clues	L3 L3 L3	10

Reading: Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. **Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.	4. write summaries based on global comprehension of reading/ listening texts 5. use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing	L3 L3	
Unit-4 **Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms	1. infer &predict about content of spoken discourse 2. engage in formal/informal conversationsunderstanding verbal &non-verbal features of communication 3. interpret graphic elements used in academic texts 4. produce a coherent paragraph interpreting a figure / graph / chart / table 5. use language appropriate for description and interpretation of graphical elements	L4 L3 L2 L4 L4	10
Unit-5 **Listening:** Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.	1. take notes while listening to a talk/lecture to answer questions 2. make formal oral presentations using effective	L3	

Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides. **Reading:** Reading for comprehension. **Writing:** Writing structured essays on specific topics using suitable claims and evidences **Grammar and Vocabulary:** Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)	strategies 3. produce a well-organized essay with adequate details 4. edit short texts by correcting common errors	L3 L3 L4	10

Detailed Syllabus

Unit 1 A Proposal to Girdle the Earth (Excerpt) by Nellie Bly
Theme: Exploration
1. "How to Fashion Your Own Brand of Success" by Howard Whitman
2. "How to Recognize Your Failure Symptoms" by Dorothea Brande
Listening

- identifying thetopic, the context and specific pieces of information

Speaking

- introducing oneself and others

Reading

- skimming for main ideas
- scanning for specific pieces of information

Writing/ Reading for Writing

- paragraphs, beginnings, introducing the topic, key words, main idea

Grammar and Vocabulary

- content words and function words
- word forms: verbs, nouns, adjectives and adverbs
- nouns: countable and uncountable; singular and plural forms
- basic sentence structures; simple question form: why-questions; word order in sentences

Learning Outcomes

- understand social or transactional dialogues spoken by native and non-native speakers of English and identify the context, topic, and pieces of specific information.
- ask and answer general questions on familiar topics and introduce oneself/others
- employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- recognize paragraph structure and be able to match headings/main ideas with paragraphs
- form sentences using proper grammatical structures and correct word forms

Unit 2 An excerpt from The District School As It Was by One Who Went to It by Warren Burton
Theme: On Campus

3. **"How to Conquer the Ten Most Common Causes of Failure" by Lois Binstock**
4. **"How to Develop Your Strength to Seize Opportunities" by Maxwell Maltz**

Listening

- answering a series of questions about main idea and supporting ideas after listening to audio texts

Speaking

- discussion in pairs/ small groups on specific topics; preparing and delivering short structured talks using suitable cohesive devices

Reading

- identifying sequence of ideas
- recognizing verbal techniques that help link the ideas in a paragraph

Writing/ Reading for Writing

- paragraph writing (specific topics) using suitable cohesive devices; using key words/phrases and organizing points in a coherent manner
- mechanics of writing: punctuation, capital letters

Grammar and Vocabulary

- cohesive devices-linkers, sign posts and transition signals
- use of articles and zero articles
- prepositions

Learning Outcomes

- comprehend short talks on general topics
- participate in informal discussions and speak clearly on a specific topic using suitable discourse markers
- understand the use of cohesive devices for better reading comprehension
- write well-structured paragraphs on specific topics using suitable cohesive devices
- identify basic errors of grammar/usage and make necessary corrections in short texts

Unit 3 The Future of Work?

Theme: Working Together

5. **"How to Make the Most of Your Abilities" by Kenneth Hildebrand**
6. **"How to Raise Your Self-Esteem and Develop Self-Confidence" by James W. Newman**

Listening

- listening for global comprehension
- summarizing what is listened to

Speaking

- discussing specific topics in pairs/ small groups
- reporting what is discussed

Reading

- reading a text in detail by making basic inferences
- recognizing and interpreting specific context clues
- strategies to use text clues for comprehension

Writing/ Reading for Writing

- summarizing-identifying main idea/s
- rephrasing what is read
- avoiding redundancies and repetitions

Grammar and Vocabulary

- Verbs-tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes

Learning Outcomes

- comprehend short talks and summarize the content with clarity and precision
- participate in informal discussions and report what discussed
- infer meanings of unfamiliar words using contextual clues

- write summaries based on global comprehension of reading/listening texts
- use correct tense forms, appropriate structure and a range of reporting verbs in speech and writing.

Unit 4 H.G Wells and the Uncertainties of Progress by Peter J. Bowler
Theme: Fabric of Change

7. **"How to Win Your War Against Negative Feelings" by Dr Maxwell Maltz**
8. **"How to Find the Courage to Take Risks" by Drs Tom Rust and Randy Reed**

Listening

- making predictions while listening to conversations/transactional dialogues without video
- listening with video

Speaking

- role plays for practice of conversational English in social and academic contexts (formal & informal)
- asking for and giving information/directions/instructions/suggestions

Reading

- understand and interpret graphic elements used in texts (convey information, reveal trends/patterns/relationships, communicate processes or display data)

Writing/ Reading for Writing

- information transfer
- describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables

Grammar and Vocabulary

- quantifying expressions-adjectives and adverbs
- comparing and contrasting
- degrees of comparison
- use of antonyms

Learning Outcomes

- make inferences and predictions while listening to spoken discourse
- understand verbal and non-verbal features of communication and hold formal / informal conversations
- interpret graphic elements used in academic texts
- produce a coherent paragraph interpreting a figure/graph/chart/table
- use language appropriate for description and interpretation of graphical elements

Unit 5 Leaves from the Mental Portfolio of a Eurasian by Sui Sin Far
Theme: Tools for Life
9."How to Become a Self-Motivator" by Charles T Jones
10. "How to Eliminate Your Bad Habits"by Og Mandino

Listening

- identifying the key terms
- understanding concepts
- answering a series of relevant questions that test comprehension

Speaking

- formal oral presentations on topics from academic contexts-without the use of PPT slides

Reading

- reading for comprehension

Writing/ Reading for Writing

- writing structured essays on specific topics using suitable claims and evidences

Grammar and Vocabulary

- reinforcing learning: articles, prepositions, tenses, subject-verb agreement

Learning Outcomes

- take notes while listening to a talk/lecture and make use of them to answer questions
- make formal oral presentations using effective strategies
- comprehend, discuss and respond to academic texts oral and in writing
- produce a well-organized essay with adequate support and detail
- edit short texts by correcting common errors

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									2	3		1
CO2									2	3		1
CO3									2	3		1
CO4									2	3		1
CO5									2	3		1

*****

I Year – I SEMESTER

L	T	P	C
3	0	0	3

MATHEMATICS – I (Calculus)
(Common to ALL branches)

Course Objectives:

1. This course will illuminate the students in the concepts of calculus.
2. To enlighten the learners in the concept of differential equations and multivariable calculus.
3. To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

Unit-1: Differential equations of first order and first degree:

Linear differential equations-Bernoulli's equations - Exact equations and equations reducible to exact form.

Applications: Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories – Electrical circuits.

Unit-2: Linear differential equations of higher order:

Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, $\sin ax$, $\cos ax$, polynomials in x^n , $e^{ax}V(x)$ and $x^n V(x)$ - Method of Variation of Parameters.

Applications: LCR circuit – Simple harmonic motion

Unit-3: Mean value theorems:

Mean value theorems (without proofs): Rolle's Theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's and Maclaurin's theorems with remainders.

Unit-4: Partial differentiation:

Introduction – Homogeneous function – Euler's theorem - Total derivative – Chain rule – Jacobian – Functional dependence – Taylor's and Mc Laurent's series expansion of functions of two variables.

Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

Unit-5: Multiple integrals:

Double integrals (Cartesian and Polar) – Change of order of integration – Change of variables (Cartesian to Polar) –Triple integrals.

Applications: Areas by double integrals and Volumes by triple integrals.

TEXT BOOKS:

1. **B.S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

REFERENCE BOOKS:

1. **H. K. Das,** Advanced Engineering Mathematics, 22nd Edition, S. Chand & Company Ltd.
2. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

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

- solve the differential equations related to various engineering fields.
- utilize mean value theorems to real life problems.
- familiarize with functions of several variables which is useful in optimization.
- apply double integration techniques in evaluating areas bounded by region.
- learn important tools of calculus in higher dimensions. Students will become familiar with 2-dimensional and 3 – dimensional coordinate systems.

Micro-Syllabus of MATHEMATICS – I (Calculus)

<table>
<tr><td colspan="3">Unit-1: Differential equations of first order and first degree:
Linear differential equations-Bernoulli’s equations - Exact equations and equations reducible to exact form.
Applications: Newton’s Law of cooling – Law of natural growth and decay – Orthogonal trajectories – Electrical circuits.</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td rowspan="12">1a. & 2a.
Differential equations of first order and first degree</td><td rowspan="3">Linear differential equations</td><td>Solution of Linear differential equations in $'y'$</td></tr>
<tr><td>Solution of Linear differential equations in $'x'$</td></tr>
<tr><td>Initial value problem</td></tr>
<tr><td rowspan="2">Non-Linear differential equations</td><td>Bernoulli’s equations</td></tr>
<tr><td>Equations reducible to Linear differential equations</td></tr>
<tr><td>Exact differential equations</td><td>Solution of Exact differential equations</td></tr>
<tr><td rowspan="6">Non-Exact differential equations</td><td>Equations reducible to Exact equations</td></tr>
<tr><td>Integrating factor found by inspection</td></tr>
<tr><td>Integrating factor of a Homogeneous equation</td></tr>
<tr><td>Integrating factor for an equation of the type $f_1(xy)ydx + f_2(xy)xdy = 0$</td></tr>
<tr><td>Integrating factor, if $\frac{\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}}{N}$ be a function of $'x'$</td></tr>
<tr><td>Integrating factor, if $\frac{\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}}{M}$ be a function of 'y'</td></tr>
<tr><td rowspan="4">1b. & 2b.
Applications</td><td rowspan="4">Application of differential equations of first order and first degree</td><td>Newton’s Law of cooling</td></tr>
<tr><td>Law of natural growth and decay</td></tr>
<tr><td>Orthogonal trajectories</td></tr>
<tr><td>Electrical circuits</td></tr>
</table>

Unit-2: Linear differential equations of higher order:

Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type e^{ax}, $\sin ax$, $\cos ax$, polynomials in x^n , $e^{ax}V(x)$ and $x^n V(x)$ - Method of Variation of Parameters.

Applications: LCR circuit – Simple harmonic motion

Unit	**Module**	**Micro content**
3a. & 4a. Linear differential equations of higher order	Homogeneous equations of higher order with constant coefficients	Finding the Complementary function
	Non-homogeneous equations of higher order with constant coefficients	Particular integral of the type $'e^{ax}'$
		Particular integral of the type $'\sin ax' \ (or) \ 'cos\, ax'$
		Particular integral of the type x^n
		Particular integral of the type $'e^{ax}$ V(x)'
		Particular integral of the type $'x^n v(x)'$
3b. & 4b. Applications	Applications of Non-homogeneous equations of higher order with constant coefficients	Method of variation of parameters
		LCR circuit
		Basic problems on simple harmonic motion

Unit-3: Mean value theorems:

Mean value theorems (without proofs): Rolle's theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's and Maclaurin's theorems with remainders.

Unit	**Module**	**Micro content**
5a. & 6a. Mean value theorems	Mean value theorems	Rolle's theorem
		Lagrange's mean value theorem
5b. & 6b. Mean value theorems	Mean value theorems	Cauchy's mean value theorem
		Taylor's expansions of $f(x)$
		Maclaurin's expansions of $f(x)$

Unit-4: Partial differentiation:

Introduction – Homogeneous function – Euler's theorem - Total derivative – Chain rule – Jacobians – Functional dependence – Taylor's and Mc Laurent's series expansion of functions of two variables.

Applications: Maxima and Minima of functions of two variables without constraints and Lagrange's method (with constraints).

Unit	Module	Micro content
7a. & 8a. Partial differentiation	**Partial Differentiation**	Euler's theorem
		Total derivative
		Chain rule
		Jacobians
7b. & 8b. Applications	**Applications of Partial Differentiation**	Taylor's and Mc Laurent's series expansion of functions of two variables
		Maxima and Minima of functions of two variables
		Lagrange's method of undetermined multipliers

Unit-5: Multiple integrals:

Double integrals (Cartesian and Polar) – Change of order of integration – Change of variables (Cartesian to Polar) –Triple integrals.

Applications: Areas by double integrals and Volumes by triple integrals.

Unit	Module	Micro content
9a. & 10a. Multiple integrals	Evaluation of Double Integrals	Double integrals
		Change of order of integration
		Double integrals in Polar co-ordinates
		Change of variables
9b. & 10b. Applications	Evaluation of Triple Integrals	Triple integrals
	Applications of Multiple Integrals	Areas by double integrals
		Volumes by triple integrals

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	2										1
CO3	3	2										1
CO4	3	2										1
CO5	3	2										1

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I Year – I SEMESTER

L	T	P	C
3	0	0	3

ENGINEERING CHEMISTRY

Knowledge of basic concepts of chemistry for Engineering students will help them as professional engineers later in design and material selection as well as utilizing the available resources.

Learning Objectives:

1. Significance and use of plastics in household appliances and composites (FRP) in aerospace and automotive industries.
2. Outline the basics for the construction of electrochemical cells, batteries and fuel cells.Understand the mechanism of corrosion and how it can be prevented.
3. Importance of advanced materials and their engineering applications.
4. Differentiate and discuss the materials used in major industries like steel industry, metallurgical industries, construction industries, electrical equipments and manufacturing industries. Lubrication is also summarized.
5. Essentiality of fuel technology.
6. Need of water purification and importance of various water purification methods.

UNIT-I: POLYMER TECHNOLOGY 14 HRS

***Polymerisation**:* Introduction-Methods of polymerisation-(emulsion and suspension)-Physical and mechanical properties.

***Plastics**:* Compounding-Fabrication (compression, injection, blown film, extrusion)-Preparation, properties and applications of PVC, ploycarbonates and Bakelite-Mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.

***Elastomers**:* Natural rubber-Drawbacks-Vulcanization-Preparation-Properties and applications of synthetic rubbers (Buna S, thiokol and polyurethanes)

Composite Materials: Fiber reinforced plastics-CFRP and GFRP.

Conducting polymers: Polyacetylene, doped conducting polymers- p-type and n-type doping.

Bio degradable polymers: Biopolymers and biomedical polymers.

UNIT-II: ELECTROCHEMICAL CELLS AND CORROSION 12 HRS

Single electrode potential-Electrochemical series and uses of series-Standard hydrogen electrode, calomel electrode, concentration cell, construction of glass electrode, Batteries: Dry cell, Ni-Cd cells, Ni-Metal hydride cells, Li-ion battery, Zinc air cells, Fuel cells-H_2 –O_2, CH_3OH-O_2, phosphoric acid, molten carbonate.

***Corrosion**:* Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, water-line corrosion- passivity of metals-galvanic series-factors influencing rate of corrosion-corrosion control: (proper designing,

cathodic protection)-protective coatings: cathodic and anodic coatings, electroplating, electroless plating (nickel), paints (constituents and its functions).

UNIT-III: CHEMISTRY OF MATERIALS 12 HRS

Nano materials: Introduction, sol-gel method, characterization by BET, SEM and TEM methods, applications of graphene- carbon nanotubes and fullerenes: Types, preparation of carbon nanomaterials by carbon-arc, laser ablation method, and applications.

Refractories: Definition , classification, properties (refractoriness, refractoriness under load, porosity and thermal spalling), failure of refractories.

Lubricants: Definition, mechanism of lubricants and properties (definition and importance).

Cement: Constituents, manufacturing, parameters to characterize the Clinker formation: lime saturation factor (LSF), silica ratio (SR), and alumina ratio (AR). Chemistry of setting and hardening, deterioration of cement.

UNIT-IV: FUELS 12 HRS

Introduction-calorific value - HCV and LCV – problems using Dulong's formula – proximate and ultimate analysis of coal sample – significance of these analysis – problems – petroleum (refining – cracking) – synthetic petrol (Fischer-Tropsch & Bergius) – petrol knocking, diesel knocking – octane and cetane rating – anti-knocking agents – introduction to alternative fuels (bio-diesel, ethanol, methanol, natural gas, LPG, CNG) – Flue gas analysis by Orsat apparatus – rocket fuels.

UNIT-V: WATER TECHNOLOGY 12 HRS

Hardness of water – determination of hardness by complexometric method – boiler troubles (priming and foaming, scale formation, boiler corrosion, caustic embrittlement) – internal treatments – softening of hard water (zeolite process and ion exchange process) – treatment of industrial waste water – potable water and its specifications – steps involved in purification of water – chlorination, break point chlorination – reverse osmosis and electro dialysis.

REFERENCE BOOKS:

1. A text book of Engineering Chemistry by S.S. Dara, S. S. Umare; S. Chand & Co., Ltd., Latest Edition.
2. Engineering Chemistry by Shashi Chawla; Dhanpat Rai Publicating Co., Latest Edition.

TEXT BOOKS:

1. Engineering Chemistry by Jain & Jain; Dhanpat Rai Publicating Co., Latest Edition
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2019 Edition.
3. Engineering Chemistry by Prasanth Rath, B. Ramadevi, Ch. Venkata Ramana Reddy, Subendu Chakravarthy; Cengage Publications, 2019 Edition.

Course Outcomes:

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

1. explain the preparation, properties and applications of thermoplastics, thermosettings, elastomers and conducting polymers.
2. know the importance of various materials and their uses in the construction of batteries and fuel cells.
3. to acquire the knowledge of nanomaterials, refractories, lubricants and cement.
4. assess the quality of various fuels.
5. understand the importance of water and its usage in various industries.

CO-PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2					2					
CO2	2	2					2					
CO3	2	2					2					
CO4	2	2					2					
CO5	2	2					2					

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I Year – I SEMESTER

L	T	P	C
3	0	0	3

PROBLEM SOLVING AND PROGRAMMING IN C
(Common to All Branches)

Course Objectives:

1. To familiarize to notion of an algorithm, editing and executing programs in Linux.
2. To Understanding branching, iteration.
3. To represent Data using arrays.
4. To use Modular programming and recursive solution formulation.
5. To familiarize pointers and dynamic memory allocation.
6. To handle data through files

UNIT-I: Introduction to C

Introduction to Computers: hardware, Memory hierarchy, Types of Computers, Types of Software – Operating Systems, Translators, Device drivers and packages. Algorithms and its characteristics, Program development steps. Structure of a C program, Features of C, The main () Function, Standard I/O functions.

Programming Style - Indentation, Comments, Identifiers, Data Types**,** Operators, Precedence and Associativity. Variables and Declarations, Format Modifiers, Escape Sequences, Types of Statements

Casting - Implicit Type Conversions, Explicit Type Conversions, Mathematical Library Functions

UNIT-II: Control Flow & Modules

Selection: if-else Statement, nested if, examples, Multi-way selection: switch, else-if, examples. **Repetition**: Basic Loop Structures, Pre-test and Post-test Loops, Counter-Controlled and Condition-Controlled Loops, for, while and do while.

Branching: break & continue.

Modular Programming: Function and Parameter Declarations, Returning a Value, Types of parameters. Parameter – scalar data as argument.

Recursion: Definition, Base condition for recursion, Mathematical Recursion, Recursion versus Iteration.

UNIT-III Arrays & Strings

Arrays: Introduction to Arrays, Input and Output of Array Values, Array Initialization, Arrays as Function Arguments, Two-Dimensional Arrays, Larger Dimensional Arrays- Matrices, 1D & 2D arrays as arguments.

Strings: String Fundamentals, String Input and Output, String Processing, Library Functions, Strings as arguments.

Unit – IV Pointers & Structures

Pointers: Concept of a Pointer, Initialization of Pointer variables, Pointers as function arguments, Passing by address, Dangling memory, Pointer Arithmetic, Character pointers,

Pointers to Pointers, Array of pointers & Pointer to array, Dynamic memory management functions, Command line Arguments.

Structures: Derived types, Structure's declaration, Initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef, enum, bit-fields.

UNIT-V: Files

Storage classes – auto, static, extern, register. Pre-processor statements

Data Files: Declaring, Opening, and Closing File Streams, File handling functions, Reading from and Writing to Text Files, File copy, merge, Writing and reading records, Random File Access.

Text Books:

1. ANSI C Programming, E Balaguruswamy, Mc-GrawHill, 5th Edition
2. ANSI C Programming, Gary J. Bronson, Cengage Learning.
3. Programming in C, ReemaThareja, OXFORD Publications

Reference Books:

1. C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage.
2. Let us C, YashwantKanetkar, BPB Publications
3. Mastering in C, KR Venu Gopal, TMH

Course Outcomes: After completing this course, Students will be able to-

CO 1: Understand algorithms and basic terminology of C

CO 2: Solve problems using control structures and modular approach

CO 3: Make use of 1D and 2D arrays along with strings for linear data handling

CO 4: Determine the use of pointers and structures

CO 5: Implement various operations on data files.

Micro-Syllabus of Problem Solving and Programming in C

UNIT I: Introduction to Computers: Hardware, Memory hierarchy, Types of Computers, Types of Software – Operating Systems, Translators, Device drivers and packages. Algorithms and its characteristics, Program development steps. Structure of a C program, Features of C, The main () Function, Standard I/O functions.
Programming Style - Indentation, Comments, Identifiers, Data Types**,** Operators, Precedence and Associativity. Variables and Declarations, Format Modifiers, Escape Sequences, Types of Statements
Casting - Implicit Type Conversions, Explicit Type Conversions, Mathematical Library Functions

Unit	Module	Micro content
Introduction to C	Introduction to Computers	Components of Computer: Hardware & Software
		Algorithm and its characteristics
		Program development steps
		Structure of a C Program

		Features of C
		The main () function and standard I/O functions
	Programming Style	Indentation, Comments, Identifiers, Data Types
		Operators, Precedence and Associativity. Variables and Declarations
		Format Modifiers, Escape Sequences
		Types of Statements
	Casting	Implicit Type Conversions
		Explicit Type Conversions
		Mathematical Library Functions

UNIT II: Selection: if-else Statement, nested if, examples, Multi-way selection: switch, else-if, examples. **Repetition**: Basic Loop Structures, Pre-test and Post-test Loops, Counter-Controlled and Condition-Controlled Loops, for, while and do while.
Branching: break & continue.
Modular Programming: Function and Parameter Declarations, Returning a Value, Types of parameters. Parameter – scalar data as argument.
Recursion: Definition, Base condition for recursion, Mathematical Recursion, Recursion versus Iteration.

Unit	**Module**	**Micro content**
Control Flow & Modular Programming	Selection Statements	if else, nested if examples
		Multi Way Selection: switch, else if examples
	Iterative Statements	Counter Controlled Loops
		Logic Controlled Loops
	Unconditional Branching	Break & Continue
	Modular Programming	Function and Parameter Declarations
		Returning a Value
		Types of parameters. Parameter – scalar data as argument.
	Recursion	Definition, Base condition for recursion
		Mathematical Recursion
		Recursion versus Iteration

UNIT III: Arrays: Introduction to Arrays, Input and Output of Array Values, Array Initialization, Arraysas Function Arguments, Two-Dimensional Arrays, Larger Dimensional Arrays- Matrices, 1D & 2D arrays as arguments.
Strings: String Fundamentals, String Input and Output, String Processing, Library Functions, Strings as arguments.

Unit	**Module**	**Micro content**
Arrays & Strings	Arrays	Introduction to Arrays, Input and Output of Array Values, Array Initialization
		Arraysas Function Arguments
		Two-Dimensional Arrays, Larger Dimensional Arrays
		Matrices, 1D & 2D arrays as arguments
	Strings	String Fundamentals, String Input and Output
		String Processing, Library Functions
		Strings as arguments

UNIT IV: Pointers: Concept of a Pointer, Initialization of Pointer variables, Pointers as function arguments,Passing by address, Dangling memory, Pointer Arithmetic, Character pointers, Pointers to Pointers, Array of pointers & Pointer to array, Dynamic memory

management functions, Command line Arguments.
Structures: Derived types, Structures declaration, Initialization of structures, accessing structures,nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef, enum, bit-fields.

Unit	Module	Micro content
Pointers and Structures	Pointers	Concept of a Pointer, Initialization of Pointer variables
		Pointers as function arguments,Passing by address
		Dangling memory, Pointer Arithmetic, Character pointers
		Pointers to Pointers
		Dynamic Memory Allocation
		Pointer to Arrays and Array of Pointers
	Command line Arguments	Command line Arguments
	Structures	Derived types, Structures declaration, Initialization of structures
		Accessing structures,nested structures, arrays of structures
		structures and functions, pointers to structures, self-referential structures
		Unions, typedef, enum, bit-fields.

UNIT V: Storage classes – auto, static, extern, register. Preproessor statements
Data Files: Declaring, Opening, and Closing File Streams, File handling functions, Reading from and Writing to TextFiles, File copy, merge, Writing and reading records, Random File Access.

Unit	Module	Micro content
Storage Classes and Files	Storage Classes	auto, static, extern and register
	Preprocessor Statements	Preprocessor Statements
	Data Files	Declaring, Opening, and Closing File Streams
		File handling functions, Reading from and Writing to TextFiles
		File copy, merge, Writing and reading records
		Random File Access

Mapping:

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

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I Year – I SEMESTER

L	T	P	C
0	0	3	1.5

ENGINEERING WORK SHOP
(Common to CE, CSE & IT)

Course Objective: To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint
b) Dovetail joint
c) Bridle joint

Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b) Dovetail fit c) square fit d) Semi-circular e) Two Wheeler tyre puncture and change of two wheeler tyre

Electrical Wiring: Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series b) Two-way switch c) Godown lighting d) Tube light

e) Three phase motor f) Soldering of wires

Course Outcomes: After completion of this lab the student will be able to

1. Apply wood working skills in real world applications. (L3)
2. Build different parts with metal sheets in real world applications. (L3)
3. Apply fitting operations in various applications. (L3)
4. Apply different types of basic electric circuit connections. (L3)
5. Demonstrate soldering and brazing. (L2)

CO-PO MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	-	-	1
CO2	2	2	-	-	-	-	-	-	-	-	-	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1
CO4	2	2	-	-	-	-	-	-	-	-	-	1
CO5	2	2	-	-	-	-	-	-	-	-	-	1

CO-PSO Matrix:

	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2

I Year – I SEMESTER

L	T	P	C
0	0	3	1.5

COMMUNICATIVE ENGLISH LAB I
(Common to All branches)

Course Objectives

The main objective of the course is to adopt activity-based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions and appear confidently for competitive examinations for career development.

The specific objectives of the course are to

1. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native and non-native speakers
2. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials like newspapers, magazines, periodicals, journals, etc.
3. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
4. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
5. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Course Outcomes

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

CO1. identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English and speak clearly on a specific topic using suitable discourse markers in informal discussions (L3)

CO2. take notes while listening to a talk/lecture; to answer questions in English; formulate sentences using proper grammatical structures and correct word forms; and use language effectively in competitive examinations (L3)

CO3. write summaries based on global comprehension of reading/listening texts; produce a coherent write-up interpreting a figure/graph/chart/table; and use English as a successful medium of communication. (L3)

Detailed Syllabus

CALL based activity. English course books selected for classroom teaching will be used for practice in the computer-based language labs. However, a brief introduction to the English Phonetics will be given to the students. Activities that encourage individual learning of the students based on the suggested texts and web resources will be used in the practical sessions.

Introduction to Sound System of English

Articulation - Airstream mechanism, Manners of Articulation, Places of Articulation, English phonetic symbols.

Accent - Syllabification, word stress and accent, stress rules and stress shift, exceptions to rules.

Intonation - Stress and accent in connected speech. Types and functions of Intonation in English.

Pair work, Role play, conversational practice and Individual speaking activities based on following essays from ***University of Success.***

1. "How to Fashion Your Own Brand of Success" by Howard Whitman

2. "How to Recognize Your Failure Symptoms" by Dorthea Brand

3. "How to Conquer the Ten Most Common Causes of Failure" by Lois Binstock

4. "How to Develop Your Strength to Seize Opportunities" by Maxwell Maltz
5. "How to Make the Most of Your Abilities" by Kenneth Hildebrand
6. "How to Raise Your Self-Esteem and Develop Self-Confidence" by James W. Newman
7. "How to Win Your War Against Negative Feelings" by Dr Maxwell Maltz
8. "How to Find the Courage to Take Risks" by Tom Rust and Randy Reed
9. "How to Become a Self-Motivator" by Charles T Jones
10. "How to Eliminate Your Bad Habits" by Og Mandino

Text Books

1. English All Round: Communication Skills for Undergraduate Learners-Volume 1, Orient Black Swan, 2019 (to be released)
2. University of Success by Og Mandino, Jaico, 2015.

Reference Books

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

AICTE Recommended Books

1. Meenakshi Raman and Sangeeta Sharma. Technical Communication. Oxford University Press, 2018.
2. Pushplata and Sanjay Kumar. Communication Skills, Oxford University Press, 2018.
3. Kulbushan Kumar. Effective Communication Skills. Khanna Publishing House, Delhi

Sample Web Resources

Grammar / Listening / Writing 1-language.com http://www.5minuteenglish.com/ https://www.englishpractice.com/ Grammar/Vocabulary English Language Learning Online http://www.bbc.co.uk/learningenglish/ http://www.better-english.com/ http://www.nonstopenglish.com/ https://www.vocabulary.com/ BBC Vocabulary Games Free Rice Vocabulary Game	Reading: https://www.usingenglish.com/comprehension/ https://www.englishclub.com/reading/short stories.htm https://www.english-online.at/Listening https://learningenglish.voanews.com/z/3613 http://www.englishmedialab.com/listening.html Speaking https://www.talkenglish.com/ BBC Learning English – Pronunciation tips Merriam-Webster – Perfect pronunciation Exercises
All Skills https://www.englishclub.com/ http://www.world-english.org/ http://learnenglish.britishcouncil.org/	

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									2	3		1
CO2									2	3		1
CO3									2	3		1

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I Year – I SEMESTER

L	T	P	C
0	0	3	1.5

ENGINEERING CHEMISTRY LAB
(Common to CE, CSE, & IT)

Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations quantitative analysis .

1. Determination of HCl using standard Na_2CO_3 solution.
2. Determination of alkalinity of a sample containing Na_2CO_3 and NaOH.
3. Determination of Mn (II) using standard oxalic acid solution.
4. Determination of ferrous iron using standard $K_2Cr_2O_7$ solution.
5. Determination of Copper (II) using standard EDTA solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of Iron (III) by colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide (pH-metric method).
9. Determination of concentration of strong acid vs strong base (by conductometric method).
10. Determination of strong acid vs strong base (by potentiometric method).
11. Determination of Mg^{+2} present in an antacid.
12. Determination of $CaCO_3$ presence in an egg shell.
13. Estimation of vitamin- C.
14. Determination of phosphoric content in soft drinks.
15. Adsorption of acetic acid by charcoal.
16. Prepatation of nylon-6, 6 and Bakelite (demonstration only)

Note: Choice of any 10 experiments from the above.

Course Outcomes: At the end of the course, the students will be able

- To estimate the amount of metal ions present in different solutions (L4 & L3)
- To analyze the quality parameters of water (L4)
- To determine the strength of different solutions by using different instrumentation techniques (L3)

Reference Books:

A Text Book of Quantitative Analysis, Arthur J. Vogel.

Learning Objectives:

1. To furnish the students with a solid foundation in Chemistry Laboratory required to solve the Engineering problems.
2. To expose the students in practical aspects of the theoritical concepts like pH, hardness of water etc.
3. To guide the students on how to handle the instruments like UV-visible spectrophotometer, potentiometer and conductometer.

Course Outcomes:

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

- To estimate the amount of metal ions present in different solutions (L4 & L3)
- To analyze the quality parameters of water (L4)
- To determine the strength of different solutions by using different instrumentation techniques (L3)

CO-PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3							2			
CO2	2	2							2			
CO3	2	3							2			

*****

I Year – I SEMESTER

L	T	P	C
0	0	3	1.5

PROBLEM SOLVING USING C LAB

(Common to All Branches)

Course Objectives:

1. Apply the principles of C language in problem solving.
2. To design flowcharts, algorithms and knowing how to debug programs.
3. To design & develop of C programs using arrays, strings pointers & functions.
4. To review the file operations, pre-processor commands.

Exercise - 1 Control Flow - I

a) Write a C Program to Find Whether the Given Year is a Leap Year or not.

b) Write a C Program to find second biggest of three numbers (Assume that all the numbers are unique).

Exercise – 2 Control Flow - II

b) Write a C Program to Find Whether the Given Number is

i) Prime Number

ii) Armstrong Number

Exercise – 3 Control Flow - III

a) Write a C program to print Floyd Triangle

b) Write a C Program to print Pascal Triangle

c) Write a C program to display a Pyramid

Exercise – 4 Arrays - Demonstration of arrays

a) Search-Linear.

b) Sorting-Bubble

c) Operations on Matrix. - Add, Subtract, Multiply

Exercise – 5 Strings

a) Implementation of string manipulation operations **with** library function: Copy, length, compare

b) Implementation of string manipulation operations **without** library function: copy, length, compare

Exercise – 6 Functions

a) Write a C Program demonstrating of parameter passing in Functions and returning values.

b) Write a C Program illustrating Fibonacci, Factorial with Recursion without Recursion

Exercise – 7 Functions - Continued

Write a C Program to compute the values of sin x and cos x and ex values using Series expansion. (Use factorial function)

Exercise - 8 Arrays, Strings and Pointers

a) Write a C Program to find min and max of an array of elements using pointers

b) Write a C Program to concatenate one string to another using pointer.

Exercise – 9 Dynamic Memory Allocations

Write a C program to represent 1D and 2D arrays using malloc () function.

Exercises - 10 Structures

a) Write a C Program to Store Information of a Movie Using Structure

b) Write a C Program to sort a set of student records in ascending order.

c) Write a C Program to Add, subtract & multiply Two Complex Numbers.

Exercise -11 Files

a) Write a C programming code to open a file and to print it contents on screen.

b) Write a C program to copy the content of one file to another.

C) Write a C program merges two files and stores their contents in another file

Course Outcomes: By the end of the Lab, the student able to

1. **Comprehend** the various concepts of a C language
2. **Develop** algorithms and flowcharts
3. **Design** and development of C problem solving skills.
4. **Acquire** modular programming skills.

Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes

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

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I Year – I SEMESTER

L	T	P	C
3	0	0	0

ENVIRONMENTAL SCIENCE
(Common to CE, CSE & IT)

OBJECTIVE:
To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life to save earth from the inventions by the engineers.

UNIT – I: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES
Definition, Scope and Importance – Need for Public Awareness.
NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other 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, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

LEARNING OUTCOMES
Students will be able to
1. articulate the basic structure, functions, and processes of key social systems affecting the environment.
2. explain how water resources should be used.
3. articulate basic understanding of effects of modern agriculture on environment.
4. explain how various paradigms or world views and their implicit and explicit assumptions and values shape the viewer's perception of environmental problems and solutions.

UNIT – II: Ecosystems, Biodiversity, and its Conservation
ECOSYSTEMS: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:
a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

BIODIVERSITY AND ITS CONSERVATION : 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-sports 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.

LEARNING OUTCOMES
Students will be able to
1. get a clear picture of structure and functions of ecosystems.

2. explain why renewable and non-renewable energy resources are important.
3. get awareness about land degradation, soil erosion & desertification.
4. gain a rigorous foundation in various scientific disciplines as they apply to environmental science, such as ecology, evolutionary biology, hydrology, and human behaviour.

UNIT – III: Environmental Pollution and Solid Waste Management

ENVIRONMENTAL POLLUTION: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

SOLID WASTE MANAGEMENT: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

LEARNING OUTCOMES UNIT-3

Students will be able to

1. demonstrate knowledge and understanding of theories in the field of Biodiversity and Systematics in the broad sense.
2. conduct basic conservation biology research.
3. explain endangered and endemic species of India.
4. identify the threats to biodiversity.

UNIT – IV: Social Issues and the Environment

SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – 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 – Public awareness.

LEARNING OUTCOMES:

Students will be able to

1. understand Cause, effects and control measures of air pollution.
2. understand soil, noise & water pollution.
3. explain the enforcement of Environmental legislation
4. understand solid waste management.

UNIT – V: Human Population and the Environment

HUMAN POPULATION AND THE ENVIRONMENT: Population growth, variation among nations. Population explosion – Family Welfare Programmed. – 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, and birds – river, hill slopes, etc.

LEARNING OUTCOMES

Students will have

1. knowledge about watershed management and environmental ethics.
2. explain the reasons for global warming
3. explain principles and impact of disasters on environment.
4. explain disaster management cycle in India.

TEXT BOOKS:

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies by Palaniswamy – Pearson education
3. Environmental Studies by Dr.S.Azeem Unnisa, Academic Publishing Company

REFERENCES:

1. Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Publications.
2. Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
3. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
4. Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Prentice hall of India Private limited.
5. A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Publishing House
6. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Prentice hall of India Private limited.

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

COURSE OUTCOMES

CO1	Able to U**nderstand** The concepts of the ecosystem
CO2	Able to U**nderstand** The natural resources and their importance
CO3	Able to learn The biodiversity of India and the threats to biodiversity ,and **Apply** conservation practices
CO4	Able to learn Various attributes of the pollution and their impacts
CO5	Able to U**nderstand** Social issues both rural and urban environment
CO6	Able to U**nderstand** About environmental Impact assessment and **Evaluate** the stages involved in EIA

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I Year – II SEMESTER

L	T	P	C
3	0	0	3

MATHEMATICS-II
(Common to All)

Course Objectives:

- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications

UNIT-1: Iterative methods: (10 hrs)

Introduction–Bisection method–Method of false position–Iteration method–Newton-Raphson method (one variable)–Jacobi and Gauss-Seidel methods for solving system of equations.

UNIT-2: Interpolation: (12 hrs)

Introduction–Errors in polynomial interpolation–Finite differences–Forward differences–Backward differences–Central differences –Relations between operators–Newton's forward and backward formulae for interpolation–Gauss's forward and backward formulae for

Interpolation – Interpolation with unequal intervals–Lagrange's interpolation formula–Newton's divide difference formula.

UNIT-3: Numerical integration and solution of ordinary difference equations: (10 hrs)

Trapezoidal rule–Simpson's $1/3^{rd}$ and $3/8^{th}$ rule–Solution of ordinary differential equations by Taylor's series–Picard's method of successive approximations–Euler's method–Modified Euler's method–Runge-Kutta method (second and fourth order).

UNIT–4: Laplace Transforms: (14 hrs)

Laplace transforms of standard functions – Shifting theorems – Transforms of derivatives and integrals – Unit step function – Dirac's delta function –Periodic function - Inverse Laplace transforms – Convolution theorem (without proof)

Applications: Evaluation of integrals using Laplace transforms - Solving ordinary differential equations (Initial value problems) using Laplace transforms.

UNIT 5: Fourier series and Fourier Transforms: (14 hrs)

Fourier series: Introduction – Periodic functions – Fourier series of periodic function – Dirichlet's conditions – Even and odd functions – Change of interval – Half-range sine and cosine series.

Fourier Transforms: Fourier integral theorem (without proof) - Fourier sine and cosine integrals – Sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms.

Text Books:

1. **B.S. Grewal,** Higher Engineering Mathematics, 44^{th} Edition, Khanna Publishers.

Reference Books:

1. **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
2. **H.K.Das,** Advanced Engineering Mathematics, 22nd Edition, S. Chand & Company Ltd.
3. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

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

- Evaluate approximate in the roots of polynomial and transcendental equations by different algorithms (EVALUATE)
- Solve system of linear algebraic equations using Gauss Jacobi, Gauss Seidel and apply Newton's forward and backward interpolation and Lagrange's formulae for equal and unequal intervals (SOLVE, APPLY, FIND)
- Apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations and also by Laplace the transforms for solving differential equations (SOLVE, APPLY, FIND)
- Find or compute the Fourier series of periodic signals (SOLVE, APPLY, FIND, ANALYSE)
- Know and be able to apply integral expressions for the forwards and inverse Fourier transform to range of non-periodic waveforms (SOLVE, APPLY, FIND)

Micro-Syllabus of MATHEMATICS-II

UNIT-1: Iterative methods: Introduction–Bisection method–Method of false position–Iteration method–Newton-Raphson method (one variable)–Jacobi and Gauss-Seidel methods for solving system of equations.

Unit	Module	Micro content
1a. Solving given polynomial	Numerical solution of algebraic and transcendental polynomials	Bisection method
		Method of false position
		Iteration method
		Newton-Raphson's method
1b Solving linear system	Solving linear system	Jacobi's method
		Gauss-seidel method

UNIT-2: Interpolation: Introduction–Errors in polynomial interpolation–Finite differences–Forward differences–Backward differences–Central differences –Relations between operators–Newton's forward and backward formulae for interpolation–Gauss's forward and backward formulae for
Interpolation – Interpolation with unequal intervals–Lagrange's interpolation formula–Newton's divide difference formula.

Unit	Module	Micro content
2a. Equal-Spaced difference tables	Finite difference tables	Forward, backward & central difference tables
		Errors in polynomials
	Finding functional values for given data	Newton's forward and backward difference interpolation formula
		Gauss forward and backward difference interpolation formula

2b. Unequal spaced data & relation between various operators	Unequal spaced data & relation between various operators	Lagrange's interpolation formula
		Relation between various operators (Shift, forward, backward, central, average & differential operators)
UNIT-3: Numerical integration and solution of ordinary difference equations: Trapezoidal rule–Simpson's $1/3^{rd}$ and $3/8^{th}$ rule–Solution of ordinary differential equations by Taylor's series–Picard's method of successive approximations–Euler's method–Modified Euler's method–Runge-Kutta method (second and fourth order).		
Unit	**Module**	**Micro content**
3a. Numerical integration	Numerical Integration	Trapezoidal rule
		Simpson's $1/3^{rd}$ rule
		Simpson's $3/8^{th}$
3b. Numerical solution of ordinary differential equations for single variable	Numerical solution of ordinary differential equations for single variable	Taylors series method
		Picard's method
		Euler's method
		Modified Euler's method
UNIT – 4: Laplace Transforms: Laplace transforms of standard functions – Shifting theorems – Transforms of derivatives and integrals – Unit step function – Dirac's delta function –Periodic function - Inverse Laplace transforms – Convolution theorem (without proof) Applications: Evaluation of integrals using Laplace transforms - Solving ordinary differential equations (Initial value problems) using Laplace transforms.		
Unit	**Module**	**Micro content**
4a Laplace Transforms	Laplace transforms and theorem	Shifting theorems
		Derivatives and integrals
		Multiplication and division
4b. Inverse Laplace transforms and Applications	Periodic functions &Inverse Laplace Transforms	Periodic functions
		Dirac delta functions
		Evaluation integrals using Laplace Transforms
		Solving differential equations using Laplace transforms
UNIT 5: Fourier series and Fourier Transforms: Fourier series: Introduction – Periodic functions – Fourier series of periodic function – Dirichlet's conditions – Even and odd functions – Change of interval – Half-range sine and cosine series. Fourier Transforms: Fourier integral theorem (without proof) - Fourier sine and cosine integrals – Sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transforms.		
Unit	**Module**	**Micro content**
5a. Fourier Series	Fourier Series	Periodic functions
		Dirichlet's conditions
		Even and odd function's

		Change of interval
		Half range sine and cosine series
5b. Fourier Transforms	Fourier Transforms	Fourier Sine and Cosine integral
		Properties of Fourier Transforms
		Fourier and Inverse Fourier Transforms
		Fourier cosine and Inverse Fourier cosine Transforms
		Fourier sine and Inverse Fourier sine Transforms
		Finite Fourier Transforms
		Inverse Finite Fourier Transforms

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	2										1
CO3	3	2										1
CO4	3	2										1
CO5	3	2										1

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I Year – II SEMESTER

L	T	P	C
3	0	0	3

MATHEMATICS – III
(Common to ALL branches)

Course Objectives:

1. To instruct the concept of Matrices in solving linear algebraic equations
2. To familiarize the techniques in partial differential equations
3. To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications

UNIT-I: Solving system of linear equations, Eigen values and Eigen Vectors (12 hrs)

Rank of a matrix by Echelon form and normal form–solving system of homogeneous and non-homogeneous linear equations–Gauss elimination, Gauss Jordan for solving system of equations- Eigen values and Eigen vectors and their properties

UNIT-II: Cayley-Hamilton theorem and quadratic forms: (12 hrs)

Cayley-Hamilton theorem (without proof)–Finding inverse and power of a matrix by Cayley-Hamilton theorem–Reduction to Diagonal form–Quadratic forms and nature of the quadratic forms–Reduction of quadratic form to canonical forms by orthogonal transformation.

Application: Free vibration of two mass systems.

UNIT – III: Vector Differentiation: (10 hrs)

Scalar and Vector point Functions-Vector Differential operator- Gradient – Directional derivatives– Divergence – Curl – Laplacian second order operator- Vector identities- Scalar Potential.

UNIT– IV: Vector Integration: (12 hrs)

Line integral – Work done – Circulation- Surface integral- Volume Integral Vector integral theorems (without proof): Greens theorem in a plane- Stokes theorem- Gauss Divergence theorem.

UNIT– V: Solutions of Partial differential Equations (14 hrs)

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

Second order PDE: Solutions of linear partial differential equations with constant coefficients RHS term of the type $e^{ax+by}, \sin(ax+by), \cos(ax+by), x^m y^n$.

Text Books:

2. **B.S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.

Reference Books:

4. **B.V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
5. **H.K.Das,** Advanced Engineering Mathematics, 22nd Edition, S. Chand & Company Ltd.
6. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

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

- develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
- solve system of linear algebraic equations using Gauss elimination, Gauss Jordan (L3)
- to interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- estimate the work done against a field, circulation and flux using vector calculus (L5)
- identify the solution methods for partial differential equation that model physical processes (L3)

Micro-Syllabus of MATHEMATICS – III

<table>
<tr><td colspan="3">UNIT-I: Solving system of linear equations, Eigen values and Eigen Vectors
Rank of a matrix by Echelon form and normal form–solving system of homogeneous and non-homogeneous linear equations–Gauss elimination, Gauss Jordan for solving system of equations-Eigen values and Eigen vectors and their properties</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td rowspan="6">1a. Solving system of linear equations</td><td rowspan="2">Rank of the given matrix</td><td>Find rank of the given matrix by reducing into Echelon form.</td></tr>
<tr><td>Find rank of the given matrix by reducing into Normal form.(Canonical form)</td></tr>
<tr><td rowspan="4">System of linear equations</td><td>Solve the system of homogeneous linear equations.</td></tr>
<tr><td>Solve the system of Non- homogeneous linear equations.</td></tr>
<tr><td>Solve the given system of linear equations using Gauss Elimination method.</td></tr>
<tr><td>Solve the given system of linear equations using Gauss Jordan method.</td></tr>
<tr><td rowspan="3">1b. Applications</td><td>Eigen values and Eigen vectors</td><td>Find eigen values and Eigen vectors of given matrix.</td></tr>
<tr><td rowspan="2">Properties of Eigen values and Eigen vectors</td><td>If λ is an eigen value of Matrix A then find eigen values of A^m or A^{-1} or $B = A^2+k_1A+K_2I$ or ….</td></tr>
<tr><td>The eigen vectors corresponding to distinct eigen values of real symmetric matrix are orthogonal.</td></tr>
<tr><td colspan="3">UNIT-II: Cayley-Hamilton theorem and quadratic forms:
Cayley-Hamilton theorem (without proof)–Finding inverse and power of a matrix by Cayley-Hamilton theorem–Reduction to Diagonal form–Quadratic forms and nature of the quadratic forms–Reduction of quadratic form to canonical forms by orthogonal transformation.</td></tr>
<tr><td>Unit</td><td>Module</td><td>Micro content</td></tr>
<tr><td></td><td>Cayley-Hamilton theorem</td><td>Verify Cayley-Hamilton theorem for given matrix A and hence find A^{-1} or A^4.</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Quadratic Forms</td><td>Reduce the given matrix into diagonal form.</td></tr>
<tr><td>Reduce the quadratic form into canonical form using orthogonal transformation method.</td></tr>
<tr><td colspan="3">UNIT – III: Vector Differentiation:
Scalar and Vector point functions-Vector Differential operator- Gradient – Directional derivatives Divergence – Curl – Laplacian second order operator- Vector identities- Scalar Potential.</td></tr>
</table>

Unit	Module	Micro content
3a. Vector Differential operator	Divergent, Curl and Gradient	Find Gradient of given scalar function.
		Find Unit normal vector at given point on given surface.
		Find divergent or Curl of given vector function.
3b. Vector identities	Vector identities	Find Scalar potential function.
		Problems on Laplacian second order operator.
		Prove the given vector identity.

UNIT– IV: Vector Integration:
Line integral – Work done – Circulation- Surface integral- Volume integral Vector integral theorems (without proof): Greens theorem in a plane- Stokes theorem- Gauss Divergence theorem.

Unit	Module	Micro content
4a. Vector integration	Line integraton, surface integration & volume integration	Evaluate given line integration along the given curve.
		Find work done by force in moving a particle from A to B along curve C.
		Find surface integral of vector function.
		Find volume integral of vector function.
4b. Vector integration theorems	Green's theorem , Stoke's theorem and Gauss Divergence throem.	Verify Green's theorem.
		Evaluate using stoke's theorem.
		Evaluate using Divergence theorem.

UNIT– V: Solutions of Partial differential Equations: Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.
Second order PDE: Solutions of linear partial differential equations with constant coefficients – RHS term of the type $e^{ax+by}, \sin(ax+by), \cos(ax+by), x^m y^n$.

Unit	Module	Micro content
5a. First order PDE	Formation of PDE	Form PDE by eliminating arbitrary constants.
		Form PDE by eliminating arbitrary functions.
	Solve First order PDE	Solve first order linear PDE.
		Solve first order non linear PDE.
5b. Higher order PDE	Solve Second order PDE.	Solve Second order linear PDE with constant coefficients with RHS terms $e^{ax+by}, \sin(ax+by), \cos(ax+by), x^m y^n$.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	2										1
CO3	3	2										1
CO4	3	2										1
CO5	3	2										1

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I Year – II SEMESTER

L	T	P	C
3	0	0	3

ENGINEERING PHYSICS

Course Objectives:

Engineering Physics curriculum which is re-oriented to the needs of non-circuital branches of graduate engineering courses offered by Vasireddy Venkatadri Institute of Technology, which serves as a transit to understand the branch specific advanced topics.

The course is designed to:

- Impart Knowledge of physical optics phenomena like Interference and Diffraction required to design instruments with higher resolution.
- Impart knowledge in basic concepts of LASERs and Holography along with their engineering applications
- Impart the knowledge of materials with characteristic utility in appliances.
- Impart the knowledge on acoustic quality of concert halls and concepts of flaw detection techniques using ultrasonic.
- Study the structure- property relationship exhibited by solid materials within the elastic limit.

Unit-I: Wave Optics:

Interference: Principle of Superposition-Interference of light – Conditions for sustained Interference-Interference in thin films (reflected geometry) - Newton's Rings (reflected geometry)

Diffraction: Fraunhofer Diffraction: - Diffraction due to single slit (quantitative), double slit(qualitative), N –slits(qualitative) and circular aperture (qualitative) – Intensity distribution curves - Diffraction grating – Grating spectrum – missing order– resolving power – Rayleigh's criterion – Resolving powers of Microscope(qualitative), Telescope(qualitative) and grating (qualitative).

Unit– II: LASERs and Holography

LASERs: Interaction of radiation with matter – Spontaneous and Stimulated emission of radiation – population inversion – Einstein's coefficients & Relation between them and their significance - Pumping Mechanisms - Ruby laser – Helium-Neon laser – Applications.

Holography: Introduction – principle – differences between photography and holography – construction and reconstruction of hologram – applications of holograms

Unit-III: Magnetism and Dielectrics

Magnetism: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment - Bohr Magneton-Classification of magnetic materials: Dia, para & Ferro – Domain concept of Ferromagnetism - Hysteresis – soft and hard magnetic materials – applications of Ferromagnetic material.

Dielectrics: Introduction- Dielectric polarization, Dielectric polarizability, Susceptibility and Dielectric constant- Types of polarizations: Electronic and Ionic (Quantitative), Orientation Polarizations (Qualitative) - Lorentz Internal field-Claussius –Mossotti's equation- Frequency dependence of polarization - Applications of dielectrics.

Unit-IV: ACOUSTICS AND ULTRASONICS

Acoustics: Introduction **–** Reverberation - Reverberation time - Sabine's formula–absorption coefficient and its determination- factors affecting acoustics of buildings and their remedies.

Ultrasonics: Properties –Production of ultrasonics by Magnetostriction & Piezoelectric methods –Non-Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays–applications.

Unit-V: ELASTICITY

Stress & strain —stress &strain curve– generalized Hooke's law – different types of moduli and their relations – bending of beams – Bending moment of a beam – Depression of cantilever.

TEXT BOOKS:

1. "Engineering Physics" by B. K. Pandey, S. Chaturvedi - Cengage Publications, 2012
2. "A Text book of Engineering Physics" by M.N. Avadhanulu, P.G. Kshirsagar - S. Chand, 2017.
3. "Engineering Physics" by D.K. Bhattacharya and Poonam Tandon, Oxford press (2015).
4. "Engineering Physics" by R.K Gaur. and S.L Gupta., - Dhanpat Rai publishers, 2012.

REFERENCE BOOKS:

1. "Engineering Physics" by M. R. Srinivasan, New Age international publishers (2009).
2. "Optics" by Ajoy Ghatak, 6th Edition McGraw Hill Education, 2017.
3. "Solid State Physics" by A.J. Dekker, Mc Millan Publishers (2011).

Course Outcomes:

The students will be able to

1. **Understand** the principles such as interference and diffraction to design and enhance the resolving power of various optical instruments.
2. **Learn** the basic concepts of LASER light Sources and Apply them to holography
3. **Study** the magnetic and dielectric materials to enhance the utility aspects of materials.
4. **Analyze** acoustic properties of typically used materials in buildings
5. **Understand** the concepts of shearing force and moment of inertia

Micro-Syllabus of Engineering Physics

Unit-I: Wave Optics:

Interference: Principle of Superposition – Interference of light – Conditions for sustained Interference – Interference in thin films (reflected geometry) - Newton's Rings (reflected geometry) **Diffraction:** Fraunhofer Diffraction:- Diffraction due to single slit (quantitative), double slit(qualitative), N –slits(qualitative) and circular aperture (qualitative) – Intensity distribution curves - Diffraction grating – Grating spectrum – missing order– resolving power – Rayleigh's criterion – Resolving powers of Microscope(qualitative), Telescope(qualitative) and grating (qualitative).

Unit	Module	Micro content
Ia. Interference	Principle of Superposition &Interference of light	Introduction to interference
		Principle of superposition
		Coherence
		Conditions for sustained Interference
	Interference in thin films	Interference in thin films by reflection (cosine's law)
		Complementary nature
		Colours of thin film

	Newton's Rings	Newton's Rings (reflected geometry)
		Experimental arrangement & conditions for diameters
		Applications: determination of wavelength of monochromatic source and refractive index of the given transparent liquid.
Ib. Diffraction	Fraunhofer Diffraction - Diffraction due to single slit	Differences between Fresnel's and Fraunhofer's diffraction
		Differences between interference and diffraction
		Fraunhofer diffraction due to single slit(quantitative)
		Fraunhofer diffraction due to circular aperture (qualitative)
	double slit (qualitative) & N – slits(qualitative)	Fraunhofer diffraction due to double slit (qualitative)
		Fraunhofer diffraction due to grating (N- slits) (qualitative)
		Intensity distribution curves
	Diffraction grating& Resolving powers	Grating spectrum, missing orders and maximum number of orders possible with a grating
		Rayleigh's criterion for resolving power
		Resolving power of grating, Telescope and Microscope (qualitative)

Unit– II: LASERs and Holography

LASERs: Interaction of radiation with matter – Spontaneous and Stimulated emission of radiation – population inversion – Einstein's coefficients & Relation between them and their significance - Pumping Mechanisms - Ruby laser – Helium-Neon laser – Applications.

Holography: Introduction – principle – differences between photography and holography – construction and reconstruction of hologram – applications of holograms

Unit	**Module**	**Micro content**
IIa. LASERs	Interaction of radiation with matter	Introduction to LASERS
		Spontaneous emission
		Stimulated emission
	Einstein's coefficients	Einstein's coefficients
		Population inversion
		Pumping mechanisms
	LASERS construction and working	Ruby laser
		Helium-Neon laser
		Applications of Lasers
IIb. Holography	Principle of holography	Introduction and Principle of holography
		Differences between photography and holography
	construction and reconstruction of hologram	Construction of hologram
		Reconstruction of hologram
		Applications of holography

Unit-III: Magnetism and Dielectrics

Magnetism: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment - Bohr magneton-Classification of magnetic materials: Dia, para & Ferro – Domain concept of Ferromagnetism - Hysteresis – soft and hard magnetic materials – applications of Ferromagnetic material.

Dielectrics: Introduction- Dielectric polarization -Dielectric polarizability, Susceptibility and Dielectric constant- Types of polarizations: Electronic and Ionic (Quantitative), Orientation Polarizations (Qualitative) - Lorentz Internal field-Claussius –Mossotti's equation- Frequency dependence of polarization - Applications of dielectrics.

Unit	Module	Micro content
IIIa. Magnetism	Introduction& Origin of permanent magnetic moment	Introduction to Magnetism, Definitions of Magnetic dipole moment, Magnetization, Magnetic susceptibility and Permeability
		Origin of magnetic moment
		Bohr magneton
	Classification of magnetic materials	Dia magnetic materials
		Para magnetic materials
		Ferro magnetic materials
	Domain concept of Ferromagnetism & Hysteresis	Domain concept of Ferromagnetism
		Hysteresis Curve
		Soft and hard magnetic materials classification based on Hysteresis Curve
		Applications of magnetic materials
IIIb. Dielectrics	Introduction& definitions	Introduction to dielectrics
		Dielectric polarization, Dielectric polarizability, susceptibility
		Dielectric constant
	Types of polarizations	Electronic polarization (Quantitative)
		Ionic polarization (Quantitative)
		Orientational polarizations (Qualitative)
	Internal field& Claussius –Mossotti's equation	Lorentz Internal fields in solids
		Clausius-Mossotti's equation
		Frequency dependence of polarization
		Applications of Dielectrics

Unit-IV: ACOUSTICS AND ULTRASONICS

Acoustics: Introduction **–** Reverberation - Reverberation time - Sabine's formula–absorption coefficient and its determination- factors affecting acoustics of buildings and their remedies.

Ultrasonics: Properties –Production of ultrasonics by Magnetostriction & Piezoelectric methods –Non-Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays–applications.

Unit	Module	Micro content
IVa. Acoustics	Introduction &Reverberation	Introduction to acoustics
		Definition of Reverberation
		Definition of Reverberation time
	Sabine's formula & absorption	Sabine's formula derivation
		Absorption coefficient
		Determination of Absorption coefficient
	Factors affecting	Basic requirements for acoustically good halls

	acoustics of buildings	Factors affecting acoustics of buildings and their remedies
IVb. Ultrasonics	Properties &Production of ultrasonics	Introduction and Properties of Ultrasonics
		Production of ultrasonics by Magnetostriction method
		Production of ultrasonics by Piezoelectric method
	Non-Destructive Testing	Non-Destructive Testing using Pulse echo system
		Non-Destructive Testing through transmission and reflection modes
	Different scanning techniques	A - Scan
		B - Scan
		C - Scan
		Applications of Ultrasonics
Unit-V: ELASTICITY: Stress & strain –stress &strain curve– generalized Hooke's law – different types of moduli and their relations – bending of beams – Bending moment of a beam – Depression of cantilever.		
Unit	**Module**	**Micro content**
V.ELASTICITY	Stress & strain	Introduction to Elasticity, Stress & Strain
		Stress & Strain curve (Behaviour of a wire under increasing load)
		Generalized Hooke's law
	Different types of moduli and their relations	Young's modulus, Bulk modulus, Rigidity modulus and Poisson's ratio
		Relations among Young's, Bulk and Rigidity moduli
	Bending of beams	Bending of beams
		Bending moment of a beam
		Cantilever and depression of cantilever (Cantilever supported at its ends and loaded in the middle)

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2										1
CO2	3	2										1
CO3	3	2										1
CO4	3	2										1
CO5	3	2										1

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I Year – II SEMESTER

L	T	P	C
3	0	0	3

ENGINEERING MECHANICS

(Common to CE and ME)

Course Objectives:

1. To understand the resolution of forces, equilibrium of force systems
2. To learn the analysis of forces in the structures and also the basic concepts of friction and its Applications to simple systems.
3. To understand the concepts of centroid, moment of inertia, centre of gravity and mass moment of inertia.
4. To understand the basic concepts of kinematics and kinetics.
5. To learn the concepts of work energy method and impulse momentum

UNIT- I: INTRODUCTION TO ENGINEERING MECHANICS (14 hours)

Force systems: Basic Concepts, Resultant of coplanar concurrent forces, Components of force in space, Moment of force and its applications, couples and resultant of force systems, Equilibrium of Force Systems, Free body diagram, Equations of equilibrium, Equilibrium of planar and spatial system.

UNIT-II: ANALYSIS OF STRUCTURES AND FRICTION (12 hours)

Trusses: Introduction, Analysis of trusses by method of joints, method of sections;

Friction: Introduction to Friction, Laws of friction, Application to simple systems and connected systems.

UNIT-III: CENTROID AND CENTRE OF GRAVITY, AREA MOMENT OF INERTIA AND MASS MOMENT INERTIA (16 hours)

Centroid: Centroid of simple figures from basic principles, centroid of composite sections;

Centre of Gravity: Center of gravity of simple body from basic principles, Center of gravity of composite bodies, Pappus theorems.

Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures.

Mass Moment of Inertia: Introduction of Mass Moment of Inertia, mass moment of inertia of composite bodies

UNIT IV: INTRODUCTION TO KINEMATICS AND KINETICS (12 hours)

Kinematics: Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.

Kinetics: Analysis as a Particle and Analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.

UNIT – V: WORK -ENERGY METHOD (10 hours)

Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method

REFRENCE BOOKS:

1. Engineering Mechanics statics and dynamics – R.C. Hibbeler, 11th Edn – Pearson Publ.
2. Mechanics for Engineers, statics - F.P. Beer & E.R. Johnston – 5th Edn Mc Graw Hill Publ.
3. Engineering Mechanics statics and dynamics, A Nelson, Mc Graw Hill publications

TEXT BOOKS:

1. Reddy Vijay Kumar K. and K. Suresh Kumar (2010), Singer's Engineering Mechanics.

2. S.P. Timoshenko and D.H. Young, Engineering Mechanics, McGraw-Hill International Edition,1983.

3. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

e-Resources:

1. http://nptel.ac.in/
2. http://mhrd.gov.in/e-contents
3. http://spoken-tutorial.org

Course Outcomes:

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

1. Compute the resultant and moment of a force system and apply the equations of equilibrium for a generalized force system **(Apply)**
2. Solve the forces in trusses, frames and also friction in various mechanical devices. **(Apply)**
3. Interpret the centroids, centers of gravity and moments of inertia of simple geometric shapes and understand the physical applications of these properties. (**Apply**)
4. Apply the basic concepts of dynamics to solve problems of engineering applications (**Apply**)
5. Solve problems using work energy equations for translation, fixed axis rotation and plane motion. (**Apply**)

Micro-Syllabus of ENGINEERING MECHANICS

UNIT- I: INTRODUCTION TO ENGINEERING MECHANICS (14 hours)

Force systems: Basic Concepts, Resultant of coplanar concurrent forces, Components of force in space, Moment of force and its applications, couples and resultant of force systems, Equilibrium of Force Systems, Free body diagram, Equations of equilibrium, Equilibrium of planar and spatial system.

Unit	Module	Micro content
1a. *Force systems*	INTRODUCTION	Basic Concepts
		Resolving forces into rectangular components
		Classification of force system
	Resultant of forces	Resultant of coplanar concurrent forces. Parallelogram law of method **(Simple problems on analytical method only)**
		Components of force in space (**Simple problems using vector method for finding resultant)**
		Moment of force & couples Varignon's theorem **(Simple problems on analytical method only)**
		resultant of force systems

1b. Equilibrium	Equilibrium of Force Systems	Defining constraint, Types of supports and reaction forces
		Free body diagram
		Equilibrium of Force Systems
		Equations of equilibrium
		Equilibrium of planar system **(Simple problems using analytical method only)**
		Equilibrium of spatial system **(Simple problems on vector method)**

UNIT-II: ANALYSIS OF STRUCTURES AND FRICTION (12 hours)

Trusses: Introduction, Analysis of trusses by method of joints, method of sections;

Friction: Introduction to Friction, Laws of friction, Application to simple systems and connected systems.

Unit	Module	Micro content
2.a. ANALYSIS OF STRUCTURES	***Trusses***	Introduction, Analysis of trusses
		Analysis of trusses by method of joints **(Simple problems on 2D Truss only)**
		Analysis of trusses by method of sections **(Simple problems on 2D Truss only)**
2.b. Friction	***Friction***	Introduction, Applications of Friction
		Laws of friction
		Cone of friction
		Simple 2D problems on Friction

UNIT-III:

CENTROID AND CENTRE OF GRAVITY, AREA MOMENT OF INERTIA AND MASS MOMENT INERTIA (16 hours)

Centroid: Centroid of simple figures from basic principles, centroid of composite sections;

Centre of Gravity: Center of gravity of simple body from basic principles, Center of gravity of composite bodies, Pappus theorems.

Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures.

Mass Moment of Inertia: Introduction of Mass Moment of Inertia, mass moment of inertia of composite bodies

Unit	Module	Micro content
3. CENTRE OF GRAVITY & MOMENT OF INERTIA	***Centroid***	Derivation of Centroid for simple figures such as Triangle, sector and semi circle from basic principles
		Centroid of composite sections
		Simple problems on *Centroid* of composite sections
	Centre of Gravity	Derivation of Center of gravity for simple body

		such as cylinder and cone from the basic principles
		Pappus theorems
	Area moments of Inertia	Definition, Parallel axis theorem and Perpendicular axis theorem
		Simple problems on ***Area moments of Inertia***
	Mass Moment of Inertia	Mass Moment of Inertia importance and its Derivation for simple bodies such as cylinder and cone
UNIT IV: INTRODUCTION TO KINEMATICS AND KINETICS (12 hours) ***Kinematics:*** Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion. ***Kinetics:*** Analysis as a Particle and Analysis as a Rigid Body in Translation – Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.		
Unit	**Module**	**Micro content**
4a. ***Kinematics***	Rectilinear motion	Equations of motion in linear motion **Simple problems on linear motion**
		Projectile motion **Simple problems on Rectilinear motion**
	Curvilinear motion	Equations of motion in Curvilinear motion
		Relation between Linear and curvilinear moton (**Simple problems)**
	Motion of Rigid Body	Types and their Analysis in Planar Motion. (**Finding Instantaneous center)**
4b. ***Kinetics***	Analysis as a Particle	D Alembert's principle
		Simple problems on Translatory motion using D Alembert's principle
	Analysis as a Rigid Body	Central Force Motion
		Equations of Plane Motion – Fixed Axis Rotation
		Rolling Bodies
		Simple problems on Rolling Bodies
UNIT – V: WORK -ENERGY METHOD (10 hours) ***Work – Energy Method:*** Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.		
Unit	**Module**	**Micro content**
5. WORK - ENERGY METHOD	Work-Energy Applications to Particle Motion	Derivation of work energy method
		Simple problems on Translation using work energy method
		Simple problems on Connected System using

		work energy method
	Impulse momentum method	**Simple problems using Impulse momentum method**
		Simple problems on Connected System using Impulse momentum method

CO-PO mapping Table with Justification

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations **(High: 3, Medium: 2, Low: 1)**

Mapping	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PSO2
C01	3	2	2	1	1	-	-	-	-	-	1	1	2	2
C02	3	2	2	1	1	-	-	-	-	-	1	1	2	2
C03	3	2	2	1	1	-	-	-	-	-	1	1	2	2
C04	3	2	2	1	1	-	-	-	-	-	1	1	2	2
C05	3	2	2	1	1	-	-	-	-	-	1	1	2	2

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I Year – II SEMESTER

L	T	P	C
3	0	0	3

BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING

(Common to CSE, IT, CE and ME)

Course Objectives:

- To introduce basics of electric circuits and to teach DC and AC electrical circuit analysis.
- To explain the working principles DC machines and speed control of various DC motors.
- To explain the working principles of transformers and AC machines and its applications.
- To introduce the basics of semiconductor physics and operation and applications of Diodes.
- To introduce the basics of transistors and explain the transistor configurations

Unit 1 DC & AC Circuits:

DC Circuits:

Electrical circuit elements (R - L and C) – Kirchhoff's laws -Voltage and Current division rules-series, parallel circuits and star-delta and delta-star transformations- [Elementary treatment only]

AC Circuits:

Representation of sinusoidal waveforms - Peak and RMS values - phasor representation - real power - reactive power - apparent power - power factor.[Elementary treatment only]

Unit 2 DC Machines:

DC Generator:

Construction-Principle and operation of DC Generator - EMF equation -Types–Applications[Elementary treatment only]

DC Motor:

Principle and operation of DC Motor – types-Torque equation - Speed control of DC Motor-Brake test- Swinburne's test-Applications. [Elementary treatment only]

Unit 3 AC Machines:

Single Phase Transformer:

Construction, Principle and operation of Single Phase Transformer –EMF Equation-Losses-Efficiency. [Elementary treatment only]

Three Phase Induction Motor: Construction- Principle and operation of three phase Induction Motor-Types- Applications. [Elementary treatment only].

Unit 4 Semiconductor Devices

Semiconductor Physics, PN Junction Diode & Zener Diode-characteristics- Applications: Rectifiers (Half Wave Rectifier & Full Wave Rectifier) [Elementary treatment only], Clippers and Clampers.

Unit 5 Bipolar Junction Transistors

Construction and working of bipolar junction transistor, CB, CE and CC Configurations and characteristics. [Elementary treatment only], Transistors as amplifiers, op-amp basics.

Text Books:

1. D. P. Kothari and I. J. Nagrath- "Basic Electrical Engineering" - Tata McGraw Hill - 2010.
2. Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

References:

1. L. S. Bobrow- "Fundamentals of Electrical Engineering" - Oxford University Press - 2011.
2. E. Hughes - "Electrical and Electronics Technology" - Pearson - 2010.

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

- Apply concepts of KVL/KCL in solving DC circuits. (Apply, Find, Solve)
- Choose correct machine for a specific application. (Understand, Apply)
- Illustrate working principles of DC and AC Machines. (Understand, Apply)
- Describe working principles of diodes and transistors. (Understand, Apply)
- Understand the applications of diodes and transistors. (Understand, Analyze)

BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating);

PO – Program Outcomes (PO 1: Engineering knowledge, PO 2: Problem analysis, PO 3: Design/Development of Solutions, PO 4: Conduct investigations of complex problems, PO 5: Modern tool usage, PO 6: The engineer and society, PO 7: Environment and sustainability, PO 8: Ethics, PO 9: Individual and team work, PO 10: Communication, PO 11: Project management and finance, PO 12: Life-long learning)

Micro-Syllabus of Basics of Electrical & Electronics Engineering

UNIT-I: DC & AC Circuits:

DC Circuits:

Electrical circuit elements (R - L and C) – Kirchhoff's laws -Voltage and Current division rules-series, parallel circuits and star-delta and delta-star transformations- [Elementary treatment only]

AC Circuits:

Representation of sinusoidal waveforms - Peak and RMS values - phasor representation - real power - reactive power - apparent power - power factor. [Elementary treatment only]

Unit	Module	Micro content
1.a DC Circuits	Definitions & circuit elements	Definitions of Voltage, Current, Power & Energy
		Types and Classification of circuit elements: R, L, C elements Active, Passive; unilateral, bilateral; linear, nonlinear; lumped, distributed elements
	Ohm's law, KCL, KVL, Voltage & Current Division rules	Ohm's Law. Active elements -Representation of Voltage and current sources in ideal and Practical cases and Passive elements –Voltage & Current relationship of R - L and C elements

		Kirchhoff's Voltage and current laws –series and parallel circuits of R, L & C elements, Voltage and Current division rules for resistive circuit only
	STAR-DELTA transformation	star-delta and delta-star transformations of resistive circuit only [Elementary treatment only]
1.b AC Circuits	Phasor representation & AC fundamentals	Representation of sinusoidal waveforms –Phase difference and phasor representation of sinusoidal waveforms
		Peak, Average and RMS values for sinusoidal waveforms only
	AC circuits & Power	Definitions of reactance and Impedance, real power - reactive power - apparent power - power factor. [Elementary treatment only]

UNIT-II: DC Machines:

DC Generator:

Construction-Principle and operation of DC Generator - EMF equation -Types– Applications [Elementary treatment only]

DC Motor:

Principle and operation of DC Motor – types-Torque equation - Speed control of DC Motor-Brake test- Swinburne's test-Applications. [Elementary treatment only]

Unit	Module	Micro content
2.a DC generators	DC generator principle of operation & applications	Construction details of dc generator-Field System, Armature
		Principle and operation of DC generator
		derivation of generated EMF-Simple problems on generated EMF
		Types of dc generators- Separately and Self excited (Shunt and series generators equivalent circuit [Elementary treatment only]) and applications.
2.b DC Motors	DC Motor principle of operation & Back EMF	Principle operation of DC Motor
		Significance of Back EMF-Simple problems on Back EMF
		Derivation of Torque Equation-Simple problems on Torque Equation Torque equation of DC motor
	Types of DC motors & Applications	Types of DC Motors (Shunt and series motors equivalent circuit) and Applications
	DC motor Speed control techniques	speed control (armature and field control methods)
	Testing of DC machines	Brake test procedure-Swinburne's test procedure [Elementary treatment only]

UNIT-III: AC Machines:

Single Phase Transformer:

Construction, Principle and operation of Single-Phase Transformer –EMF Equation-Losses-Efficiency. [Elementary treatment only]

Three Phase Induction Motor: Construction- Principle and operation of three phase Induction Motor-Types- Applications. [Elementary treatment only].

Unit	Module	Micro content
3.a Single Phase transformer	Basics of transformer	Construction, principle of operation of single-phase transformer, Types of single-phase transformer
	EMF equation & Phasor diagram	EMF Equation of a transformer and simple problems on EMF equation of single-phase transformer
		Ideal Transformer on NO load with phasor diagram
	Transformer performance	Losses, Efficiency. [Elementary treatment only]
3.b. Three Phase Induction Motor	Basics of 3-phase induction motor	Construction and principles of 3-phase induction motor
	Types and applications	Types (Squirrel Cage and slip ring induction motor construction)- Applications

UNIT – IV: Semiconductor Devices

Semiconductor Physics, PN Junction Diode & Zener Diode-characteristics- Applications: Rectifiers (Half Wave Rectifier & Full Wave Rectifier) [Elementary treatment only], Clippers and Clampers.

Unit	Module	Micro content
4.a. Semiconductor physics & Diodes	Semiconductor Physics	Classification of materials based on energy band diagram
		Current density in conductor, Intrinsic semiconductor & properties of silicon and germanium
		Extrinsic semiconductor: P-type and N-type, Conductivity of extrinsic semiconductor and law of mass action, Diffusion & Drift currents-N junction formation.
	PN Junction Diode & Zener Diode	Working principle of PN junction diode: forward bias, reverse bias
		Diode current equation (Expression only), Basic problems on usage of diode current equation.
		Diode circuit models: Ideal Diode Model, Ideal Diode Model with V_{γ},. Reverse breakdown phenomena, Zener diode characteristics
4.b Diode Applications	Voltage regulator	Zener Diode as Voltage Regulator
	Diode Rectifier Circuits	PN junction Diode Rectifiers (Working principle, Input and Output Waveforms and Expressions of output DC voltage for each) PN junction Diode

		Rectifiers (Working principle, Input and Output Waveforms and Expressions of output DC voltage for each)
	Clipper circuits	Bridge. Basics of Clippers: Series Positive, Series negative, Shunt Positive, Shunt negative, Dual clipping (without bias voltage).

UNIT V: Bipolar Junction Transistors

Construction and working of bipolar junction transistor, CB, CE and CC Configurations and characteristics.[Elementary treatment only], Transistors as amplifiers, op-amp basics.

Unit	**Module**	**Micro content**
5.a BJT	BJT construction & working	Periodic functions Construction, Configuration and models
		Working of BJT, Definitions of α, β and γ
	BJT CB,CE characteristics	CB characteristics: Input, output characteristics , current relation, dynamic input and output resistances and base-width modulation
		CE characteristics: Input, output characteristics , current relation, dynamic input and output resistances
	BJT Amplifier	Transistor as an amplifier
5.b OP-Amp basic	Basics of OP-amp & characteristics	Block diagram of OP-AMP (Qualitative treatment)
		Ideal characteristics of OP-AMP
	Basic OP-amp circuits	Inverting amplifier circuit
		Non-inverting amplifier circuit

CO PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	2										1
CO3	3											1
CO4	3	2										1
CO5	3											1

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I Year – II SEMESTER

L	T	P	C
1	0	3	2.5

ENGINEERING GRAPHICS & DESIGN

(Common to CE, CSE and IT)

Course Objectives:

- Expose the students to use Drafting packages for generating Engineering curves and conventions followed in Preparation of engineering drawings.
- Make the students to understand the concepts of orthographic projections of Lines and Plane Surfaces.
- To understand the concepts of orthographic projections of Regular Solids.
- Develop the ability of understanding sectional views and Development of Solid Surfaces.
- Enable them to use computer aided drafting packages for Conversion of Isometric view to Orthographic Projection and vice versa.

UNIT-I: INTRODUCTION TO AUTOCAD:

Basic commands, Customization, ISO and ANSI standards for coordinate dimensioning, Annotations, layering, 2D drawings of various mechanical components, 2D drawings of various electrical and electronic circuits. Creation of engineering models- floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; (Experiments should be Planned According to respective Core Branch Applications)

UNIT-II: THEORY OF PROJECTION:

Principles of Orthographic Projections-Convention: Projections of Points, Projections of Lines inclined to both planes, Projections of planes inclined to one Plane & Projections of planes inclined to both Planes

UNIT III: PROJECTIONS OF REGULAR SOLIDS:

Projections of Solids –with the axis perpendicular to one of the principal planes, with the axis Inclined to one of the principal planes, Projections of Solids –with the axis Inclined to Both the principal planes

UNIT IV: DEVELOPMENT OF SURFACES & SECTIONAL ORTHOGRAPHIC VIEWS

Development of surfaces of Right Regular Solids – Prism, Pyramid, Cylinder and, Cone. Draw the sectional orthographic views of geometrical solids

UNIT V: ISOMETRIC PROJECTIONS

Conversion of isometric views to orthographic views, drawing of isometric views - simple Solids, Conversion of orthographic views to isometric views of simple Drawings

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Graphics with Autocad by Kulkarni D.M, PHI Publishers
3. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age
4. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

REFERENCE BOOKS:

1. Engineering Drawing by K.L.Narayana& P. Kannaiah, Scitech Publishers

2. Engineering Graphics for Degree by K.C. John, PHI Publishers

3. Engineering Graphics by PI Varghese, McGrawHill Publishers

4. AutoCAD 2018 Training Guide (English, Paperback, Sagar Linkan) ISBN: 9789386551870, 938655187X RUPAPUBLICATIONS

Websites

1.https://www.autodesk.com.au/campaigns/autocad-tutorials

2. https://nptel.ac.in/courses/112104172

Course Outcomes: Upon successful completion of the course, the student will be able to

CO1: Prepare erinngineeg drawings as per BIS conventions Understand level, KL2}

CO2: Produce computer generated of orthographic projections of Lines and Plane surfaces using CAD software {Apply level, KL3}

CO3: Use the knowledge of orthographic projections of Solids to represent engineering information/concepts and present the same in the form of drawings {Apply level, KL3}

CO4: Use the knowledge of sectional views and Development of Solid Surfaces in Real time Applications {Apply level, KL3}

CO5: Develop isometric drawings of simple objects reading the orthographic projections of those objects {Analyze level, KL4}

CO-PO Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	–	3	–	–	–	–	2	–	1
CO2	2	1	1	–	3	–	–	–	–	2	–	1
CO3	2	2	2	–	3	–	–	–	–	2	–	1
CO4	2	2	2	–	3	–	–	–	–	2	–	1
CO5	2	2	2	–	3	–	–	–	–	2	–	1

CO-PSO Matrix:

	PSO1	PSO2
CO1	–	1
CO2	–	1
CO3	–	1
CO4	–	1
CO5	–	1

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I Year – II SEMESTER

L	T	P	C
0	0	3	1.5

ENGINEERING PHYSICS LAB

Course Objectives:

The Applied Physics Lab is designed to:

- Understand the concepts of interference and diffraction and their applications.
- Apply the concept of LASER in the determination of wavelength.
- Recognize the importance of energy gap in the study of conductivity and Hall Effect.
- Illustrate the magnetic and dielectric materials applications.
- Apply the principles of semiconductors in various electronic devices.

Course Outcomes:

The students will be able to:

1. Operate optical instruments like microscope and spectrometer
2. Determine thickness of a paper with the concept of interference
3. Estimate the wavelength of different colours using diffraction grating and resolving power
4. Plot the intensity of the magnetic field of circular coil carrying current with distance
5. Calculate the band gap of a given semiconductor

LIST OF EXPERIMENTS

(Any 10 of the following listed 15 experiments)

1. Determination of wavelength of a Source-Diffraction Grating-Normal incidence.
2. Newton's rings – Radius of Curvature of Plano - Convex Lens.
3. Determination of thickness of a spacer using wedge film and parallel interference fringes.
4. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
5. Energy Band gap of a Semiconductor p - n junction.
6. Characteristics of Thermistor – Temperature Coefficients
7. Determination of dielectric constant by charging and discharging method
8. Variation of dielectric constant with temperature
9. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
10. LASER - Determination of wavelength by plane diffraction grating
11. Verification of laws of vibrations in stretched strings – Sonometer.
12. Determine the radius of gyration using compound pendulum
13. Rigidity modulus of material by wire-dynamic method (torsional pendulum)
14. Dispersive power of diffraction grating.
15. Determination of Hall voltage and Hall coefficients of a given semiconductor using Hall Effect.

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	2										1
CO3	3	2										1
CO4	3	2										1
CO5	3	2										1

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I Year – II SEMESTER

L	T	P	C
0	0	3	1.5

BASIS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB
(Common to CE, ME and CSE, IT)

Course Objectives:

- To Verify Kirchhoff's laws, Voltage and Current division rules.
- To learn speed control and testing of DC Shunt Motor.
- To learn and understand the operation of induction motor.
- To learn applications of diodes and transistors.

Course Outcomes: Verify Kirchhoff's Laws and voltage and current division rules for DC supply.

- Analyze the performance of AC and DC Machines by testing.
- Perform speed control of DC shunt motor.
- Perform the half wave and full wave rectifier.

List of Experiments: -

1. Verification of Kirchhoff laws.
2. Verification of Voltage division rule and current division rule.
3. Speed control of DC Shunt Motor.
4. Perform Brake test on DC Shunt Motor.
5. Conduct Swinburne's test on DC Shunt Motor.
6. Brake test on 3-phase Induction Motor.
7. Draw the V-I characteristics of P-N Junction Diode.
8. Draw the V-I characteristics of zener Diode.
9. Half wave rectifier and Full wave rectifier operations using diodes.
10. Draw the BJT-CB Configuration characteristics.
11. Draw the BJT-CE Configuration characteristics.
12. Draw the BJT-CC Configuration characteristics.
13. Study of circuit simulation software (any one- TINA-PRO/ PSPICE/ CIRCUIT MAKER/ GPSIM/ SAPWIN etc).

Text Books:

1. D. P. Kothari and I. J. Nagrath- "Basic Electrical Engineering" - Tata McGraw Hill - 2010.
2. Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

References:

1. L. S. Bobrow- "Fundamentals of Electrical Engineering" - Oxford University Press - 2011.
2. E. Hughes - "Electrical and Electronics Technology" - Pearson - 2010.

CO PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										1
CO2	3	2										1
CO3	3											1
CO4	3	2										1

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I Year – II SEMESTER

L	T	P	C
0	0	3	1.5

COMMUNICATIVE ENGLISH LAB
(Common to All Branches)

The main objective of the course is to adopt activity-based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions and appear confidently for competitive examinations for career development.

The specific objectives of the course are to

1. Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native and non-native speakers
2. Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials like newspapers, magazines, periodicals, journals, etc.
3. Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
4. Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
5. Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Course Outcomes

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

CO1. prioritize information from reading texts after selecting relevant and useful points and paraphrase short academic texts using suitable strategies and conventions (L3)

CO2. make formal structured presentations on academic topics using PPT slides with relevant graphical elements (L3)

CO3. participate in group discussions using appropriate conventions and language strategies (L3)

CO4. prepare a CV with a cover letter to seek internship/ job (L2)

CO5. collaborate with a partner to make presentations and Project Reports (L2)

Detailed Syllabus

CALL based activity. English course books selected for classroom teaching will be used for practice in the computer-based language labs. Watching and listening to Video clips.
Listening Activity: Selected speeches of eminent personalities, audio texts, dialogues and discussions
Speaking: JAM, Oral Presentations, Group Discussions
Writing: Different types of reports
Project: Power point presentation of 5 min on a specific topic
Pair work, Role play, conversational practice and Individual speaking activities based on following essays from ***University of Success***.
1. "How to Get Yourself Organized" by Michael LeBeouf
2. "How to Turn Your Desires into Gold" by Napoleon Hill
3. "How to Look Like a Winner How to Increase Your Value" by Og Mandino
4. "How to Swap a Losing Strategy" by Auren Uris and Jack Tarrant
5. "How to Bounce Back from Failure" by Og Mandino
6. "How to Prevent Your Success from Turning into Ashes" by Allan Fromme
7. "How to Have a Happy Life" by Louis Binstock

8. “How to Keep the Flame of Success Shining Brightly” by Howard Whitman

Any ten Supplementary Language Activities from ***UN Global Goals*** document

1. “Developing children’s understanding of the Global Goals” by Carol Read
2. “End poverty in all its forms everywhere” by SylwiaZabor-Zakowska
3. “End hunger, achieve food security and improved nutrition and promote sustainable agriculture” by Linda Ruas
4. ‘Ensure healthy lives and promote well-being for all at all ages” by Carmen Flores
5. “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” by Daniel Xerri
6. “Achieve gender equality and empower all women and girls” by Jemma Prior and Tessa Woodward
7. “Ensure availability and sustainable management of water and sanitation for all” by Wei KeongToo
8. “Ensure access to affordable, reliable, sustainable and modern energy for all” by Phil Wade
9. “Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all” by Nik Peachey
10. “Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation” by MaluSciamarelli
11. “Reduce inequality within and among countries” by Alan Maley
12. “Make cities and human settlements inclusive, safe, resilient and sustainable” by David Brennan
13. “Ensure sustainable consumption and production patterns” by Laszlo Katona and Nora Tartsay
14. “Take urgent action to combat climate change and its impacts” by Maria Theologidou
15. “Conserve and sustainably use the oceans, seas and marine resources for sustainable development” by Jill Hadfield and Charlie Hadfield
16. “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss” by ChrysaPapalazarou
17. “Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels” by Rebeca Duriga
18. “Strengthen the means of implementation and revitalise the global partnership for sustainable development” by Jennifer Verschoor and Anna Maria Menezes
19. “Content and the Sustainable Development Goals: going beyond language learning” by AdrianTennant
20. “Using extensive reading creatively to raise awareness of issues of equality and justice” by SueLeather
21. “Storytelling for a better world” by David Heathfield
22. “Using the Sustainable Development Goals in the EAP classroom” by Averil Bolster and Peter Levrai

Text Books

1. Alan Maley and Nik Peachy. *Integrating global issues in the creative English Classroom: Withreference to the United Nations Sustainable Development Goals.* British Council Teaching English, 2018 (Public Domain UN Document)

2. *University of Success* by Og Mandino, Jaico, 2015 (Reprint).

Reference Books

1. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
2. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
5. Chaturvedi, P. D. and ChaturvediMukesh. *The Art and Science of Business Communication: Skills, Concepts, Cases and Applications.* 4Ed. Pearson, 2017.

AICTE Recommended Books

1. Meenakshi Raman and Sangeeta Sharma. *Technical Communication.* Oxford University Press,2018.
2. Pushplata and Sanjay Kumar. *Communication Skills*, Oxford University Press, 2018.
3. Kulbushan Kumar. *Effective Communication Skills.* Khanna Publishing House, Delhi

Sample Web Resources

Grammar / Listening / Writing 1-language.com http://www.5minuteenglish.com/ https://www.englishpractice.com/ Grammar/Vocabulary English Language Learning Online http://www.bbc.co.uk/learningenglish/ http://www.better-english.com/ http://www.nonstopenglish.com/ https://www.vocabulary.com/ BBC Vocabulary Games Free Rice Vocabulary Game	Reading https://www.usingenglish.com/comprehension/ https://www.englishclub.com/reading/short stories.htm https://www.english-online.at/ Listening https://learningenglish.voanews.com/z/3613 http://www.englishmedialab.com/listening.html Speaking https://www.talkenglish.com/ BBC Learning English – Pronunciation tips Merriam-Webster – Perfect pronunciation Exercises
All Skills https://www.englishclub.com/ http://www.world-english.org/ http://l	

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									2	3		1
CO2									2	3		1
CO3									2	3		1
CO4									2	3		1
CO5									2	3		1

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I Year – II SEMESTER

L	T	P	C
3	0	0	0

CONSTITUTION OF INDIA

Course Objectives:

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
- To understand the central and state relation financial and administrative.

UNIT-I

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

LEARNING OUTCOMES:

After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History, features of Indian constitution
- Evaluate Preamble Fundamental Rights and Duties

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

LEARNING OUTCOMES: - After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

UNIT-III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

LEARNING OUTCOMES: - After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor and Chief Minister
- Explain the role of state Secretariat
- Differentiate between structure and functions of state secretariate

UNIT-IV

Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation Panchayati: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

LEARNING OUTCOMES: - After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Myer and elected representatives of Municipalities
- Evaluate Zilla panchayat block level organisation

UNIT-V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission: Functions of Commissions for the welfare of SC/ST/OBC and women

LEARNING OUTCOMES: - After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissionerate
- Analyze role of state election commission
- Evaluate various commissions of viz SC/ST/OBC and women

REFERENCES:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subash Kashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government and Politics Hans
7. J. Raj Indian Government and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

E-RESOURCES:

1. nptel.ac.in/courses/109104074/8
2. nptel.ac.in/courses/109104045/
3. nptel.ac.in/courses/101104065/
4. www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

Course Outcomes: At the end of the semester/course, the student will be able to have a clear knowledge on the following:

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government.

- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

Course Outcomes:

CO-1	Know the sources, features and principles of Indian Constitution.
CO-2	Learn about Union Government, State government and its administration.
CO-3	Get acquainted with Local administration and Pachayati Raj.
CO-4	Be aware of basic concepts and developments of Human Rights.
CO-5	Gain knowledge on roles and functioning of Election Commission

CO-PO Matrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	3			3		2	3	-	3	2
CO2	2	-	2			2		2	2	-	3	2
CO3	3	-	3			2		2	2	-	3	3
CO4	2	-	3			2		2	2	-	3	3
CO5	3	-	1			3		3	3	-	3	2

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II Year – I SEMESTER

L	T	P	C
2	1	0	3

COMPLEX VARIABLES AND STATISTICAL METHODS

(Common to CE. EEE, ME and ECE)

Course Objectives:

The student should be able to

- Familiarize the complex variables.
- Familiarize the students with the foundations of probability and statistical methods
- Equip the students to solve application problems in their disciplines.

Pre-Requisites:

1. Calculus
2. Partial Differentiation
3. Multiple Integration
4. Set Theory

Unit-I: FUNCTIONS OF A COMPLEX VARIABLE AND COMPLEX INTEGRATION

Functions of a complex variable: Introduction – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne-Thompson method.

Complex Integration: Complex integration – Line integral – Cauchy's integral theorem – Cauchy's integral formula (All without proofs).

Unit– II: SERIES EXPANSIONS AND RESIDUE THEOREM

Series Expansions: Radius of convergence – Expansion in Taylor's series, Maclaurin's series - Laurent's series.

Residue Theorem: Types of singularities – Isolated – pole of order m – Essential – Residues – Residue theorem (without proof)

Unit-III: PROBABILITY, DISTRIBUTIONS AND SAMPLING THEORY

Probability, Distributions: Probability-Baye's Theorem-Random Variables-Discrete and Continuous Random Variables-Distribution Function-Mathematical Expectation and Variance-Binomial, Poisson and Normal distributions.

Sampling Theory: Population and Samples-Sampling distribution of Means -Point and Interval Estimations-Maximum error of estimate.

Unit-IV: TEST OF HYPOTHESIS

Introduction–Hypothesis-Null and Alternative Hypothesis-Type I and Type II Errors-Level of Significance-One tail and two-tail Tests-Tests concerning one mean and two means (Large and Small samples)-Tests on proportions.

Unit-V: CURVE FITTING AND CORRELATION

Method of least Squares-Straight Line-Parabola-Exponential-Power Curves-Correlation-Correlation Coefficient-Rank Correlation-Regression coefficient and Properties-Regression lines.

TEXT BOOKS:

1. "Higher Engineering Mathematics", by B.S. Grewal, 44th Edition, Khanna Publishers.

2. "Fundamentals of Mathematical Statistics", by S. C. Gupta and V. K. Kapoor 11/e (Reprint) 2019, Sultan Chand & Sons Publications

REFERENCE BOOKS:

1. Miller and Freund's, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
2. T. K. V. Iyenger, Probability and Statistics, S. Chand & Company Ltd, 2015.
3. Jay I. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.

Course Outcomes:

The students will be able to

Apply Cauchy-Riemann equations to complex function in order to determine whether given continuous function is analytic **(L3)**

Find the differentiation, integration of complex functions used in engineering problems and make use of Cauchy residue theorem to evaluate certain integrals **(L3)**

Apply discrete and continuous probability distributions and **Design** the components of a classical hypothesis test **(L3 &L6)**

Infer the statistical inferential methods based on small and large sampling tests. **(L4)**

Interpret the association of characteristics and through correlation and regression tools **(L4)**

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Complex Variables and Statistical Methods

Unit-I: FUNCTIONS OF A COMPLEX VARIABLE AND COMPLEX INTEGRATION

Functions of a complex variable: Introduction – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne-Thompson method.

Complex Integration: Complex integration – Line integral – Cauchy's integral theorem – Cauchy's integral formula (All without proofs).

Unit	Module	Micro content
Ia. Analytic Functions	Introduction of Analytic function	Cauchy-Riemann equations in cartesian
		Cauchy-Riemann equation in Polar form
		Verify the given function is analytic or not.
	Harmonic function	Prove that real and imaginary parts of analytic function are harmonic.
		Finding conjugate harmonic function for given part of analytic function.
	Orthogonal trajectory	Newton's Rings (reflected geometry)
		Experimental arrangement & conditions for diameters
	Finding analytic function	Using Milen-Thomson method find analytic function whose real or imaginary are known.
Ib. Complex Integration	Introduction of Complex integration	Evaluation of Complex Integration Using line integral along the given curve.
	Cauchy's Integration	Verification of Cauchy's Integral theorem
		Evaluation of Complex integration using Cauchy's integral theorem.
		Evaluation of Complex integration using Cauchy's

		integral formula.

Unit– II: SERIES EXPANSIONS AND RESIDUE THEOREM

Series Expansions: Radius of convergence – Expansion in Taylor's series, Maclaurin's series - Laurent's series.

Residue Theorem: Types of singularities – Isolated – pole of order m – Essential – Residues – Residue theorem (without proof)

Unit	Module	Micro content
IIa. Series Expansion of Complex Function	Taylor's Expansion	Expand given function as Taylor's series about z = a.
		Expand given function as Taylor's series in powers of z.
	Laurent's Expansion	Expand given function as Laurent series about z = a.
		Expand given function as Laurent series in powers of z.
	LASERS construction and working	Ruby laser
		Helium-Neon laser
		Applications of Lasers
IIb. Residue Theorem	Evaluation of integration using residue theorem	Find poles and residue at each pole of f(z)
		Evaluate integral of f(z) using residue theorem.

Unit-III: PROBABILITY, DISTRIBUTIONS AND SAMPLING THEORY

Probability, Distributions: Probability-Baye's Theorem-Random Variables-Discrete and Continuous Random Variables-Distribution Function-Mathematical Expectation and Variance-Binomial, Poisson and Normal distributions.

Sampling Theory: Population and Samples-Sampling distribution of Means -Point and Interval Estimations-Maximum error of estimate.

Unit	Module	Micro content
IIIa. Probability, Distributions	Probability	Find probability using Baye'e theorem
		Write probability distribution for given random variable. And find mean , variance and S.D. of random variable.
	Probability distributions	Mean and variance of Binomial, Poisson and normal distributions.
		Find probability of Binomial event.
		Find probability of Poisson event.
		Find probability of Normal event.
IIIb. Sampling Theory	Sampling theory	Write sampling distribution of sample mean. And find mean of sampling distribution and S.D. of sampling distribution.

Unit-IV: TEST OF HYPOTHESIS

Introduction–Hypothesis-Null and Alternative Hypothesis-Type I and Type II Errors-Level of Significance-One tail and two-tail Tests-Tests concerning one mean and two means (Large and Small samples)-Tests on proportions.

Unit	Module	Micro content
IVa. Test of Hypothesis	Test significance of large samples	Test significance of single mean or proportions.
		Test significance of two means or proportions.
IVb. Test of	Test significance of	Test significance of single mean

Hypothesis	small samples	Test significance of two means
		Test significance of variances
		Test of goodness of fit
		Test for independence of attributes.

Unit-V: CURVE FITTING AND CORRELATION

Method of least Squares-Straight Line-Parabola-Exponential-Power Curves-Correlation-Correlation Coefficient-Rank Correlation-Regression coefficient and Properties-Regression lines.

Unit	**Module**	**Micro content**
Va. Curve Fitting	By least square approximation method fit the data in to given curve	Fit the data in to line equation.
		Fit the data into a second degree polynomial or parabola.
		Fit the data into power curve $y = a\ x^b$
		Fit the data into power curve $y = a\ b^x$
		Fit the data into power curve $y = a\ e^{bx}$
Va. Correlation and Regression	Correlation	Find correlation coefficient
		Find Karl Pearson's coefficient of correlation.
	Regression	Find regression coefficient and lines.

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		2										
CO2		2										
CO3	2	1										
CO4	1	1										
CO5	2	3										

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II Year – I SEMESTER

L	T	P	C
3	0	0	3

STRENGTH OF MATERIALS-I

Course Objectives:

1. To give preliminary concepts of strength of materials and principles of elasticity and plasticity, stress strain behaviour of materials and their governing laws. The moduli of elasticity and their relations.
2. To impart concepts of bending moment and shear force for beams with different boundary and loading conditions and to draw the diagrams which shows variation along the span
3. To give concepts of stresses developed in the cross section using bending and shear stress equations.
4. To give concepts of torsion and governing torque equation, the power transmitted by shafts and springs and designs the cross section when subjected to loading using different theories of failures.
5. To classify cylinders based on their thickness and to derive equations for measurement of stresses across the cross section when subjected to internal pressure.

Unit-I: SIMPLE STRESSES AND STRAINS

Elasticity and plasticity (Definitions) – Types of stresses and strains– Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety, Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section-simple problems – composite bars (Concept and problems) – Temperature stresses (Concept only-no problems).

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

Unit– II: SHEAR FORCE AND BENDING MOMENT

Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads (simple problems), uniformly distributed load, uniformly varying loads and combination of these loads– Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

Unit-III: FLEXURAL STRESSES 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 and angle sections.

Unit-IV: TORSION OF CIRCULAR SHAFTS AND SPRINGS

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: – Assumptions made in the theory of pure torsion – Torsion moment of resistance – Polar section modulus – Power transmitted by shafts (concept and problems) – Combined bending and torsion and end thrust (Concept only-no problems).

Springs: Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple –springs in series and parallel (concept only).

Unit-V: THIN CYLINDERS AND THICK CYLINDERS

Thin Cylinders: Thin seamless cylindrical shells –Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders.

Thick Cylinders: Introduction Lame's theory for thick cylinders –Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders.

TEXT BOOKS:

1. "Strength of materials", by R. K. Bansal, Volume 1 and 2.
2. "Strength of materials", by S.S. Bhavakati.

REFERENCE BOOKS:

1. Strength of Materials by S.S. Rattan, Tata McGraw Hill Education Pvt. Ltd.
2. Strength of materials by R.K. Rajput, S. Chand & Co, New Delhi.
3. Strength of Materials by S. Ramamrutham, Dhanpat Rai Publishing Co., (P) Ltd. New Delhi
4. Theory of Structures by S. P. Timoshenko& DH. Young.

Course Outcomes:

The students will be able to

CO1: ***Analyse*** the stresses and strains in a member subjected to different loadings and understand the strain energy under different load conditions. (Understanding, Analysing)

CO2: ***Apply*** different methods and analyse the various beams subjected to different loads using shear force and bending moment diagrams (Applying, Analysing)

CO3: ***Evaluate*** flexure and shear stresses for different beam sections. (Evaluating)

CO4: ***analyse*** the shafts and springs applying principle of torsion (Applying, Analysing)

CO5: Interpret the stresses in thick and thin cylindrical shells subjected to internal pressure (Understanding)

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Strength of Materials-I

Unit-I: SIMPLE STRESSES AND STRAINS

Elasticity and plasticity (Definitions) – Types of stresses and strains– Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety, Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section-simple problems – composite bars (Concept and problems) – Temperature stresses (Concept only-no problems).

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

Unit	Module	Micro content
Ia. Elasticity and plasticity	stress – strain diagram for mild steel	Elasticity and plasticity , Types of stresses and strains
		Hooke's law ,Working stress, factor of safety
	Elastic moduli	Young's modulus
		Shear modulus
		Bulk modulus

		Relation between them
	Stress- strain diagram for mild steel	stress – strain diagram for mild steel
	Bars of varying cross-section and composite bars	Concept and problems (simple)
	Temperature stresses	Concept only
Ib. Strain energy	Resilience, Gradual, sudden, impact and shock loadings – simple applications.	Definitions
		Derivation of gradual and sudden loading
		Problems

Unit– II: SHEAR FORCE AND BENDING MOMENT

Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads (simple problems), uniformly distributed load, uniformly varying loads and combination of these loads– Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

Unit	Module	Micro content
IIa/ IIb. Shear Force And Bending Moment	Introduction	Definition of beam, Types of beams
		Concept of shear force and bending moment
	Beams (simply supported , cantilever and overhanging)	Point loads
		Uniformly Distributed Load
		Uniformly Varying Load
		Simple problems
	Point of contra flexure and relation between load , SF and BM	Point of contra flexure and relation between load , SF and BM

Unit-III: FLEXURAL STRESSES 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 and angle sections.

Unit	Module	Micro content
IIIa. Flexural Stresses	Introduction	Theory of simple bending, assumptions Neutral axis
	Derivation of bending equation	M/I =f/y = E/R
		Determination of bending stresses
	Section modulus	Rectangular, circular sections (Solid and Hollow), I,T Angle and Channel sections
		Design of simple beams sections.
IIIb. Shear Stresses	Introduction	Derivation and assumptions
	Shear stresses distribution	Rectangular, circular, triangular, I, T and angle sections.

Unit-IV: TORSION OF CIRCULAR SHAFTS AND SPRINGS

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion equations: – Assumptions made in the theory of pure torsion – Torsion moment of resistance – Polar section modulus – Power transmitted by shafts (concept and problems) – Combined bending and torsion and end thrust (Concept only-no problems).

Springs: Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple –springs in series and parallel (concept only).

Unit	Module	Micro content
IVa. Torsion of Circular Shafts	Introduction	Theory of pure torsion, derivation and assumptions
		Polar moment of inertia and torsion moment of resistance
	Power transmitted by shafts	Power transmitted by shafts (concept and problems
		Combined bending and torsion and end thrust (Concept only).
IVb. Springs	Introduction	Types of springs
	Deflection	Close coiled helical spring under axial pull and axial couple
		Open coiled helical spring axial pull and axial couple
		springs in series and parallel (concept only)

Unit-V: THIN CYLINDERS AND THICK CYLINDERS

Thin Cylinders: Thin seamless cylindrical shells –Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders.

Thick Cylinders: Introduction Lame's theory for thick cylinders –Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders.

Unit	Module	Micro content
Va. Thin Cylinders	Introduction	Thin cylindrical shells
		Derivation of longitudinal and circumferential stresses
	Strains	Hoop strain
		Longitudinal strain
		Volumetric strain
		changes in diameter, and volume of thin cylinders.
Vb. Thick Cylinders	Introduction	Lame's theory for thick cylinders
	Derivation	Hoop stresses
		Radial stresses
		Thick cylinders (simple problems)
		Compound cylinders (simple problems)

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2									2	
CO2	3	2									2	
CO3	2	2									2	1
CO4	3	2			1						2	1
CO5	3	2			2						2	3

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II Year – I SEMESTER

L	T	P	C
3	0	0	3

SURVEYING

Course Objectives:

1. To understand the concept of chain surveying, instruments for chaining and the concept of linear measurements.
2. To Know about the compass, angles and bearings. To know the application of compass in the field work. To know the concept of traversing.
3. To find the elevation difference between various points. To know about various methods of levelling. To Know the uses of contour maps and locating the contours.
4. To know how to operate the theodolite. To find the horizontal & vertical angles. To understand the concept of tachometry.
5. To calculate the areas along irregular boundaries and volume of earthwork from various rules. To Know the elements of simple & compound curves. To understand the basic concepts behind the EDM, Total station, GIS & GPS.

Unit-I: FUNDAMENTAL CONCEPTS, LINEAR MEASUREMENTS & CHAIN SURVEYING

Introduction: Object, Primary divisions, Classification & Principles of Surveying. Scales- Plane & Diagonal. Error due to use of wrong scale, Shrunk scale.

Chain Surveying: Instruments for chaining, Ranging out survey lines, Error due to incorrect chain, Errors in chaining, Tape corrections. Chain triangulation, Survey stations, Survey lines, Field book, Obstacles in chaining, Cross staff survey**.**

Unit– II: COMPASS SURVEYING & TRAVERSING

Compass Surveying: Introduction, Definitions, Designation of bearings, Types of compass, temporary adjustments of compass, Included angles, Magnetic declination, Dip, Local attraction, Errors in compass survey.

Traversing: Introduction of traversing, Methods of traversing, Closing error, Balancing a traverse.

Unit-III: LEVELLING AND CONTOURING

Levelling: Definitions in levelling, Methods of levelling, levelling instruments, Temporary adjustments of a level, Principles of levelling, Bookings & Reducing levels, Curvature & Refraction, Errors in Levelling.

Contouring: Introduction of contouring, Definitions, Characteristics of contours, Methods of locating contours, Uses of contour maps.

Unit-IV: THEODOLITE & TACHEOMETRIC SURVEYING

Theodolite: Introduction of theodolite, Definitions, Temporary adjustments, Measurement of Horizontal angles & Vertical angles. Fundamental lines and desired relations.

Tachometric Surveying: Introduction of tachometry, Methods of tachometry- Fixed hair method, Movable hair method & Tangential method.

Unit-V: CALCULATION OF AREA & VOLUME, CURVES, EDM, TOTAL STATION, GIS & GPS

Calculation of Area & Volume: Computation of area from offsets area from coordinates. Volume- Measurements from cross sections, Prismoidal formula, Trapezoidal formula. Volume from spot levels & volume from contour plan.

Total Station: Introduction of curves & Classification. Elements of simple & compound curves. Introduction of EDM, Total station, Remote sensing, GIS (Geographic Information System) & GPS (Global Positioning System).

TEXT BOOKS:

1. Surveying, Vol. I & II by Dr. B. C. Punmia, Ashok K. Jain, ArunK.Jain, Laxmi Publications.
2. Surveying, Vol. I & II by S. K. Duggal, TataMc-Graw Hill.

REFERENCE BOOKS:

1. Surveying and Levelling by N. N. Basak, Tata McGraw Hill.
2. Surveying Vol. I & II by Dr. K. R. Arora, Standard Book House.
3. Surveying and Levelling by Subramanian, Oxford University Press.
4. Textbook of Surveying by C. Venkatramaiah , University Press.

Digital Materials:

https://nptel.ac.in/courses/105/107/105107122/

https://nptel.ac.in/courses/105/104/105104101/

Course Outcomes:

After completing this course, Students will be able to

CO1 Understand the concept of chain surveying, instruments for chaining and the overall concept of linear measurements. (Remembering, Understanding & Applying)

CO2 Know the uses of compass, calculate the angles from bearings. Understand the concept of declination & Local attraction. Application of compass in the field work. Know the Concept of traversing & its applications. (Remembering, Understanding & Applying)

CO3 Find the elevation difference between various points using a level. Understand the concept of various methods of levelling. Know the uses of contour maps in the field and locating the contours. (Remembering, Understanding & Applying)

CO4 Operate the theodolite & find the horizontal & vertical angles. Know the uses of tacheometry & find the distance & elevation of different points (Remembering, Understanding & Applying)

CO5 Calculate the areas along irregular boundaries & area from coordinates. Find the volume of earthwork from various rules. Know the elements of simple & compound curves. Understand the basic concepts behind the EDM, Total station, GIS & GPS. (Remembering, Understanding & Applying)

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Surveying

Unit-I: FUNDAMENTAL CONCEPTS, LINEAR MEASUREMENTS & CHAIN SURVEYING

Introduction: Object, Primary divisions, Classification & Principles of Surveying. Scales- Plane & Diagonal. Error due to use of wrong scale, Shrunk scale.

Chain Surveying: Instruments for chaining, Ranging out survey lines, Error due to incorrect chain, Errors in chaining, Tape corrections. Chain triangulation, Survey stations, Survey lines, Field book, Obstacles in chaining, Cross staff survey**.**

Unit	Module	Micro content
Ia/Ib. Fundamental Concepts, Linear	Object, Primary divisions, Classification & Principles of Surveying	Object of surveying, Divisions: Plane & Geodetic
		Classification of surveying

Measurements and Chain Surveying		Principles of surveying
	Scales- Plane & Diagonal. Error due to use of wrong scale, Shrunk scale	Scales- Plane scale & Diagonal scale
		Formula of error due to wrong scale- Short problems
		Formula of Shrunkscale- Short problems
	Instruments for chaining	Instruments for chaining
	Ranging out survey lines	Direct & Indirect ranging Ranging
	Error due to incorrect chain	Formula for error due to incorrect chain- Short problems
	Errors in chaining	Cumulative & Compensating errors
	Tape corrections	Absolute length, temperature, pull, sag, slope corrections- Short problems
	Chain triangulation, Survey stations, Survey lines, Field book	Chain triangulation, Terminology, Field book- Single line & Double line field book
	Obstacles in chaining	Obstacles to chaining, Obstacles to Ranging, Obstacles to both (Concept only, No problems)
	Cross staff survey	Concept & problems on Cross staff survey

Unit– II: COMPASS SURVEYING & TRAVERSING

Compass Surveying: Introduction, Definitions, Designation of bearings, Types of compass, temporary adjustments of compass, Included angles, Magnetic declination, Dip, Local attraction, Errors in compass survey.

Traversing: Introduction of traversing, Methods of traversing, Closing error, Balancing a traverse.

Unit	**Module**	**Micro content**
IIa/ IIb. Compass Surveying & Traversing	Introduction, Definitions, Designation of bearings	Introduction, Definitions
		Designation of bearings- Whole circle bearings & Quadrantal bearings, Conversions- Fore bearing & Back bearing, Conversions.
	Types of compass, temporary adjustments of compass	Prismatic compass & Surveyor's compass, Difference between Surveyor's & Prismatic compass
		Temporary adjustments of Prismatic compass
	Included angles, Magnetic declination, Dip, Local attraction, Errors in compass	Angles from bearings, Bearings from angles.

	survey	Magnetic declination, Variations in Declinations. Problems in Declination
		Local attraction, Elimination of local attraction, Problems on local attraction
		Errors in compass survey
	Introduction of traversing, Methods of traversing, Closing error, Balancing a traverse.	Introduction, Methods of traversing
		Closing error concept
		Balancing the traverse by Bowditch's method, Transit method & Axis method only.

Unit-III: LEVELLING AND CONTOURING

Levelling: Definitions in levelling, Methods of levelling, levelling instruments, Temporary adjustments of a level, Principles of levelling, Bookings & Reducing levels, Curvature & Refraction, Errors in Levelling.

Contouring: Introduction of contouring, Definitions, Characteristics of contours, Methods of locating contours, Uses of contour maps.

Unit	Module	Micro content
IIIa/IIIb. Levelling and Contouring	Definitions in levelling, Methods of levelling, Levelling instruments, Temporary adjustments of a level	Definitions in levelling
		Methods of levelling
		Levelling instruments- Level & Staff only
		Temporary adjustments of a level
	Principles of leveling, Bookings & Reducing levels, Curvature & Refraction, Errors in Levelling.	Steps in levelling, Differential levelling
		Bookings & Reducing levels- H.I Method & Rise and fall method. Problems on both methods
		Correction for Curvature & Refraction
		Errors in levelling
	Introduction of contouring, Definitions, Characteristics of contours, Methods of locating contours, Uses of contour maps.	Introduction of contouring
		Characteristics of contours
		Methods of locating contours
		Uses of contour maps.

Unit-IV: THEODOLITE AND TACHEOMETRIC SURVEYING

Theodolite: Introduction of theodolite, Definitions, Temporary adjustments, Measurement of Horizontal angles & Vertical angles. Fundamental lines and desired relations.

Tachometric Surveying: Introduction of tachometry, Methods of tachometry- Fixed hair method, Movable hair method & Tangential method.

Unit	Module	Micro content
Iva/ IVb. Theodolite And Tacheometric Surveying	Introduction of theodolite, Definitions, Temporary adjustments, Measurement of Horizontal angles & Vertical angles. Fundamental lines and desired relations.	Introduction of theodolite, Definitions
		Temporary adjustments,
		Measurement of Horizontal

		angles by Repitition method & Reiteration methods
		Vertical angle by general method
		Fundamental lines and desired relations, Errors in theodolite survey
	Introduction of tacheometry, Methods of tacheometry- Fixed hair method, Movable hair method & Tangential method.	Introduction of tacheometry
		Methods of tacheometry- Fixed hair method, Movable hair method & Tangential method
		Principle of stadia method, Distance & Elevation formulae for staff vertical condition. Problems
		Tangential method, Problems

Unit-V: CALCULATION OF AREA & VOLUME, CURVES, EDM, TOTAL STATION, GIS & GPS

Calculation of Area & Volume: Computation of area from offsets area from coordinates. Volume- Measurements from cross sections, Prismoidal formula, Trapezoidal formula. Volume from spot levels & volume from contour plan.

Total Station: Introduction of curves & Classification. Elements of simple & compound curves.

Introduction of EDM, Total station, Remote sensing, GIS (Geographic Information System) & GPS (Global Positioning System).

Unit	Module	Micro content
Va/ Vb. Calculation of Area & Volume, Curves, Edm, Total Station, GIS & GPS	Computation of area from offsets area from coordinates. Volume- Measurements from cross sections, Prismoidal formula, Trapezoidal formula. Volume from spot levels & volume from contour plan.	Computation of area from offsets- Mid ordinate, Average ordinate, Trapezoidal & Simpson's rule
		Area by co-ordinates
		Volume- Measurements from cross sections- Level section only
		Volume by Trapezoidal & Prismoidal rules only
		Volume from spot levels & volume from contour plan.
	Introduction of curves & Classification. Elements of simple & compound curves.	Introduction of curves & Classification
		Elements of simple curve
		Elements of compound curve
	Introduction of EDM, Total station, Remote sensing, GIS (Geographic Information System) & GPS (Global Positioning System).	Introduction of EDM, Total station
		Introduction of Remote sensing
		Introduction of GIS (Geographic Information System)
		Introduction of GPS (Global Positioning System)

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2									2	
CO2	3	2									2	
CO3	2	2									2	1
CO4	3	2			1						2	1
CO5	3	2			2						2	3

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II Year – I SEMESTER

L	T	P	C
3	0	0	3

FLUID MECHANICS

Course Objectives:

1. Understand the properties of fluid and their behaviour at various conditions.
2. Understand the various forces acting on hydraulic structures and flow properties.
3. Understand the concept of conservation of mass and its application.
4. Understand the concept of energy and momentum conservation and their applications.
5. Study behaviour of fluid at various fluid properties and characteristics
6. Study the energy losses in pipe flow and measurement of flow in pipes.

Unit-I: FLUID PROPERTIES

Physical properties of fluids – specific weight, specific gravity, viscosity, surface tension, vapor pressure and their influences on fluid motion, pressure at a point, classification of fluids, Pascal's law and its practical significance, Hydrostatic law of pressure distribution - atmospheric, absolute, gauge and vacuum pressures - measurement of pressure. Pressure gauges, Manometers – Piezometer, Differential U – tube Manometer and inverted U-tube manometer. Digital Manometers; Application of fluid properties in day to day life.

Unit– II: HYDRO STATICS AND FLUID KINEMATICS

Hydro Statics: Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Centre of pressure.

Fluid Kinematics: Description of fluid flow, Stream line, path line and streak line and stream tube. Classification of flows: Steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and ir-rotational flows – Equation of continuity for one, two, three dimensional flows – stream function and velocity potential function. Application of hydrostatic in regulation of flow in canals.

Unit-III: FLUID DYNAMICS

Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line from the fundamentals and from Euler's equation – its limitations and applications. Momentum equation and its application – hydraulic analysis of the pipe bend. Application of energy equations in the field.

Unit-IV: MEASUREMENT OF FLOW

Classification of orifices, small orifice and large orifice. Difference between mouthpiece and orifice. Pitot tube, Venturimeter and Orifice meter - flow over rectangular, triangular, trapezoidal and Stepped notches - –Broad crested weirs. Digital flow measuring devices**.**

Unit-V: LAMINAR FLOW AND TURBULENT FLOWS

Reynold's experiment – its practical significance. Characteristics of Laminar & Turbulent flows, Laws of Fluid friction, Hagen-Poiseulle Formula, Flow between parallel plates, Flow through long tubes, hydrodynamically smooth and rough flows. Darcy-Weisbach equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line, variation of friction factor with Reynold's number – Moody's Chart, Hazen-Williams formula. Conducting field survey for new advanced pipes and their losses (Case Base learning).

TEXT BOOKS:

1. Fluid Mechanics, P. N. Modi and S. M. Seth, Standard book house, New Delhi
2. A text of Fluid mechanics and hydraulic machines, R. K. Bansal – Laxmi Publications (P) ltd., New Delhi Digital Design by Mano, PHI

REFERENCE BOOKS:

1. Mechanics of Fluids, Merle C. Potter, David C. Wiggert and Bassem H. Ramadan, CENGAGE Learning
2. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Oxford Higher Education

Course Outcomes:

The students will be able to

CO1 Explain the influence of the fluid properties in static condition and motion. (Understand)

CO2 State and explain hydrostatic forces on submersible hydraulic structures. (Apply)

CO3 Estimate various properties and characteristics in a pipe flow using continuity, momentum and energy equations. (Apply)

CO4 Analyze the behavior of fluids using mathematical equations in Laminar and Turbulent conditions. (Analyze)

CO5 Apply various devices to measure the flow in pipes and tanks. (Apply)

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Fluid Mechanics

Unit-I: FLUID PROPERTIES

Physical properties of fluids – specific weight, specific gravity, viscosity, surface tension, vapor pressure and their influences on fluid motion, pressure at a point, classification of fluids, Pascal's law and its practical significance, Hydrostatic law of pressure distribution - atmospheric, absolute, gauge and vacuum pressures - measurement of pressure. Pressure gauges, Manometers – Piezometer, Differential U – tube Manometer and inverted U-tube manometer. Digital Manometers; Application of fluid properties in day to day life.

Unit	Module	Micro content
Ia/Ib. Fluid Properties	Physical properties	specific weight of fluids
		specific gravity of fluids
		viscosity of fluids
		surface tension of fluids
		vapour pressure of fluids
		simple problems on relationship among the properties of fluids
	Pascal's law	Pascal's law
		its practical significance
	Hydrostatic law of pressure distribution	Hydrostatic law of pressure distribution
		problems on Hydrostatic law of pressure distribution
	Measurement of pressure	Pressure gauges
		Manometers
		Piezometer
		Differential U – tube Manometer

		inverted U-tube manometer
		simple problems on U – tube differential manometer.

Unit– II: HYDRO STATICS AND FLUID KINEMATICS

Hydro Statics: Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Centre of pressure.

Fluid Kinematics: Description of fluid flow, Stream line, path line and streak line and stream tube. Classification of flows: Steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and ir-rotational flows – Equation of continuity for one, two, three dimensional flows – stream function and velocity potential function. Application of hydrostatic in regulation of flow in canals.

Unit	Module	Micro content
IIa/ IIb. Hydro Statics and Fluid Kinematics	Hydrostatic forces on submerged plane	Horizontal surfaces
		Vertical surfaces
		Inclined surfaces
		curved surfaces
	Center of pressure	problems on vertical place surfaces
		problems on inclined place surfaces
	Stream line	Definitions and properties
	path line	Definitions and properties
	stream tube	Definitions and properties
	Classification of flows	Classification of flows
		practical examples
	continuity equation for three dimensional flows	Derivation
		simple problems
	Stream function	Stream function
		properties
	Velocity potential function	Velocity potential function
		properties

Unit-III: FLUID DYNAMICS

Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line from the fundamentals and from Euler's equation – its limitations and applications. Momentum equation and its application – hydraulic analysis of the pipe bend. Application of energy equations in the field.

Unit	Module	Micro content
IIIa/IIIb. Fluid Dynamics	Euler's Equation Bernoulli's equation along a stream line	Derivation
		Derivation
		applications
		simple problems.
	Momentum equation	Momentum equation
		application

	Hydraulic analysis of pipe bend	simple problems on pipe bend
Unit-IV: MEASUREMENT OF FLOW Classification of orifices, small orifice and large orifice. Difference between mouthpiece and orifice. Pitot tube, Venturimeter and Orifice meter - flow over rectangular, triangular, trapezoidal and Stepped notches - –Broad crested weirs. Digital flow measuring devices**.**		
Unit	**Module**	**Micro content**
IVa/ IVb. Measurement of Flow	flow measurement	Derivation using the small orifice
		Derivation using the large orifice
		numerical problems.
	velocity of flow	Derivation using Pitot tube
		numerical problems
	flow measurement	Derivation using Venturi meter
		Derivation using Orifice meter
		Derivation using rectangular notches
		Derivation using broad crested weirs
		numerical problems
		error estimation in measured discharge
	discharge measurement	Derivation using triangular notches
		error estimation in measured discharge.
		Derivation using trapezoidal notches
		error estimation in measured discharge.
		Derivation using stepped notches
		error estimation in measured discharge.
Unit-V: LAMINAR FLOW AND TURBULENT FLOWS Reynold's experiment – its practical significance. Characteristics of Laminar & Turbulent flows, Laws of Fluid friction, Hagen-Poiseulle Formula, Flow between parallel plates, Flow through long tubes, hydro dynamically smooth and rough flows. Darcy-Weisbach equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line, variation of friction factor with Reynold's number – Moody's Chart, Hazen-Williams formula. Conducting field survey for new advanced pipes and their losses (Case Base learning).		
Unit	**Module**	**Micro content**
Va/Vb. Laminar Flow and Turbulent Flow	Reynold's experiment	Reynold's experiment
		practical significance
	laminar and turbulent flow	Difference between laminar and turbulent flow
	Hagen-Poiseulle Formula	Derivation
		simple numerical problems
	Flow between parallel plates	Flow between parallel plates
		simple numerical problems

	Darcy-Weisbach equation	Derivation
		Numerical problems
	minor losses	Various types of minor losses
	Pipes in series	Numerical Problems
	pipes in parallel	Numerical Problems
	energy line	Total energy line
	gradient line	hydraulic gradient line
	friction factor	variation of friction factor with Reynold's number
	Moody's Chart	Theory only
	Hazen-Williams formula	Theory only

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										
CO2		2		3								
CO3		2		3								
CO4	2			3								
CO5	3	1		2								

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II Year – I SEMESTER

L	T	P	C
2	0	0	2

BUILDING MATERIALS AND CONSTRUCTION

Course Objectives:

1. Identify various building materials and their structural requirements.
2. Review different types of masonry construction.
3. Explain the significance of cement and lime in construction.
4. Identify the suitable material for construction and various building components.
5. Discuss about various building services and finishing.

Unit-I: BUILDING MATERIALS-I

Stones: Properties of building stones – relation to their structural requirements, classification of stones – stone quarrying – precautions in blasting, dressing of stone

Aggregates: Classification of aggregate – Coarse and fine aggregates

Bricks: Composition of good brick earth, various methods of manufacturing of bricks.

Unit– II: BUILDING MATERIALS-II

Tiles: Characteristics of good tile - manufacturing methods, types of tiles.

Steel: General; Manufacture of steel; Uses of steel; Market forms of steel.

Glass: Manufacture of glass

Wood: Structure – Properties- Seasoning of timber- Classification of various types of woods used in buildings- Defects in timber.

Unit-III: BUILDING MATERIALS-III

Lime: Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime.

Cement: Portland cement- Chemical Composition – Hydration, setting and fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement. Various ingredients of cement concrete and their importance

Unit-IV: BUILDING COMPONENTS AND MASONRY

Building Components: Lintels, arches, stair cases – types. Different types of floors – Concrete, Mosaic, Terrazzo floors, Pitched, Types of roofs – King and Queen post Trusses. R.C.C Roofs, Pre-fabricated roofs.

Masonry: Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls.

Unit-V: BUILDING SERVICES AND FINISHES

Building Services: Plumbing services, water distribution, sanitary lines and fittings, ventilators, functional requirements.

Finishing: Damp Proofing and water proofing materials and uses – Plastering Pointing, white washing and distempering. Paints: Constituents of a paint – Types of paints – Painting of new/old wood- Varnish.

Formwork, Scaffolding

TEXT BOOKS:

1. Engineering Materials by S.C.Rangwala
2. Building Materials, B. C. Punmia, Laxmi Publications private ltd.
3. Building Construction, B.C. Punmia, Laxmi Publications (p) ltd.

REFERENCE BOOKS:

1. S.K. Duggal "Building Materials"- New age International Publisher,
2. R.K. Rajput "Engineering Materials (Including construction materials)"-, S.Chand Publications.
3. P.C Varghese "Building Construction" Prentice-Hall of India Private Ltd.

Course Outcomes:

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

CO1: Identify suitability of stones, bricks, tiles, glass and steel as building materials. {Understand level, KL2}

CO2: Make out the appropriate masonry to be used for building construction and importance of wood {Apply level, KL3}

CO3: Recognize the importance of lime and cement as building materials. {Understand level, KL2}

CO4: Pick up the appropriate building components for comfortable construction. {Apply level, KL3}

CO5: Identify the appropriate type of finishing techniques and building services which are generally used in buildings. {Understand level, KL2}

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Building Materials and Construction

Unit-I: BUILDING MATERIALS-I

Stones: Properties of building stones – relation to their structural requirements, classification of stones – stone quarrying – precautions in blasting, dressing of stone

Aggregates: Classification of aggregate – Coarse and fine aggregates

Bricks: Composition of good brick earth, various methods of manufacturing of bricks.

Unit	Module	Micro content
Ia/Ib. Building Materials-I	Stones	Properties of building stones
		Classification of Stone- Physical, Chemical and Geological
		Stone Quarrying
		Precaution in Blasting
		Dressing of Stone
	Aggregates	Aggregates definition
		Classifications of Aggregates based on size, Geological origin, Shape
	Bricks	Composition of Goof Brick Earth
		Harmful Ingredients in Brick Earth
		Comparison between brickwork and stonework
		Manufacturing of Bricks
		Tempering of Clay- Pug Mill

		Burning- Clamps
		Burning- Intermittent and Continuous Kilns
		Qualities of good Brick

Unit– II: BUILDING MATERIALS-II

Tiles: Characteristics of good tile - manufacturing methods, types of tiles.

Steel: General; Manufacture of steel; Uses of steel; Market forms of steel.

Glass: Manufacture of glass

Wood: Structure – Properties- Seasoning of timber- Classification of various types of woods used in buildings- Defects in timber.

Unit	**Module**	**Micro content**
IIa/ IIb. Building Materials-II	Tiles	Types of Tiles- Common Tiles, Encaustic tiles
		Manufacturing of Common and Encaustic Tiles
		Characteristic of Good Tile
		Types of Common Tiles- Drain Tiles, Roof Tiles, Floor or paving Tiles
	Steel	Steel- Introduction
		Manufacturing of Steel
		Bessemer's Process
		Cementation Process
		Crucible steel process
		Duplex Process
		Eletyric Process
		L.D. Process
		Open-Hearth process
		Uses of Steel
		Market forms of Steel
	Glass	Introduction to Glass
		Classification of Glass based on chemical composition
		Types of Glass properties and their uses
		Manufacturing of Glass
	Wood	Classification of Trees
		Structure of Tree- Macro and Micro Structure
		Processing of Timber
		Seasoning of Timber
		Different of methods of Seasoning
		Conversion of Timber
		Preservation of Timber
		Defects in Timber
		Industrial Timber- Vbeneers, Plywood, Fiberboard, Impreg timber, compreg Timber, Hard Board, GUlam, Chip Board, Block Board, Flush Door Shutters
		List of Indian Timber Trees used for Engineering purposes

Unit-III: BUILDING MATERIALS-III

Lime: Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime.

Cement: Portland cement- Chemical Composition – Hydration, setting and fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement. Various ingredients of cement concrete and their importance

Unit	Module	Micro content
IIIa/IIIb. Building Materials-III	Lime	Classification of Binding Materials
		Sources of Lime
		Constituent of Limestone
		Classification of Lime- Fat Lime, Hydraulic Lime, Poor Lime
		I.S Classification of Lime
		Comparison between fat lime and Hydraulic Lime
		Manufacturing of Fat Lime
		Manufacturing of Natural Hydraulic Lime
		Manufacturing of Artificial Hydraulic Lime
		Uses of Lime
		Precaution while handling Lime
	Cement	Characteristics of Cement
		Properties of Cement
		Composition of Ordinary Cement
		Function of Cement Ingredients
		Harmful Constituents of cement
		Setting action of Cement
		Field Test for cement
		Laboratory Test for Cement
		Uses of Cement
		Varieties of Cement

Unit-IV: BUILDING COMPONENTS AND MASONRY

Building Components: Lintels, arches, stair cases – types. Different types of floors – Concrete, Mosaic, Terrazzo floors, Pitched, Types of roofs – King and Queen post Trusses. R.C.C Roofs, Pre-fabricated roofs.

Masonry: Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls.

Unit	Module	Micro content
IVa/ IVb. Building Components and Masonry	Building Components	Lintels
		Definition
		Classification of Arches
		Classification of Arches
		Arches
		Definition
		Components of Arches
		Classification of Arches
		Stair Case
		Definition, terminology
		Classification of Stairs
		Floor

		Different Types of Floors
		Cement Concrete Flooring
		Mosaic Flooring
		Terrazzo Flooring
		Roof
		Types of Roofs
		King-Post Truss
		Queen Post Truss
		Madras- Terrace roofing
		Pre-fabricated roof
	Masonry	Advantage of Masonry
		Terminology
		Types of bonds
		Classification of Stone Masonry
		Rubble Masonry
		Ashlar Masonry
		Cavity Walls
		Partition Walls
		Types of Partition walls
Unit-V: LAMINAR FLOW AND TURBULENT FLOWS Reynold's experiment – its practical significance. Characteristics of Laminar & Turbulent flows, Laws of Fluid friction, Hagen-Poiseulle Formula, Flow between parallel plates, Flow through long tubes, hydro dynamically smooth and rough flows. Darcy-Weisbach equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line, variation of friction factor with Reynold's number – Moody's Chart, Hazen-Williams formula. Conducting field survey for new advanced pipes and their losses (Case Base learning).		
Unit	**Module**	**Micro content**
Va/Vb. Laminar Flow and Turbulent Flow	Building Services	Plumbing Services
		Water distribution
		Sanitary Line
		Sanitary Fittings
		Ventilator and its requirements
	Finishing	Damp Proofing
		Types of Damp proofing
		Materials used for Damp Proofing
		Water Proofing
		Types of Water proofing
		Materials used for Water Proofing
		Plastering
		Types of Plastering
		Pointing
		Paint
		Constituents of paint
		Types of paint
		Painting of various Surfaces
		Varnish
		Types of varnishes
		White washing and Colour Washing
	Scaffolding and formwork	Scaffolding
		Components

		Types of Scaffolding
		Form Work
		Classification of formwork

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1		2		1		2	1				
CO2	1		2			2	2					
CO3	1		2		3							
CO4	1				3							
CO5	1				3							

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II Year – I SEMESTER

L	T	P	C
3	0	0	3

SCIENTIFIC COMPUTING USING PYTHON

Pre-Requisites: Engineering Mathematics

Course objectives:

1. To understand basic operations in Python
2. To apply use if-else statements and switch-case statements to write programs in Python to tackle any decision-making scenario
3. To Perform, Store and retrieve information using Data structures
4. To Understand Use of python libraries for problem solving
5. To Create graphical form representation for computed data.

Unit-I: INTRODUCTION AND DATA TYPES

Introduction: History of Python, Need of Python Programming, Applications of python, Running Python Scripts, Variables, Assignment, Keywords and Identifiers, Input-Output, Indentation.

Data Types: Integers, Floats, Complex Numbers, Strings, Booleans; Type Conversion.

Unit– II: OPERATORS AND CONTROL FLOW

Operators: Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations

Control Flow: Boolean Expression, if, if-else, for, while, break, continue, pass.

Unit-III: DATA STRUCTURES AND FUNCTIONS

Data Structures: Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences and Comprehensions.

Functions: Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Recursive and Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

Unit-IV: MODULES, PYTHON PACKAGES, LIBRARIES

Modules: Creating modules, import statement, from.

Math Module: Constants, Power and logarithmic functions, Trigonometric functions, Angular conversion, Hyperbolic functions.

Python package: Introduction to PIP, Installing Packages via PIP, Using Python Packages.

Popular libraries: Introduction and applications of popular libraries: Scipy, Numpy, Sympy, Matplotlib, and Pandas

Numpy Library: Numpy import, Basic functions, Matrices Addition, Subtraction, Multiplication, Transpose, Inverse, Eigen values and Eigenvectors using Numpy.

Unit-V: DATA VISUALIZATION

Matplotlib: Loading the library and importing the data, How Mat plot lib works, different types of plots: line plots, Scatter plots, Bar plots, contour plot modifying the appearance of a plot, plotting multiple plots, Modifying the tick marks, axes labelling.

Scipy: Interpolation and Numerical Integrations Using Scipy

TEXT BOOKS:

1. Python for civil and structural engineers by Vittorio Lora.
2. Scientific Computing In Python By Abhijit Kar Gupta. TECHNO WORLD PUB

REFERENCE BOOKS:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Numerical Python: Scientific Computing and Data Science Applications by Robert Johansson.
3. Let Us Python by Yashavant Kanetka

Course Outcomes:

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

CO1: Understand basic operations in Python {Understand level, KL2}

CO2: Apply use if-else statements and switch-case statements to write programs in Python to tackle any decision-making scenario {Apply, KL3}

CO3: Perform, Store and retrieve information using Data structures {analyse, KL4}

CO4: Understand Use of python libraries for problem solving. {Understand level, KL2}

CO5: Create graphical form representation for computed data. {Create, KL6}

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Scientific Computing Using Python

Unit-I: INTRODUCTION AND DATA TYPES

Introduction: History of Python, Need of Python Programming, Applications of python, Running Python Scripts, Variables, Assignment, Keywords and Identifiers, Input-Output, Indentation.

Data Types: Integers, Floats, Complex Numbers, Strings, Booleans; Type Conversion.

Unit	Module	Micro content
Ia. Introduction to Python	Introduction	History of Python
		Need of Python Programming
		Applications of python
		Running Python Scripts using Jupyter Notebook and Spyder.
	Variables and literals	Variables
		Assignment, list of Keywords and Identifiers,
		Naming rules
		Input-Output (print, input),
		Indentation.
Ib. Data Types	python data types	Integers, Floats, Complex Numbers, Strings, Booleans
		Finding of variable type
		Type Conversion

Unit– II: OPERATORS AND CONTROL FLOW

Operators: Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations

Control Flow: Boolean Expression, if, if-else, for, while, break, continue, pass.

Unit	Module	Micro content

IIa. Operator	**Operators**	Arithmetic Operators
		Comparison (Relational) Operators
		Assignment Operators
		Logical Operators
		Membership Operators
		Identity Operators
		Expressions and order of evaluations.
IIb. Control Flow	**Control Flow**	if, if-elif-else, For, While, Break, Continue, Pass

Unit-III: DATA STRUCTURES AND FUNCTIONS

Data Structures: Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences and Comprehensions.

Functions: Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Recursive and Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

Unit	Module	Micro content
IIIa. Data Structures	Data Structures	Lists - Operations, Slicing,
		tuples
		sets
		Dictionaries
		Sequences and list comprehensions
IIIb. Functions	Functions	Defining Functions, Calling Functions, Passing Arguments
		Keyword Arguments, Default Arguments, arbitrary arguments
		Recursive and Anonymous Functions
		Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

Unit-IV: MODULES, PYTHON PACKAGES, LIBRARIES

Modules: Creating modules, import statement, from.

Math Module: Constants, Power and logarithmic functions, Trigonometric functions, Angular conversion, Hyperbolic functions.

Python package: Introduction to PIP, Installing Packages via PIP, Using Python Packages.

Popular libraries: Introduction and applications of popular libraries: Scipy, Numpy, Sympy, Matplotlib, and Pandas

Numpy Library: Numpy import, Basic functions, Matrices Addition, Subtraction, Multiplication, Transpose, Inverse, Eigen values and Eigenvectors using Numpy.

Unit	Module	Micro content
IVa/ IVb. Modulues, Python,	Modules	Creating modules, import statement, from
		Math Module: Constants, Power and logarithmic

Packages, Libraries		functions, Trigonometric functions, Angular conversion, Hyperbolic functions.
	Python package	Introduction to PIP, Installing Packages via PIP, Using Python Packages.
	Popular libraries	Introduction and applications of popular libraries: Scipy, Numpy, Sympy, Matplotlib, and Pandas
	Numpy Library	Numpy import, Basic functions,
		Matrices Addition, Subtraction, Multiplication, Transpose, Inverse
		, Eigen values and Eigenvectors using Numpy

Unit-V: DATA VISUALIZATION

Matplotlib: Loading the library and importing the data, How Mat plot lib works, different types of plots: line plots, Scatter plots, Bar plots, contour plot modifying the appearance of a plot, plotting multiple plots, Modifying the tick marks, axes labelling.

Scipy: Interpolation and Numerical Integrations Using Scipy

Unit	**Module**	**Micro content**
Va/Vb. Data Visualization	Matplotlib	Loading the library and importing the data, How Mat plot lib works
		different types of plots: line plots, Scatter plots, Bar plots, contour plot modifying the appearance of a plot, plotting multiple plots, Modifying the tick marks, axes labeling.
	Scipy	Interpolation and Numerical Integrations Using Scipy

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	1							1
CO2	3	3	3	3	1							
CO3	2	3	2									
CO4	2	3	1	1	3						1	2
CO5	3	3	2	1	2					2		1

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II Year – I SEMESTER

L	T	P	C
0	0	3	1.5

SURVEYING FIELD WORK

Course Objectives:

To know about various surveying instruments & their applications in the field.

Course Outcomes:

At the end of the course the students can able to

CO1: Do plane surveying with chain, compass & plane table.

CO2: Do levelling & contouring.

CO3: Operate the theodolite & tachometer in the field applications.

CO4: Setting out simple curve.

CO5: Operate the Total station in the field applications.

LIST OF EXPERIMENTS

1. Survey of an area by Chain surveying using chain & cross staff.
2. Chaining across obstacles.
3. Determination of distance between two inaccessible points using prismatic compass.
4. Radiation & intersection methods by Plane table.
5. Differential levelling using auto level.
6. Contouring by Indirect method
7. Measurement of horizontal & vertical angles using theodolite.
8. Trigonometric levelling: Base is accessible & inaccessible conditions.
9. Determination of Tachometric constants- Field procedure.
10. Determination of elevation & horizontal distance of a point using tachometer.
11. Setting out simple curve.
12. Temporary adjustments of Total station.
13. Measurement of horizontal, vertical angles & REM using Total station.
14. Area measurement using Total station
15. Stakeout using Total station.

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3						2		2			
CO2	3						2		2			
CO3	3						2		2			
CO4	3						2		2			
CO5	3						2		2			

	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2

*****

II Year – I SEMESTER

L	T	P	C
0	0	3	1.5

STRENGTH OF MATERIALS LABORATORY

Course Objectives:

The course aims for providing hands on practice on material behaviour subjected to tensile, compressive, torsion and shear loadings. The course also deals with material hardness and impact resistance.

Course Outcomes:

At the end of the course the students can able to

CO1: Perform necessary experiments to determine the mechanical properties of materials under different loading conditions

CO2: Analyze the experimental results for assessment of the strength of the given material

LIST OF EXPERIMENTS

1. Study of stress-strain characteristics of Mild steel/HYSD bars by UTM.
2. Determination of modulus of elasticity of the material of the beam by conducting bending test on simply supported beam.
3. Determination of modulus of elasticity of the material of the beam by conducting bending test on Cantilever beam.
4. Verification of Maxwell's Reciprocal theorem on beams.
5. Determination of modulus of elasticity of the material of the beam by conducting bending test on simply supported beam with one end overhang.
6. Determination of modulus of rigidity by conducting torsion test on solid circular shaft.
7. Determination of hardness of the given material by Brinnel's/Vicker's/ test
8. Determination of hardness of the given material by Rockwell hardness test.
9. Determination of impact strength of the given material by conducting Charpy/Izod test
10. Determination of ultimate shear strength of steel by conducting direct shear test.
11. Determination of modulus of rigidity of the material of closely coiled helical spring.
12. Determination of compressive strength of wood/ concrete cube/ brick/ with grain parallel / perpendicular to loading.

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			2								
CO2	3			2								

	PSO1	PSO2
CO1	1	2
CO2	1	2

*****

II Year – I SEMESTER

L	T	P	C
0	0	3	1.5

SCIENTIFIC COMPUTING PYTHON LAB

Course Objectives:

1. To understand basic operations in Python
2. To apply use if-else statements and switch-case statements to write programs in Python to tackle any decision-making scenario.

Course Outcomes:

At the end of the course the students can able to

CO1: Perform necessary experiments to det Understand basic oprations in Python.

CO2: **Apply** use if-else statements and switch-case statements to write programs in Python to tackle any decision-making scenario.

CO3: **Perform**, Store and retrieve information using Data structures.

CO4: **Understand** Use of python libraries for problem solving.

CO5: **Create** graphical form representation for computed data.

LIST OF EXPERIMENTS

Section 1

Exercise 1 – Input and Output

a) Write a Python program which accepts the user's first and last name and print them in reverse order with a space between them.

b) Write a Program which takes input for a variable and returns its type.

c) Write a Python program to get the Python version you are using.

Exercise 2 - Operations

a) Write a Python program that will accept the base and height of a triangle and compute the area.

b) Write a program to compute distance between two points coordinates taking (x1, y1) and (x2, y2) input from the user (Pythagorean Theorem)

c) Write a program to convert length in m to Ft-in

Section 2

Exercise - 3 Control Flow: If-Else

a) Write a Program for checking whether the given number is an Even or Odd.

b) Write a program to convert angles bearings) in Whole circle bearing (WCB) system to Reduced Bearing (RB) system.

c) Write a Python program to convert temperatures to and from Celsius, Fahrenheit. Or vice versa.

Exercise 4 - Control Flow – For, while

a) Python Program to Find the Sum of first N Natural Numbers

b) Python Program to Display the multiplication Table

c) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

Section 3

Exercise - 5 - DS

a) write a Program to Illustrate Different List Operations

b) Find mean and standard deviation for the given set of numbers in a list.

c) write a Program to Illustrate Different Tuples Operations

Exercise - 6 DS - Continued

a) Python Program to Illustrate Different Set Operations

b) Python Program to Illustrate Different Dictionaries Operations

Exercise - 7 Functions

a) Python Program to Make a Simple Calculator using functions

b) Write a function to compute and return area of triangle with user give three sides.

c) Write a program to find the sum of natural using recursive function

Section 4

Exercise - 8 - Modules

a) Define all functions used in Exercise 7 create as module and save it as "functions.py".

b) Execute all the operations performed in Exercise 7 by importing above module "functions.py" without defining any function.

c) Install any package using (pip) and list all the available functions using dir() function.

Exercise 9 - Math Module

a) write a Program to Illustrate Different Constants, Power and logarithmic, Angular conversion functions in math module

b) write a Program to Illustrate Different Trigonometric and Hyperbolic functions in math module

Exercise 10 - Numpy

a) Write a program that defines a matrix and prints using Numpy.

b) Write a program to perform Addition, Subtraction, Multiplication of two square matrices of same size using Numpy.

c) Write a program to perform Transpose, Inverse, Eigen values and Eigenvectors of a 5x5 matrix using Numpy.

Section 5

Exercise 11 – Matplotlib

a) Write a Program to Draw bending moment and shear force diagram of a cantilever with point load at end.

b) Write a Program to Draw bending moment and shear force diagram of a simply supported beam with UDL.

Exercise 12 - Scipy

a) Write a program to find numerical integration of a given equation and range [a,b] using Scipy.

b) Write a program to perform 1D linear interpolation between two numbers using Scipy.

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1							1
CO2	3	3	3	3	1							
CO3	2	3	2									
CO4	2	3	1	1	3						1	2
CO5	3	3	2	1	2					2		1

	PSO1	PSO2	PSO3
CO1	3	3	1
CO2	3	3	1
CO3	2	3	
CO4	2	3	
CO5	3	3	1

*****

II Year – I SEMESTER

L	T	P	C
2	0	0	0

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

OBJECTIVE:

To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.

1. The course aim of the importing basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledge system
2. To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act 2003.
3. The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge and protection.
4. To know the student traditional knowledge in different sector.

UNIT – I:

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

UNIT – II:

. Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

UNIT – III:

Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act); B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.

UNIT – IV:

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

UNIT – V:

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

TEXT BOOKS:

1. Traditional Knowledge System in India, by Amit Jha, 2009
2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.
3. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002
4. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino

e- Resources & other digital material:

1. https://www.youtube.com/watch?v=LZP1StpYEPM
2. http://nptel.ac.in/courses/121106003/

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

CO1: understand the concept of Traditional knowledge and its importance

CO2: Know the need and importance of protecting traditional knowledge.

CO3: Understand legal framework of TK, Contrast and compare the ST and other traditional forest dwellers

CO4: Know the various enactments related to the protection of traditional knowledge.

CO5: Understand the concepts of Intellectual property to protect the traditional knowledge

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II Year – II SEMESTER

L	T	P	C
3	0	0	3

STRENGTH OF MATERIALS-II

Course Objectives:

The student should be able to

1. To give preliminary concepts of Principal stresses and strains developed in cross section of the beams analytically as well as graphically due to stresses acting on the cross section and stresses on any inclined plane and to know different failure theories adopted in designing of structural members
2. The concepts above will be utilized in measuring deflections in beams under various loading and support conditions.
3. To classify columns and calculation of load carrying capacity using different empirical formulas and to assess stresses due to axial loads for different end conditions.
4. To calculate combined effect of direct and bending stresses with different engineering structures.
5. Impart the concept of unsymmetrical bending, location of neutral axis and shear centre.

Unit-I: PRINCIPAL STRESSES AND STRAINS

Stresses and strains: Introduction –Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses– Two perpendicular normal stresses accompanied by a state of simple shear — Principal stresses and strains, Mohr's circle of stresses -graphical solutions

Theories of failures: Introduction – Various Theories of failures like Maximum Principal Stress theory – Maximum Principal Strain theory – Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory- Simple applications.

Unit-II: DEFLECTION OF BEAMS

Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods. Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L. uniformly varying load- Mohr's theorems – Moment area method – application to simple cases including overhanging beams-deflections of propped cantilevers.

Unit-III: COLUMNS AND STRUTS

Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns- assumptions- derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula – Prof. Perry's formula.

Unit-IV: DIRECT AND BENDING STRESSES

Stresses under the combined action of direct loading and B.M., Core of a sections – determination of stresses in the case of chimneys, retaining walls and dams – conditions for stability – stresses due to direct loading and B.M. about both axes.

Unit-V: UNSYMMETRICAL BENDING

Introduction – Centroidal principal axes of section –Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending – Principal axes –

Resolution of bending moment into two rectangular axes through the centroid – Location of neutral axis.

Shear Centre: Introduction - Shear centre for symmetrical and unsymmetrical sections- Basic concepts.

TEXT BOOKS:

1. Mechanics of Materials- by R. C. Hibbler
2. Strength of materials by S. S. Bhavakatti
3. Strength of materials by R.K.Bansal vol. 1 & 2

REFERENCE BOOKS:

1. Fundamentals of Solid Mechanics M.L. Gambhir, PHI Learning Pvt. Ltd., New Delhi
2. Introduction to text book of strength of material by U.C. Jindal, Galgotia publications.
3. Strength of materials by R. Subramanian, Oxford university press, New Delhi
4. Strength of Materials by S. Ramamrutham Dhanpat Rai Publishing Co., (P) Ltd. New Delhi
5. Theory of structures by S.P. Timoshenko & DH. Young

Course Outcomes:

The students will be able to

CO1: Analyse principal stresses and strains and understands theories of failure and its application (**Understanding, Analysing level- KL2, KL4)**

CO2: Compute deflections in beams due to different loading conditions. **(Applying- KL3**)

CO3: Analyze and evaluate the stresses in columns by various theories. **(Analysing, Evaluating Level- KL4, KL5)**

CO4: Analyze strength and stability of structural members subjected to, direct and bending Stresses. (**Applying**, **Analysing level- KL3, KL4)**

CO5: Understand the concepts of unsymmetrical bending and shear center. **(Understanding level- KL2)**

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Strength of Materials-II

Unit-I: PRINCIPAL STRESSES AND STRAINS

Stresses and strains: Introduction –Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses– Two perpendicular normal stresses accompanied by a state of simple shear — Principal stresses and strains, Mohr's circle of stresses -graphical solutions

Theories of failures: Introduction – Various Theories of failures like Maximum Principal Stress theory – Maximum Principal Strain theory – Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory- Simple applications.

Unit	Module	Micro content
Ia. Principal Stresses and Strains	Introduction	Stresses on an inclined section of a bar under axial loading
	Compound stresses	Normal and tangential stresses on an inclined

		plane for biaxial stresses
		Two perpendicular normal stresses accompanied by a state of simple shear(Concept and problems)
		Principal stresses and strains (Concept and problems)
	Principal stresses and strains	Principal stresses and strains (Concept and problems)
	Mohr's circle of stresses- graphical solutions	Mohr's circle of stresses- graphical solutions (Concept only)
Ib. Theories of Failures	Theories of Failures	Maximum Principal Stress theory – Maximum Principal Strain theory
		Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory
		Simple applications

Unit-II: DEFLECTION OF BEAMS

Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods. Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L. uniformly varying load- Mohr's theorems – Moment area method – application to simple cases including overhanging beams-deflections of propped cantilevers.

Unit	**Module**	**Micro content**
IIa/IIb. Deflection of Beams	Bending into a circular arc	slope, deflection and radius of curvature (Concept only)
		Differential equation for the elastic line of a beam
	Double integration and Macaulay's methods.	slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L, uniformly varying load.
	Mohr's theorems – Moment area method	application to simple cases including overhanging beams-deflections of propped cantilevers for simple loading cases

Unit-III: COLUMNS AND STRUTS

Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns- assumptions- derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula – Prof. Perry's formula.

Unit	**Module**	**Micro content**
IIIa/IIIb. Columns and Struts	Introduction	Types of columns – Short, medium and long columns

		Axially loaded compression members – Crushing load
	Euler's theorem	For long columns- assumptions- derivation of Euler's critical load formulae for various end conditions
		Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory
	Rankin's formula	For long and short columns
	Long columns subjected to eccentric loading	Secant formula (concepts and problems)
	Empirical formulae	Straight line formula (concept only). – Prof. Perry's formula (concept only)

Unit-IV: DIRECT AND BENDING STRESSES

Stresses under the combined action of direct loading and B.M., Core of a sections – determination of stresses in the case of chimneys, retaining walls and dams – conditions for stability – stresses due to direct loading and B.M. about both axes.

Unit	**Module**	**Micro content**
IVa/IVb. Direct and Bending Stresses	Introduction	Direct and bending stresses
	Stresses under the combined action of direct loading and B.M.	Stresses under the combined action of direct loading and B.M.
		Core of a sections (concept and problems)
	Stresses in the case of chimneys, retaining walls and dams.	Stresses in the case of chimneys, retaining walls and dams (Concept and problems)
		Conditions for stability
	Stresses due to direct loading and B.M. about both axis	Stresses due to direct loading and B.M. about both axis.(Concept and problems)

Unit-V: UNSYMMETRICAL BENDING

Introduction – Centroidal principal axes of section –Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending – Principal axes – Resolution of bending moment into two rectangular axes through the centroid – Location of neutral axis.

Shear Centre: Introduction - Shear centre for symmetrical and unsymmetrical sections- Basic concepts.

Unit	**Module**	**Micro content**
Va/Vb. Unsymmtrical Bending	Introduction	Centroidal principal axes of section
		Moments of inertia referred to any set of rectangular axes
	Stresses in beams subjected to unsymmetrical bending	Principal axes – Resolution of bending moment into two rectangular axes through the centroid
		Location of neutral axis
	Shear Centre	Introduction - Shear centre for symmetrical and unsymmetrical sections-(Concepts only)

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		1						2		
CO2	3	2		2						2		
CO3	3	2		1						1		
CO4	3	2		1						2		
CO5	3	2		1						1		

	PSO1	PSO2	PSO3
CO1	2	2	1
CO2	2	2	1
CO3	2	2	1
CO4	2	2	1
CO5	1	1	1

*****

II Year – II SEMESTER

L	T	P	C
3	0	0	3

HYDRAULICS AND HYDRAULIC MACHINERY

Prerequisites: 1. Fluid Mechanics

Course Objectives:

The student should be able to

1. To understand the fundamental concepts of open channel uniform flow and Non-uniform flow conditions.
2. To study the concept of boundary layer control and its practical applications.
3. To understand the need of relationship between model and prototype and able to predict the prototype behavior based on the field conditions
4. To predict the influence of hydrodynamic forces acting on vanes at different conditions.
5. To understand the working mechanism and performance characteristics of a turbine.
6. To understand the working mechanism and performance characteristics of a pump.

Unit-I: FLOW IN OPEN CHANNELS

Uniform Flow in Open Channels: Types of channels –Types of flows – Velocity and pressure distribution – Chezy's, and Manning's formulae for uniform flow – Most Economical sections, Critical flow: Specific energy-critical depth – computation of critical depth.

Non-Uniform Flow in Open Channels: Steady Gradually Varied flow-Dynamic equation, Mild, Critical, Steep, horizontal and adverse slopes-surface profiles-direct step method- Rapidly varied flow, hydraulic jump, energy dissipation.

Unit-II: BOUNDARY LAYER THEORY

Boundary layer (BL) – concepts, Characteristics of boundary layer along a thin flat plate - laminar and turbulent Boundary layer, separation of BL, Control of BL, flow around submerged Objects-Drag and Lift- Magnus effect.

Unit-III: HYDRAULIC SIMILITUDE

Dimensional Analysis-Rayleigh's method and Buckingham's pi theorem-study of Hydraulic models – Geometric, kinematic and dynamic similarities-dimensionless numbers – model and prototype relations.

Unit-IV: HYDRAULIC TURBINES

Basics of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency - Angular momentum principle.

Hydraulic Turbines: Classification of turbines. Pelton wheel - Francis turbine – Kaplan turbine - working, velocity diagram, work done and efficiency, hydraulic design, draft tube – theory and efficiency. Unit and specific quantities, performance characteristics curves of the turbine.

Unit-V: PUMPS

Centrifugal Pumps: Classification, different heads and efficiencies, work done - Manometric head-minimum starting speed of the pump-specific speed, performance characteristics curves of pumps.

Reciprocating Pumps: Classification, working principle, work done, indicator diagram and slip. Shear Centre: Introduction - Shear centre for symmetrical and unsymmetrical sections- Basic concepts.

TEXT BOOKS:

1. Open Channel flow, K. Subramanya, Tata McGraw Hill Publishers

2. A text of Fluid mechanics and hydraulic machines, Rajput
3. Fluid Mechanics, P. N. Modi and S. M. Seth, Standard book house, New Delhi

REFERENCE BOOKS:

1. Fluid Flow in Pipes and Channels, G.L. Asawa, CBS
2. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Oxford Higher Education.
3. A text of Fluid mechanics and hydraulic machines, R. K. Bansal – Laxmi Publications (P) ltd., New Delhi Digital Design by Mano, PHI
4. Mechanics of Fluids, Merle C. Potter, David C. Wiggert and Bassem H. Ramadan, CENGAGE Learning.

Course Outcomes:

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

CO1: Able to Design of an economical open channel section and estimate the energy profile of the flow in the channel.

CO2: Able to apply concept of boundary layer in operation and design of moving vehicles

CO3: Able to establish relationship among the variables in any natural phenomena and predict design parameters of the prototype using similitude.

CO4: Able to predict the type of material, size and shape of vanes using the analysis of impact of jet.

CO5: Able to configure various components of turbines, pumps and their installation.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Hydraulics and Hydraulic Machinery

Unit-I: FLOW IN OPEN CHANNELS

Uniform Flow in Open Channels: Types of channels –Types of flows – Velocity and pressure distribution – Chezy's, and Manning's formulae for uniform flow – Most Economical sections, Critical flow: Specific energy-critical depth – computation of critical depth.

Non-Uniform Flow in Open Channels: Steady Gradually Varied flow-Dynamic equation, Mild, Critical, Steep, horizontal and adverse slopes-surface profiles-direct step method- Rapidly varied flow, hydraulic jump, energy dissipation.

Unit	Module	Micro content
Ia. Uniform Flow in Open Channels	Uniform Flow in Open Channels	Velocity and pressure distribution in various channels
		Most Economical channel sections – Rectangular Channel section, Circular Channel Section and Trapezoidal channel section
		Specific Energy Diagram – Critical depth, critical velocity & critical discharge – numerical problems on critical depth in rectangular channel.
Ib. Non-Uniform Flow in Open Channels	**Non-Uniform Flow in Open Channels**	Difference between Gradually varied flow and rapid varied flow
		Dynamic equation for gradually varied flow

		Various type of flow profiles
		Direct step method – rectangular channel
		Hydraulic Jump – Typical features
		The relationship between initial depth and final depth

Unit-II: BOUNDARY LAYER THEORY

Boundary layer (BL) – concepts, Characteristics of boundary layer along a thin flat plate - laminar and turbulent Boundary layer, separation of BL, Control of BL, flow around submerged Objects-Drag and Lift- Magnus effect.

Unit	Module	Micro content
IIa/IIb. Boundary Layer Theory	**Boundary Layer Theory**	Formation of Boundary layer
		Characteristics of Boundary along the thin flat plate
		Mechanism of Separation of Boundary layer
		Control measures for separation of boundary layer
		Drag - Lift – Types – Empirical formulae
		Flow around the cylindrical object
		Magnus effect

Unit-III: HYDRAULIC SIMILITUDE

Dimensional Analysis-Rayleigh's method and Buckingham's pi theorem-study of Hydraulic models – Geometric, kinematic and dynamic similarities-dimensionless numbers – model and prototype relations.

Unit	Module	Micro content
IIIa/IIIb. Hydraulic Similitude	Hydraulic Similitude	Dimensional analysis using Rayligh's and Buckingham method
		Different types of hydraulic models
		Dimensionless numbers
		Relationship between varies variables of model and prototypes

Unit-IV: HYDRAULIC TURBINES

Basics of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency - Angular momentum principle.

Hydraulic Turbines: Classification of turbines. Pelton wheel - Francis turbine – Kaplan turbine - working, velocity diagram, work done and efficiency, hydraulic design, draft tube – theory and efficiency. Unit and specific quantities, performance characteristics curves of the turbine.

Unit	Module	Micro content
IVa. Basics of Turbo Machinery	Basics of Turbo Machinery	Impact of jet on stationary, moving and inclined curved vanes – velocity triangles

		Angular momentum principle
IVa. Hydraulic Turbines	Hydraulic Turbines	Difference between Pelton and Francis Turbine
		Working principle, velocity triangle and work done
		Different types of efficiencies
		Draft tube – functional significance of draft tube
		Relationship between the unit variables
		Performance characteristics curves of the turbines
Unit-V: PUMPS **Centrifugal Pumps:** Classification, different heads and efficiencies, work done - Manometric head-minimum starting speed of the pump-specific speed, performance characteristics curves of pumps. **Reciprocating Pumps:** Classification, working principle, work done, indicator diagram and slip. Shear Centre: Introduction - Shear centre for symmetrical and unsymmetrical sections- Basic concepts.		
Unit	**Module**	**Micro content**
Va/Vb. Pumps	Pumps	Working principle and efficiencies of centrifugal pump
		Minimum starting speed of the pump
		Specific speed – empirical formula and its significance
		Performance characteristics curves of the pumps
		Difference between reciprocating pump and centrifugal pump
		Working principle and work done of reciprocating pump
		Slip and its practical significance

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	2	1			1	1		1
CO2	3	3	2	2	2	1			1	1		1
CO3	3	3	2	2	2	1			1	1		1
CO4	3	3	2	2	2	1			1	1		1
CO5	3	3	2	2	2	1			1	1		1

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II Year – II SEMESTER

L	T	P	C
3	1	0	4

STRUCTURAL ANALYSIS-I

Prerequisites:

1. Strength of Materials

Course Objectives:

The student should be able to

1) To give preliminary concepts of Indeterminacy and Structural Integrity of beams, plane trusses and plane frames
2) Assessment of bending moment and shear force in Propped cantilevers, Fixed beams and Continuous beams due to various loading conditions.
3) To analyze continuous beams with and without settlement of supports by applying Slope-Deflection method
4) Estimate the deflection of simple beams using Strain – Energy method (Castigliano's theorem)
5) Impart the concept of influence lines for assessment of maximum SF and BM at a given section of beams, Pratt and Warren trusses.

Unit-I: Determinacy and structural Integrity

Static Determinacy and Indeterminacy of Beams, Plane Trusses and Plane Frames, Internal and External Structural Integrity (Stability) of Beams, Plane Trusses and Plane Frames: Stable, Un-Stable and Over-Rigid, Statically Determinate Vs Indeterminate Structures.

Propped Cantilevers: Analysis of propped cantilever beams - shear force and Bending Moment Diagrams-Deflection of propped cantilevers.

Unit-II: FIXED BEAMS

Introduction to statically indeterminate beams with U. D. load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads - shear force and Bending Moment Diagrams-Deflection of fixed beams including effect of sinking of support, effect of rotation of a support.

Unit-III: CONTINUOUS BEAMS

Introduction-Clapeyron's theorem of three moments- Analysis of continuous beams with constant moment of inertia with one or both ends fixed- continuous beams with overhang, continuous beams with different moment of inertia for different Spans-Effects of sinking of supports-shear force and Bending moment diagrams

Unit-IV: SLOPE AND DEFLECTION METHOD

Introduction, Kinematic Indeterminacy / Degrees of Freedom, derivation of slope deflection equation, application to continuous beams with and without settlement of supports.

Energy Theorems: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castigliano's first theorem-Deflections of simple beams.

Unit-V: INFLUENCE LINES

Definition of influence line for SF, Influence line for BM- load position for maximum SF at a Section-Load position for maximum BM at a sections, single point load, U.D. load longer than

the span, U.D. load shorter than the span- Influence lines for forces in members of Pratt and Warren trusses**.**

TEXT BOOKS:

1. C. S. Reddy, Basic Structural Analysis, Tata Mc.Graw-Hill, NewDelhi.
2. R. C. Hibbeler, Structural Analysis, Pearson, New Delhi
3. T. S. Thandavamoorthy, Analysis of Structures , Oxford University Press, NewDelhi
4. V. N. Vazirani , M. M. Ratwani and S. K. Duggal, Analysis of Structures- Vol. I and II, Khanna Publishers, NewDelhi
5. S. S. Bhavikatti, Structural Analysis – Vol.I & II, Vikas Publications

REFERENCE BOOKS:

1. Devdas Menon, Structural Analysis, Narosa Publishers
2. A. Kassimali, Structural Analysis, Cengage Learning
3. R. Vaidyanathan and P. Perumal, Structural Analysis Vol I & II, Laxmi Publications
4. K. U. Muthu, H. Narendra, Maganti Janardhana and M. Vijayanand, Basic Structural Analysis, I k International
5. Theory of Structures, B. C Punmia, A. K Jain & Arun K. Jain, LakshmiPublications

Course Outcomes:

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

CO1 Distinguish between the determinate and indeterminate structures.

CO2 Estimate the bending moment and shear forces in fixed and propped cantilever beams

CO3 Analyze the continuous beams using various methods - three moment method and slope deflection method.

CO4 Apply Strain – Energy Method (Castigliano's theorem) to determine the deflection of simple beams

CO5 Draw the influence line diagrams for beams, Pratt and Warren trusses

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Structural Analysis

Unit-I: Determinacy and structural Integrity

Static Determinacy and Indeterminacy of Beams, Plane Trusses and Plane Frames, Internal and External Structural Integrity (Stability) of Beams, Plane Trusses and Plane Frames: Stable, Un-Stable and Over-Rigid, Statically Determinate Vs Indeterminate Structures.

Propped Cantilevers: Analysis of propped cantilever beams - shear force and Bending Moment Diagrams-Deflection of propped cantilevers.

Unit	Module	Micro content
Ia. Determinacy and Structural Integrity	Introduction	Static Determinate and indeterminate members
		Degree of Indeterminacy of Beams,
		D.I of Plane Trusses and Plane Frames,
		Structural Integrity (Stability) of Beams
		S.I of Plane Trusses and Plane Frames
		Stable, Un Stable and Over-Rigid structures

		Statically Determinate vs Indeterminate Structures.
Ib. Propped Cantilever	Analysis of propped cantilever beams and S.F and B.M diagrams	propped cantilever beams subjected to udl over full span
		subjected to concentrated load at different lengths
		subjected to different number of loads
		Effect of yield
	Deflection of propped cantilevers	propped cantilever beams subjected to udl over full span
		subjected to concentrated load at different lengths

Unit-II: FIXED BEAMS

Introduction to statically indeterminate beams with U. D. load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads - shear force and Bending Moment Diagrams-Deflection of fixed beams including effect of sinking of support, effect of rotation of a support.

Unit	**Module**	**Micro content**
IIa/IIb. Fixed Beams	Fixed end moments SFD and BMD	statically indeterminate beams with U. D. load
		central point load
		eccentric point load
		number of point loads and uniformly varying load
		couple and combination of loads
		Practice problems
	Deflection	Deflection of fixed beam with different loading
		Effect of sinking of support
		Effect of rotation of a support.

Unit-III: CONTINUOUS BEAMS

Introduction-Clapeyron's theorem of three moments- Analysis of continuous beams with constant moment of inertia with one or both ends fixed- continuous beams with overhang, continuous beams with different moment of inertia for different Spans-Effects of sinking of supports-shear force and Bending moment diagrams

Unit	**Module**	**Micro content**
IIIa/IIIb. Continuous Beams	Introduction	Introduction
		Clapeyron's theorem of three moment equation derivation
	Analysis of continuous beam with constant Moment of inertia	Analysis of C.B with one end fixed
		Analysis of C.B with both ends fixed
		Analysis of C.B with overhang
		Practice problems
	Analysis of continuous beam	Analysis of C.B with one end fixed
		Analysis of C.B with both ends fixed

	with different Moment of inertia	Analysis of C.B with overhang
		Practice problems
		Effect of sinking of supports
		Practice problems

Unit-IV: SLOPE AND DEFLECTION METHOD

Introduction, Kinematic Indeterminacy / Degrees of Freedom, derivation of slope deflection equation, application to continuous beams with and without settlement of supports.

Energy Theorems: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castigliano's first theorem-Deflections of simple beams.

Unit	Module	Micro content
IVa. Slope-Deflection Method	Introduction	Degrees of freedom
		Slope-deflection equation derivation
	Analysis of continuous beams with and without settlement of supports	Continuous beam with different loadings like concentrated load, udl and uvl
		Slope and deflection calculation for different combination of loadings in continuous beams
		Model problems
IVb. Energy Theorems	Strain Energy	Definition for Strain Energy
		Expression of Strain Energy due to Axial Load
		Expression of Strain Energy due to S.F
		Expression of Strain Energy due to B.M
		Castigliano's First Theorem
		Deflections of Simple Beams Using Energy Theorem
		Practice Problems

Unit-V: INFLUENCE LINES

Definition of influence line for SF, Influence line for BM- load position for maximum SF at a Section-Load position for maximum BM at a sections, single point load, U.D. load longer than the span, U.D. load shorter than the span- Influence lines for forces in members of Pratt and Warren trusses**.**

Unit	Module	Micro content
Va/Vb.Influence Lines	Influence Lines	Definition of influence line
		Definition of influence line for S.F & B.M
		load position for maximum SF at a section
		load position for maximum BM at a section
		ILD for single point load in beams
		U.D. load longer than the span
		U.D. load shorter than the span
		Influence lines for forces in members of Pratt trusses
		Influence lines for forces in members of Warren trusses
		Practice problems

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	1			1	1		1
CO2	3	3	2	2	2	1			1	1		1
CO3	3	3	2	2	2	1			1	1		1
CO4	3	3	2	2	2	1			1	1		1
CO5	3	3	2	2	2	1			1	1		1

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II Year – II SEMESTER

L	T	P	C
3	0	0	3

TRANSPORTAION ENGINEERING

Course objectives:

The student should be able to

1. To impart knowledge on history of road development in India, Highway alignment and design of road geometric elements
2. To acquire design principles of Highway Geometrics and Pavements
3. To learn various highway construction and maintenance procedures
4. To know various components and their functions in a railway track and to acquire design principles of geometrics in a railway track
5. To know various techniques for the effective movement of trains

Unit–1: 13 HOURS

Highway Development and Planning: Highway development in India, Highway planning, Different road development plans, Classification of roads, Road network patterns, Highway alignment – Factors affecting

Highway Geometric Design: Importance of geometric design, Highway cross sectional elements, Sight distance elements, Design of horizontal Alignment - Design of super elevation and extra widening; Design of transition curves, Design of vertical alignment, Gradients, Vertical curves.

Unit–2:14 HOURS

Traffic Engineering: Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC Method

Unit–3: 14 HOURS

Highway Materials: Subgrade soil: classification –Group Index – Subgrade soil strength – California Bearing Ratio – Modulus of Subgrade Reaction. Stone aggregates: Desirable properties – Tests for Road Aggregates – Bituminous Materials: Types – Desirable properties – Tests on Bitumen – Bituminous paving mixes: Requirements – Marshall Method of Mix Design.

Highway Construction And Maintenance: Types of Highway Construction – Earthwork; Construction of Earth Roads, Gravel Roads, Water Bound Macadam Roads, Bituminous Pavements and Construction of Cement Concrete Pavements. Pavement Failures, Maintenance of Highways, pavement evaluation

Unit–4: 12 HOURS

Pavement Design : Pavements – Types, Functions and components; Design factors, Flexible pavement design methods, Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses – Combination of stresses – Design of slabs – Design of Joints – IRC method

Unit–5:12 HOURS

Introduction To Railway Engineering: Permanent way – Components and their functions – Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints

Track Geometric Design – Alignment – Engineering Surveys - Gradients- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – safe speed on curves – Transition curve – Compound curves – Reverse curves – Extra clearance on curves – widening of gauge on curves – vertical curves

Course Outcomes: Upon successful completion of the course, the student will be able to

CO1	Plan highway network for a given area and design highway geometrics (**Understand & Apply)**
CO2	Design Intersections and prepare traffic management plans (**Understand, Apply & Create**)
CO3	Judge the suitability of pavement materials in road construction and able to construct and maintainhighways (**Understand & Evaluate**)
CO4	Design flexible and rigid pavements (**Create**)
CO5	Plan, design and maintain railway track and its elements **(Understand & Create)**

Text books:

1. Highway Engineering, Khanna S. K., Justo C. E. G and Veeraragavan A, Nem Chand Bros., Roorkee
2. Traffic Engineering and Transportation Planning, Kadiyali L. R, Khanna Publishers, New Delhi
3. Railway Engineering, Satish Chandra and Agarwal M. M., Oxford University Press, New Delhi

Reference books:

1. Principles of Highway Engineering, Kadiyali L. R, Khanna Publishers, New Delhi Railway Engineering, Saxena & Arora – Dhanpat Rai, New Delhi.
2. Highway, Railway, Airport and Harbor Engineering, Subramanian K. P, Scitech Publications (India) Pvt Limited, Chennai

Micro Syllabus of Transportation Engineering

Unit-1: Highway Development and Planning: Highway development in India, Highway planning, Different road development plans, Classification of roads, Road network patterns, Highway alignment – Factors affecting

Highway Geometric Design: Importance of geometric design, Highway cross sectional elements, Sight distance elements, Design of horizontal Alignment - Design of super elevation and extra widening; Design of transition curves, Design of vertical alignment, Gradients, Vertical curves.

Unit	Module	Micro content
1. Highway Development and Planning & Highway Geometric Design	Highway development in India, Highway planning, Different road development plans	Highway development in India
		Highway planning
		Different road development plans
	Classification of roads, Road network patterns, Highway alignment – Factors affecting	Classification of roads
		Road network patterns
		Factors affecting highway alignment
	Importance of geometric design, Highway cross sectional elements, Sight distance elements	Importance of geometric design
		Highway cross sectional elements
		Sight distance elements
	Design of horizontal Alignment - Design of	Design of horizontal Alignment
		Design of super elevation

	super elevation and extra widening; Design of transition curves	Design of extra widening
		Design of transition curves
	Design of vertical alignment, Gradients, Vertical curves	Design of vertical alignment
		Design of gradients
		Design of vertical curves

Unit-2: Traffic Engineering: Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC Method

Unit	**Module**	**Micro content**
2. Traffic Engineering	Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies	Basic Parameters of Traffic
		Volume, Speed and Density
		Traffic Volume Studies
	Speed studies –spot speed and speed & delay studies; Parking Studies	Speed studies
		Spot speed, speed & delay studies
		Parking Studies
	Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors	Road Accidents-Causes and Preventive measures
		Condition Diagram and Collision Diagrams
		PCU Factors
	Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings	Factors Affecting capacity of Highways
		LOS Concepts
		Road Traffic Signs
		Road markings
	Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections	Types of Intersections; At-Grade Intersections
		Design of Plain, Flared, Rotary and Channelized Intersections
	Design of Traffic Signals –Webster Method –IRC Method	Design of Traffic Signals
		Webster Method
		IRC Method

Unit-3: Highway Materials: Subgrade soil: classification –Group Index – Subgrade soil strength – California Bearing Ratio – Modulus of Subgrade Reaction. Stone aggregates: Desirable properties – Tests for Road Aggregates – Bituminous Materials: Types – Desirable properties – Tests on Bitumen – Bituminous paving mixes: Requirements – Marshall Method of Mix Design.
Highway Construction And Maintenance: Types of Highway Construction – Earthwork; Construction of Earth Roads, Gravel Roads, Water Bound Macadam Roads, Bituminous Pavements and Construction of Cement Concrete Pavements. Pavement Failures, Maintenance of Highways, pavement evaluation

Unit	**Module**	**Micro content**
3. Highway Materials	Subgrade soil: classification –Group	Subgrade soil: classification –Group Index

& Highway Construction And Maintenance	Index – Subgrade soil strength – California Bearing Ratio	Subgrade soil strength – California Bearing Ratio
	Modulus of Subgrade Reaction. Stone aggregates: Desirable properties – Tests for Road Aggregates	Modulus of Subgrade Reaction
		Stone aggregates: Desirable properties
		Tests for Road Aggregates
	Bituminous Materials: Types – Desirable properties – Tests on Bitumen – Bituminous paving mixes: Requirements – Marshall Method of Mix Design	Bituminous Materials: Types – Desirable properties
		Tests on Bitumen
		Bituminous paving mixes: Requirements
		Marshall Method of Mix Design
	Types of Highway Construction – Earthwork; Construction of Earth Roads, Gravel Roads, Water Bound Macadam Roads	Types of Highway Construction – Earthwork
		Construction of Earth Roads, Gravel Roads, Water Bound Macadam Roads
	Bituminous Pavements and Construction of Cement Concrete Pavements. Pavement Failures, Maintenance of Highways, pavement evaluation	Bituminous Pavements and Construction of Cement Concrete Pavements
		Pavement Failures
		Maintenance of Highways, pavement evaluation

Unit-4: Pavement Design : Pavements – Types, Functions and components; Design factors, Flexible pavement design methods, Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses – Combination of stresses – Design of slabs – Design of Joints – IRC method

Unit	**Module**	**Micro content**
4. Pavement Design	Pavements – Types, Functions and components; Design factors, Flexible pavement design methods	Pavements – Types, Functions and components
		Design factors
		Flexible pavement design methods
	Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses – Combination of stresses – Design of slabs – Design of Joints – IRC method	Rigid Pavements: Design Considerations
		Wheel load stresses –Temperature stresses – Frictional stresses
		Combination of stresses
		Design of slabs – Design of Joints
		IRC method

Unit-5:Introduction To Railway Engineering: Permanent way – Components and their functions – Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints **Track Geometric Design** – Alignment – Engineering Surveys - Gradients- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – safe speed on curves – Transition curve – Compound curves – Reverse curves – Extra clearance on curves – widening of gauge on curves – vertical curves		
Unit	**Module**	**Micro content**
5. Introduction To Railway Engineering & Track Geometric Design	Permanent way – Components and their functions – Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints	Permanent way – Components and their functions
		Rail Fastenings – Creep of Rails
		Theories related to creep – Adzing of Sleepers
		Sleeper density – Rail joints
	Alignment – Engineering Surveys - Gradients- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve	Alignment – Engineering Surveys - Gradients
		Cant and Negative Super elevation
		Cant Deficiency – Degree of Curve
	Safe speed on curves – Transition curve – Compound curves – Reverse curves	Safe speed on curves
		Transition curve – Compound curves – Reverse curves
	Extra clearance on curves – widening of gauge on curves – vertical curves	Extra clearance on curves
		Widening of gauge on curves
		Vertical curves

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2		2								
CO2	2		2		2							
CO3	2											
CO4	2	3										
CO5	2	2	2									

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II Year – II SEMESTER

L	T	P	C
3	0	0	3

CONCRETE TECHNOLOGY

Course Objectives:

The student should be able to

1. Identify the physical and chemical properties of concrete ingredients and able to conduct tests on cement and aggregates.
2. Comprehend the workability of concrete, manufacturing processes of concrete and the behavior of fresh, hardened concrete.
3. Gain the knowledge about NDT methods, quality control of concrete and how to conduct the tests on hardened concrete.
4. Identify the properties like elasticity, creep, shrinkage; special concretes and their applications in the diverse construction field.
5. Acquire the practical knowledge on mix design principles, concepts and methods.

Unit-I: CONCRETE INGREDIENTS & ITS PROPERTIES

Cements & Admixtures: Portland cement – Chemical composition – Hydration, setting of cement – Structure of hydrated cement – Tests on physical properties – Different grades of cement – Admixtures – Mineral and chemical admixtures.

Aggregates: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregate – Specific gravity, bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate – Maximum size of aggregate.

Unit-II: FRESH & HARDENED CONCRETE

Fresh Concrete: Production of concrete, mixing, compaction curing, Properties of fresh concrete. Workability – Factors affecting workability – Measurement of workability bydifferenttests–Settingtimesofconcrete–Effectoftimeandtemperatureonworkability– Segregation & bleeding.

Hardened Concrete: Water / Cement ratio – Abram's Law – Gel Space ratio – Nature of strength of concrete – Maturity concept – Strength in tension & compression – Factors affecting strength – Relation between compression & tensile strength -Curing.

Unit-III: TESTING AND QUALITY CONTROL OF CONCRETE

Testing of Hardened Concrete: Compression tests–Tension tests–Factors affecting strength – Flexure tests–Splitting tests–Non-destructive testing methods– codal provisions for NDT.

Quality control of Concrete: Behaviour of concrete in extreme environment; temperature problem in concreting, hot weather, cold weather and under water conditions, Resistance to freezing, sulphate and acid attack, efflorescence, fire resistance; Inspection and testing of Concrete-Concrete cracking, types of cracks, causes and remedies.

Unit-IV: PHYSICAL PROPERTIES OF CONCRETE AND SPECIAL CONCRETES

Elasticity, Creep & Shrinkage: Modulus of elasticity – Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage – Types of shrinkage.

Special concretes: Light weight aggregates – Lightweight aggregate concrete – Cellular concrete – No-fines concrete – High density concrete – Fibre reinforced concrete – Different types of fibres– Factors affecting properties & Applications of F.R.C – Polymer concrete –

Types of Polymer concrete – Properties of polymer concrete & Applications – High performance concrete – Self consolidating concrete – SIFCON.

Unit-V: MIX DESIGN

Factors in the choice of mix proportions – Durability of concrete– Statistical methods – Acceptance criteria – Proportioning of concrete mixes by various methods – BIS method of mix design.

TEXT BOOKS:

1. Concrete Technology by M. S. Shetty – S. Chand & Co. ;2004
2. Properties of Concrete by A. M. Neville – Low priced Edition – 4th edition
3. Concrete Technology by M.L. Gambhir – Tata Mc. Graw Hill Publishers, NewDelhi

REFERENCE BOOKS:

1. Concrete Technology by A.R. Santha Kumar, Oxford University Press, NewDelhi.
2. Concrete Technology by A.R. Santha Kumar, Edition-2013, Oxford University Press, New Delhi.
3. Design of Concrete Mixes by N.Krishnam Raju,2nd edition,CBS Publishers & Distributors
4. Concrete: Microstructure, Properties and materials by P Kumar Mehta, P J M Monteiro, MC Graw Hill Education Publisher, New Delhi.
5. Concrete Technology by R.S. Varshney, Oxford and IBH.

Code books:

1. IS10262: 2019 Guidelines for concrete mix design proportioning
2. IS 456: 2000 Plain and Reinforced Concrete - Code of Practice

Course Outcomes:

CO1 Illustrate the physical and chemical properties of concrete ingredients and able to conduct tests on cement and aggregates.

CO2 Clarify the physical properties of fresh and hardened concrete and also about the manufacturing of concrete.

CO3 Estimate the creep and shrinkage of concrete and how to conduct the different tests such as compression and tension on hardened concrete and also summarize the quality control of concrete under different conditions.

CO4 Distinguish the special concretes like Self compacting concrete, Fibre reinforced concrete, Polymer concrete and light weight concrete etc.

CO5 Design the mix proportions for the specific work for required strength and workability with available materials at workplace.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Concrete Technology

Unit-I: CONCRETE INGREDIENTS & ITS PROPERTIES

Cements & Admixtures: Portland cement – Chemical composition – Hydration, setting of cement – Structure of hydrated cement – Tests on physical properties – Different grades of cement – Admixtures – Mineral and chemical admixtures.

Aggregates: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregate – Specific gravity, bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate – Maximum size of aggregate.

Unit	Module	Micro content

Ia/Ib. Concrete Ingredients & its Properties	Cements & Admixtures	Portland cement: history ,manufacturing process
		Chemical composition of cement, bouge's compounds and their functions
		Cement hydration, hydration 5 stages, setting times
		Structure of hydrated cement
		Tests on physical properties: sp.gravity, fineness, compressive strength, normal consistency, initial and final setting time, soundness
		Admixtures: purpose and applications, types of admixtures
		Various Mineral and chemical admixtures and their applications.
		Various types of cement and their applications.
	Aggregates	Classification of aggregate
		Particle shape & texture
		mechanical properties of aggregate – Specific gravity, bulk density, porosity, adsorption & moisture content of aggregate
		Bulking of sand
		Alkali aggregate reaction - factors affecting-control measures
		Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate
		Maximum size of aggregate IS 456 recommendations.

Unit-II: FRESH & HARDENED CONCRETE

Fresh Concrete: Production of concrete, mixing, compaction curing, Properties of fresh concrete. Workability – Factors affecting workability – Measurement of workability bydifferenttests–Settingtimesofconcrete–Effectoftimeandtemperatureonworkability– Segregation & bleeding.

Hardened Concrete: Water / Cement ratio – Abram's Law – Gel Space ratio – Nature of strength of concrete – Maturity concept – Strength in tension & compression – Factors affecting strength – Relation between compression & tensile strength -Curing.

Unit	Module	Micro content
IIa/IIb. Fresh and Hardened Concrete	Fresh Concrete	Various stages Production of concrete: Batching, Mixing, Transporting, Placing, Compacting, Finishing, Curing
		Properties of fresh concrete. Workability – Factors affecting workability–Measurement of workability by different tests: slump,

		compaction factor, vee-bee tests
		Effect of time and temperature on workability
		Initial and final Setting times of concrete
		Segregation & bleeding, factors affecting and control measures
	Hardened Concrete	Water / Cement ratio, role of w/c ratio in strength contribution
		Abram's Law – Gel Space ratio – Maturity concept-plowman's maturity equation problems
		Factors affecting strength – Relation between compression & tensile strength

Unit-III: TESTING AND QUALITY CONTROL OF CONCRETE

Testing of Hardened Concrete: Compression tests–Tension tests–Factors affecting strength – Flexure tests–Splitting tests–Non-destructive testing methods– codal provisions for NDT.

Quality control of Concrete: Behavior of concrete in extreme environment; temperature problem in concreting, hot weather, cold weather and under water conditions, Resistance to freezing, sulphate and acid attack, efflorescence, fire resistance; Inspection and testing of concrete-Concrete cracking, types of cracks, causes and remedies.

Unit	Module	Micro content
IIIa/IIIb. Testing and Quality control of Concrete	Testing of Hardened Concrete	Compression tests: cubes and cylinders as per Indian standard
		Tension test: direct and split tensile strength
		Flexure tests Tension tests: 4 point bending test
		Various Non- destructive testing methods and their applications
		Rebound hammer and UPV test methodology.
	Quality control of Concrete	Behavior of concrete in extreme environment
		temperature problem in concreting, hot weather, cold weather and under water conditions: control techniques
		Resistance to freezing, sulphate and acid attack, efflorescence, fire resistance;
		Concrete cracking, types of cracks, causes and remedies

Unit-IV: PHYSICAL PROPERTIES OF CONCRETE AND SPECIAL CONCRETES

Elasticity, Creep & Shrinkage: Modulus of elasticity – Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage – Types of shrinkage.

Special concretes: Light weight aggregates – Lightweight aggregate concrete – Cellular concrete – No-fines concrete – High density concrete – Fibre reinforced concrete – Different types of fibres– Factors affecting properties & Applications of F.R.C – Polymer concrete – Types of Polymer concrete – Properties of polymer concrete & Applications – High performance concrete – Self consolidating concrete – SIFCON.

Unit	Module	Micro content
IVa/IVb. Physical	Elasticity, Creep &	Modulus of elasticity, measurement concrete

Properties of Concrete and Special Concretes	Shrinkage	elasticity, various types of modulus of elasticity: initial tangent, tangent, secant modulus, and chord modulus
		Relation between modulus of elasticity and compressive strength
		Creep, factors effecting creep, creep measurement
		Relation between creep & time – Nature of creep
		Shrinkage: types: plastic, dry, autogenous, carbonation shrinkage, factors affecting and control measures
	Special concretes	Introduction and applications
		Light weight aggregates, Lightweight aggregate concrete, Cellular concrete, No-fines concrete
		High density concrete
		Fibre reinforced concrete, Different types of fibres, Factors affecting properties & Applications of F.R.C
		Polymer concrete – Types of Polymer concrete – Properties of polymer concrete & Applications
		High performance concrete
		Self-consolidating concrete
		SIFCON
		Self-healing concrete

Unit-V: MIX DESIGN

Factors in the choice of mix proportions – Durability of concrete– Statistical methods – Acceptance criteria – Proportioning of concrete mixes by various methods – BIS method of mix design.

Unit	**Module**	**Micro content**
Va/Vb. Concrete Mix Design	Durability requirements and acceptance critreria	Durability of concrete : durability requirements as per IS456
		Factors in the choice of mix proportions
		Statistical methods – Acceptance criteria
		List of various methods of Proportioning of concrete mixes
	IS method of mix design	BIS method of mix design as per 10262:2019.
		Problems on Mix design as per IS10262

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3		2	2			2				2	1
CO2	3	2	2	2							1	2
CO3	2	2	1	2								
CO4	3		2				1				1	1
CO5	3	3	3				1				2	2

*****

II Year – II SEMESTER

L	T	P	C
0	0	3	1.5

BUILDING PLANNING & DRAWING LAB

Pre Requisites: AutoCAD Basics

Course objectives:

1. Initiating the student to different building bye-laws and regulations.
2. Imparting the planning aspects of residential buildings and public buildings.
3. Giving training exercises on various sign conventions and different building units.
4. Imparting the skills and methods of planning of various buildings.

Outcomes: At the end of the course the students can able to

CO1: Able to plan various buildings as per the building by-laws.

CO2: Able to distinguish the relation between the plan, elevation and cross section and identify the form and functions among the buildings.

CO3: Expected to learn the skills of drawing building elements and plan the buildings as per requirements.

LIST OF EXPERIMENTS

1. History of Indian Architecture
2. Overview of NBC- 2016 and Building Bye Laws
3. Principles of Planning of a Residential building, Orientation of building and Minimum standards for various parts of Residential Building with respect to AP GO No: 168
4. Principles of Planning of Commercial buildings and Minimum standards for various parts of Commercial Buildings with respect to AP GO No: 168
5. Prepare a line diagram of 2BHK for the given site according Go No: 168
6. Prepare a line diagram of 3BHK for the given site according Go No: 168
7. Overview of IS 962-1989 and Software's used for 2D and 3D drawings
8. Draw the Sign conventions of Building, Electrical and Plumbing
9. Draw any given Field Measurement book sketch
10. Draw the Plan, Section and Elevation of a two bed room house
11. Draw the Plan, section and Elevation of a MIG house
12. Draw the Plan, Section and Elevation of an Educational building
13. Plan, Section and Elevation of a Hotel/Motel building
14. Plan, Section and Elevation of a Hospitals/Dispensaries building
15. Draw the plan of a given Layout
16. Draw a detailing Diagram of RCC Beam & Column
17. Draw a detailing diagram of RCC Slab and Isolated foundation

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2		2			2		2		
CO2	2	2	1		1					3		
CO3	2	2	1		3		2	2		3		1

*****

II Year – II SEMESTER

L	T	P	C
0	0	3	1.5

ENGINEERING GEOLOGY LAB

Course objectives:

1. To identify the mega-scopic types of Ore minerals & Rock forming minerals.
2. To identify the mega-scopic types of Igneous, Sedimentary, Metamorphic rocks.
3. To identify the topography of the site & material selection

Outcomes:

At the end of the course the students can able to

CO1: Identify and classify the geological minerals

CO2: Measure the rock strengths of various rocks

CO3: Prepares, analyses and interpret the Engineering Geologic maps.

CO4: Test the geological material and ground to check the suitability of civil engineering project construction.

CO5: Investigate the project site for mega/mini civil engineering projects site selection for mega engineering projects like Dams, Tunnels, disposal sites etc

LIST OF EXPERIMENTS

1. Description of Physical properties of minerals. (Demonstration)
2. Identification of
   a. Rock forming minerals – Quartz group, Feldspar group, Garnet group, Mica group &Talc, Chlorite, Olivine, Kyanite, Asbestos, Tourmelene, Calcite, Gypsum, etc…
   b. Ore forming minerals – Magnetite, Hematite, Pyrite, Pyralusite, Graphite,Chromite, etc…
3. Description of Various Classification of Rocks and their properties. (Demonstration)
4. Identification of rocks.
   a) Igneous rocks – Types of Granite, Pegmatite, Gabbro, Dolerite, Syenite, GranitePoryphery, Basalt, etc…
   b) Sedimentary rocks – Sand stone, Ferrugineous sand stone, Lime stone, Shale, Laterite, Conglamorate, etc…
   c) Metamorphic rocks – Biotite – Granite Gneiss, Slate, Muscovite & Biotiteschist,Marble, Khondalite, etc…
5. Study of common Goelogical Structures and Importance in Civil Engineering. (Demo)
6. Interpretation and drawing of sections for geological maps showing tilted beds, faults,unconformities etc.
7. Simple Structural Geology problems.
8. Strength of the rock using laboratory tests.
9. Field work – To identify Minerals, Rocks, Geomorphology& Structural Geology.
10. A Report on importance of Study of Geology in Constrction & Selection of site for mega/mini civil engineering projects like Dams, Tunnels, disposal sites etc.

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1									
CO2	3	2	2									
CO3	3	2	1									
CO4	3	2	2									
CO5	2	2	1									

*****

II Year – II SEMESTER

L	T	P	C
0	0	3	1.5

FLUID MECHNAICS AND HYDRAULICS MACHINERY LAB

Course objectives:

1. To impart practical exposure to use various flow measuring devices for making engineering judgements.
2. To provide practice in estimating friction losses.
3. To impart training to use various hydraulic turbines and pumps.

Outcomes:

At the end of the course the students can able to

CO1: Calibrate flow measurement devices like venturimeter and orifice meter, etc...
CO2: Estimate the friction and measure the frictional losses in fluid flow.
CO3: Compute the performance of various hydraulic turbines and pumps

LIST OF EXPERIMENTS

1. Calibration of Venturimeter & Orifice meter
2. Determination of Coefficient of discharge for a small orifice by a Constant head method.
3. Calibration of Orifice meter
4. Calibration of contracted Rectangular Notch and /or Triangular Notch
5. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
6. Verification of Bernoulli's equation.
7. Impact of jet on vanes
8. Performance test on Pelton wheel turbine
9. Performance test on Francis turbine.
10. Efficiency test on centrifugal pump.
11. Efficiency test on reciprocating pump.

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										
CO2	3	3										
CO3	3	3	2	2								

*****

II Year – II SEMESTER

L	T	P	C
2	0	0	0

PROFESSIONAL ETHICS AND HUMAN VALUES

OBJECTIVE:

1. To give basic insights and inputs to the student to inculcate Human Values to grow as a responsible human being with proper personality.
2. Professional Ethics instils the students to maintain ethical conduct and discharge their professional duties.

UNIT – I: 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 – II: 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

UNIT – III: ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation - Engineering Projects VS. Standard Experiments - Engineers as responsible experimenters — Codes of ethics - Industrial Standards - A balanced outlook on law- The challenger case study.

UNIT – IV: SAFETY, RESPONSIBILITIES AND RIGHTS

Safety and risk- Assessment of safety and risk- Risk benefit analysis and reducing risk- Three Mile Island and Chernobyl case study - Collegiality and loyalty -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 Corporation's -Environmental ethics-computer ethics -weapons development Engineers as managers - consulting engineers-engineers as expert witnesses and advisors Moral leadership - sample code of Ethics (Specific to a particular Engineering Discipline).

TEXT BOOKS:

1. R.S.Nagarajan, a Textbook on "Professional Ethics and Human Values", New Age Publishers — 2006.
2. Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw Hill, New York 1996.

REFERENCES

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
2. Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall, New Jersey,2004 (Indian Reprint now available)
3. Charles E Harris, Michael S. Protchard and Michael I Rabins, "Engineering Ethics Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available).
4. John R Boatright, "Ethics and the conduct of business", Pearson Education, New Delhi,2003.
5. Edmund G Seebauer and Robert L Barry, "Fundamentals of ethics for scientists and engineers", Oxford University Press, Oxford, 2001.

Course Outcomes:

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

CO1 Able to U**nderstand** the basic perception of profession, professional ethics, various moral & social issues, concepts of the Ethics

CO2 Able to U**nderstand** Human Values and their importance

CO3 Able to **Understand** industrial standards, code of ethics and role of professional ethics in engineering field.

CO4 Able to be aware of professional rights and responsibilities of an engineer, responsibilities of an engineer for safety and risk benefit analysis

CO5 Able to acquire knowledge about various roles of engineers in variety of global issues and able to **appl**y ethical principles to resolve situations that arise in their professional lives

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1						3	1	3	3		3	
CO2						3		3	2		3	
CO3						3	2	3	2		3	
CO4						3	3	3	2		3	
CO5						3	3	3	3		3	

*****

II Year – II SEMESTER

L	T	P	C
0	0	2	1

SOCIAL RELEVANT PROJECT

Preamble:

There is lot of scientific and technological changes in the nation during last few decades in almost all the sectors. The state and central governments are introducing many schemes to all classes of people of the nation to increase the productivity in various sectors. India is a rural centric nation and the fruits of the scientific inventions and new technology shall be shared among all remote corners of the nation. With this aim, a socially relevant project is newly introduced in the curriculum with an objective of taking up the projects relevant to the societal needs.

Objectives:

(1) The students shall explore the technological needs of society
(2) The students shall understand the technological problems of society

General guidelines:

1. A socially relevant project shall be a community service based project and it shall be innovative.
2. A student has to pursue the socially relevant project to solve real life and pressing problems of society.
3. The pursued socially relevant projects shall contribute to national development goals and priorities.
4. Socially relevant project can be carried out by an individual student or by a team of maximum 5 of concerned department.
5. The student(s) shall visit the society (Villages/Hospitals/Social Service Organizations etc) to identify the problem and conduct literature survey and provide a feasible solution.
6. The socially relevant project selected shall be in the broad area of concerned discipline of course. Preference shall be given to rural societal problems.
7. Each team shall work under the supervision of a faculty member of the concerned department.
8. If the course is offered in II Year I Semester, the student or team of students shall complete this project during the vacation after I Year and so on.
9. The duration of the project is about 15 to 20 hrs in total and students may split total duration into 2 to 3 hrs per day based convenience. The attendance shall be maintained by the supervisor.

Outcomes

(1) The students are being able to provide a solution the technological problems of society
(1) The students are able suggest technological changes which suits current needs of society
(2) The students are able to explain new technologies available for problems of the society.

Reference:

(1) Web Link: http://iitk.ac.in/new/socially-relevant-research
(2) https://csie.iitm.ac.in/SocialProjectsIITM.html
(3) http://www.iitkgp.ac.in/files/csr/csr_education.pdf

III-Year-I Semester PC3101	STRUCTURAL ANALYSIS-II	L	T	P	C
		3	0	0	3

Prerequisites:

1. Structural Analysis-I

Course Objectives:

1. Familiarize student with force response of Arches and Cables
2. Equip student with quick and approximate analysis of building frames for gravity and lateral loads
3. Enable students to analyze beams and frames by Moment Distribution and Matrix methods
4. Impart knowledge on plastic analysis of beams and portal frames

UNIT I **14 HOURS**

Cables: Introduction, characteristics and general equation of cable, analysis of cables subjected to concentrated loads and uniformly distributed loads, temperature effects, analysis of anchor cables and pylons

Arches: Introduction to arches; Arch vs Beam**,** Importance of supports, Types of arches and indeterminacy, Theoretical Arch and Actual Arch, Elastic theory of arches – Eddy's theorem, Determination of internal forces, Analysis of three-hinged and two-hinged arches – rib shortening and temperature effects, tied-arch and fixed arch (no analytical question)

UNIT – II **14 HOURS**

Gravity Load Analysis Using Approximate Methods: Analysis of continuous beams and portal frames using Inflection Points, Analysis of building frames using Substitute Frame Method

Lateral Load Analysis Using Approximate Methods: Application to building frames. (i) Portal Method (ii) Cantilever Method.

UNIT – III **10 HOURS**

Moment Distribution Method: Degrees of freedom, Member flexural stiffness and carry over factors, Distribution factors, Analysis of continuous beams with and without sinking of supports, Portal frames without and with Sway

UNIT – IV **10 HOURS**

Plastic Analysis: Assumptions, Yielding and Plastic hinge concept - Yield Moment and Plastic Moment - Plastic Section Modulus - Shape factor - Collapse Load, Theorems and methods of plastic analysis, Analysis of statically indeterminate beams and portal frames.

UNIT – V **12 HOURS**

Introduction to Matrix Methods (System Approach):

Flexibility method: Introduction, application to continuous beams (maximum of two unknowns) including support settlements.

Stiffness method: Introduction, application to continuous beams (maximum of two unknowns) including support settlements.

TEXT BOOKS

1. C.S. Reddy, Basic Structural Analysis, Tata McGraw-Hill

2. T. S. Thandavamoorthy, Structural Analysis, Oxford University Press (India)

3. S. S. Bhavikatti, Structural Analysis – Vol I & II, Vikas Publications

4. K. U. Muthu et al., Structural Analysis – Vol I & II, IK International

5. V. K. M. Selvam, Fundamentals of Limit Analysis of Structures, Dhanpat Rai Publications

REFERENCES

1. Structural Analysis-II, IIT Kharagpur – NPTEL (web course)
https://nptel.ac.in/courses/105/105/105105109/#

2. Devdas Menon, Structural Analysis, Narosa Publishers

3. Comprehensive Structural Analysis-Vol. I & 2, R. Vaidyanathan & P. Perumal- Laxmi Publications Pvt. Ltd., New Delhi

4. Structural Analysis, R.C. Hibbeler, Pearson Education, India

5. G. S. Pandit and Gupta, Matrix Analysis of Structures, Tata McGraw-Hill

Course Outcomes:

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

CO1: Analyze cables and arches

CO2: Apply approximate methods and determine the structural response of building frames subjected to gravity loads and lateral loads respectively

CO3: Analyze continuous beams and portal frames using Moment Distribution and Matrix methods

CO4: Carry out plastic analysis of continuous beams and portal frames

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Structural Analysis

UNIT I Cables: Introduction, characteristics and general equation of cable, analysis of main cables subjected to concentrated loads and uniformly distributed loads, temperature effects, analysis of anchor cables and pylons

Arches: Introduction to arches; Arch vs Beam**,** Importance of supports and indeterminacy, Theoretical Arch and Actual Arch, Elastic theory of arches – Eddy's theorem, Determination of internal forces, Analysis of three-hinged and two-hinged arches – rib shortening and temperature

effects.

Unit	Module	Micro content
Ia. Cables	Analysis of cable	Cable subjected to concentrated loads
		Cable subjected to UDL
		Cables subjected to UDL with supports at different levels
		Effect of temperature on internal force of cable subjected to UDL with supports at same level
		Analysis of anchor cable and pylon with pulley and saddle on roller supports
Ib. Arches	Introduction	Arch vs Beam; Importance of supports
		Types of arches and indeterminacy
		Theoretical and actual arch
		Eddy's theorem
	Three-hinged arch	Analysis of symmetrical three-hinged parabolic arch subjected to UDL and / Concentrated loads
		Analysis of un-symmetrical three-hinged parabolic arch (supports at different levels) subjected to UDL and / Concentrated loads
		Analysis of three-hinged segmental (circular) arch –Supports at Same level only
	Two-hinged arch	Analysis of two hinged parabolic arch subjected to UDL (assuming secant variation of MOI)
		Determination of horizontal reaction 'H' of circular or semi-circular arch subjected to UDL
		Analysis of parabolic arch subjected to UDL with rib-shortening, yielding of supports and temperature effect (assuming secant variation of MOI)
	Tied-arch and fixed arch	Theory only

Unit-II: Gravity Load Analysis Using Approximate Methods: Analysis of continuous beams and portal frames using Inflection Points, Analysis of building frames using Substitute Frame Method

Lateral Load Analysis Using Approximate Methods: Application to building frames. (i) Portal Method (ii) Cantilever Method.

Unit	Module	Micro content
IIa. Gravity load analysis	Analysis by assumption of	Analysis of three-span continuous beam subjected to UDL and / point loads

	Inflection points	Analysis of single bay- two storey portal frame subjected to UDL on beams
	Substitute Frame Method	Analysis of two bay – two storey portal frame subjected to UDL on beams
IIb. Lateral load analysis	Portal method	Analysis of two bay – two storey portal frame
	Cantilever method	

UNIT – III Moment Distribution Method: Degrees of freedom, Member flexural stiffness and carry over factors, Distribution factors, Analysis of continuous beams with and without sinking of supports, Portal frames without and with Sway.

Unit	**Module**	**Micro content**
IIIa/b. Moment Distribution Method	Introduction	Degrees of freedom
		Member flexural stiffness and carry over factors
		Distribution factors
	Analysis of continuous beam	Analysis of continuous beams with various supports – spans subjected to UDL or concentrated load or triangular load –without and with sinking of supports
	Analysis of portal frames	Analysis of single bay-single storey portal frame without sway subjected to UDL and / point loads
		Analysis of single bay-single storey portal frame with sway subjected to UDL and / point loads

UNIT – IV Plastic Analysis: Assumptions, Yielding and Plastic hinge concept - Yield Moment and Plastic Moment - Plastic Section Modulus - Shape factor - Collapse Load, Theorems and methods of plastic analysis, Analysis of statically indeterminate beams and portal frames.

Unit	**Module**	**Micro content**
IVa/b. Plastic Analysis	Introduction	Assumptions of analysis, Yielding and plastic hinge concept, Yield moment and Plastic moment
		Plastic section modulus and shape factor, collapse load
		Theorems and methods of plastic analysis
	Analysis of S.I. beams (rigid supports)	Analysis of Fixed beam with UDL and constant EI
		Analysis of Fixed beam with UDL and varying EI (Stepped Fixed beam)
		Two span continuous beam subjected to UDL / point loads and different supports and EI
	Analysis of Portal Frames	Analysis of single bay-single storey portal frame subjected to UDL / point loads without sway

		Analysis of single bay-single storey portal frame subjected to UDL / point loads with sway
UNIT – V Introduction to Matrix Methods (System Approach): Flexibility method: Introduction, application to continuous beams (maximum of two unknowns) including support settlements. Stiffness method: Introduction, application to continuous beams (maximum of two unknowns) including support settlements.		
Unit	Module	Micro Content
Va. Flexibility Method	Introduction	Flexibility and stiffness definitions, relationship between flexibility and stiffness, flexibility and stiffness coefficients for bending members; Flexibility vs Stiffness Methods
	Analysis of Continuous beam	Analysis of continuous beam without and with sinking of supports
Vb. Stiffness Method	Analysis of Continuous beam	Analysis of continuous beam without and with sinking of supports

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3								1		
CO2	1	3								2		
CO3	2	3								2		
CO4	1	3								1		

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III-Year-I Semester	DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES	L	T	P	C
PC3102		3	0	0	3

Course Objectives:

1. To impart basic concepts of design of individual components of the reinforced concrete structures using limit state and working stress method.
2. To impart concepts of limit state design and serviceability checks for different components of RCC structures using the Indian standard codes with different loading conditions and to sketch the reinforcement details of designed structure.
3. To understand the principles of singly reinforced beams and doubly reinforced beams.
4. To enable the students to design of Important RCC structures like beams, slabs, and columns and footings.
5. For the given loads, impart the students to design according to IS codes.

Unit-I: INTRODUCTION TO DESIGN METHODS **10 HOURS**

Working stress method: Introduction- loading standards – Dead, live, wind and earthquake loads, Elastic theory: design constants, modular ratio, neutral axis depth and moment of resistance for balanced, under-reinforced and over-reinforced sections. – Design for bending – analysis and design of singly reinforced and doubly reinforced beams.

Limit state method: Concepts of limit state design – Characteristic loads –Characteristic strength – Partial load and safety factors – Assumptions in limit state design – stress - block parameters – limiting moment of Resistance.

Unit– II: DESIGN OF BEAMS **13 HOURS**

Beams: Design of singly and doubly reinforced beams-effective depth-Moment of Resistance-Minimum depth and minimum tension reinforcement- Design examples of simply supported and cantilever beams.

Flanged sections: Analysis of singly and doubly reinforced flanged sections – Design of flanged sections- effective width of flange- Minimum depth and minimum tension reinforcement.

Shear and Torsion: Limit state design of section for Shear and torsion – Concept of Anchorage and development length, Deflection- IS Code provisions.

Unit-III: DESIGN OF SLABS **13 HOURS**

Slabs: Introduction to types of slabs- One way slab- two-way slabs- Design examples for one way and two-way slabs – Continuous slab design – Reinforcement detailing.

Unit-IV: DESIGN OF COLUMNS **12 HOURS**

Columns: Different types of columns – Design of short and long columns – Columns subjected to axial load – Columns subjected to uni-axial and bi axial bending – IS code provisions– Reinforcement detailing.

Unit-V: DESIGN OF FOOTINGS **12 HOURS**

Footings: Different types of footings – Design of isolated footings – Square, rectangular shape footings – Design of footings subjected to axial load and uni axial moment – Reinforcement Detailing.

Note: All designs from Unit II should be in limit state design.

Following plates should be prepared by the students.

1. Reinforcement detailing of Rectangular beams, T-beams and L-beams.
2. Reinforcement detailing of columns and isolated footings.
3. Detailing of one-way and two-way slabs.
4. Reinforcement detailing of continuous slabs.

TEXT BOOKS:

3. Limit State Design, A. K. Jain.
4. Limit State Design of Reinforced concrete, B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, 2007, Laxmi Publications.

REFERENCE BOOKS:

1. Reinforced concrete design, S.Unnikrishna Pillai & Devdas Menon, 3rd edition,Tata Mc.Graw Hill, New Delhi.
2. N.C. Sinha and S.K Roy, *"Fundamentals of Reinforced Concrete"*, 4th Edition, S. Chand publishers, 2002
3. N. Krishna Raju and R.N. Pranesh, *"Reinforced Concrete Design"*, 8th Edition, New age International Publishers, New Delhi, 2004.
4. Fundamentals of Reinforced concrete design, M.L. Gambhir, 3rd edition, Printice Hall of India Private Ltd.
5. IS Codes: IS 456:2000, IS 875(Part I & II)

Course Outcomes:

The students will be able to

CO1: ***Understand*** the fundamental behaviour of RCC structures and code provisions of IS 456:2000 and IS 875.

CO2: ***Analyse*** the different types of beams subjected to different loading conditions and understand the variation of moment of resistance (Understanding, Analysing)

CO3: ***Apply*** the IS code provisions for design of sections and determining the reinforcement detailing satisfying the given loading conditions (Applying, Analysing)

CO4: ***Design*** of slabs, columns and footings for given loading conditions (Designing)

CO5: ***Drawing*** the reinforcement detailing of beams, columns and footings and slabs for obtained data in design. (Analysing, drawing)

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Designing, 6 - Drawing

Micro-Syllabus of Design and Drawing of reinforced Concrete Structures

Unit-I: INTRODUCTION TO DESIGN METHODS

Working stress method: Introduction- loading standards – Dead, live, wind and earthquake loads, Elastic theory: design constants, modular ratio, neutral axis depth and moment of resistance for balanced, under-reinforced and over-reinforced sections. – Design for bending – analysis and design of singly reinforced and doubly reinforced beams.

Limit state method: Concepts of limit state design – Characteristic loads –Characteristic strength – Partial load and safety factors – Assumptions in limit state design – stress - block parameters – limiting moment of Resistance.

Unit	Module	Micro content

Ia. Working stress Method	Introduction	Loading standards, dead load, live load, earthquake load and wind load
	Elastic theory	Design constant
		Modular ratio
		Depth of neutral axis
	Moment of Resistance	For balanced section
		For under reinforced section
		For over reinforced section
	Design	Singly reinforced section
		Doubly reinforced section
Ib. Limit state method	Basic concept of limit state design.	Partial load and safety factors
		Assumptions
		Stress block parameters
		Limiting moment of resistance

Unit– II: DESIGN OF BEAMS

Beams: Design of singly and doubly reinforced beams-effective depth-Moment of Resistance-Minimum depth and minimum tension reinforcement- Design examples in simply supported and cantilever beams

Flanged sections: Analysis of singly and doubly reinforced flanged sections – Design of flanged sections- effective width of flange- Minimum depth and minimum tension reinforcement

Shear and Torsion: Limit state design of section for Shear and torsion – Concept of Anchorage and development length, Deflection- IS Code provisions.

Unit	Module	Micro content
II. Design of Beams	Rectangular beams	Design of singly reinforcement and doubly reinforcement beams (limit state)
		Moment of resistance
		Minimum reinforcement
		Design examples of simply supported and cantilever beams
	Flanged beams	Analysis of singly and doubly reinforced flanged sections
		Effective width of flange
		Design of flanged sections
	Shear and Torsion	Limit state design of section for Shear and torsion
		Concept of Anchorage
		Development length
		Deflection
		IS code provisions

Unit-III: DESIGN OF SLABS

Slabs: Introduction to types of slabs- One way slab- two way slabs- Design examples for one way and two way slabs – Continuous slab design – Reinforcement detailing.

Unit	Module	Micro content
III. Design of slabs	Types of slabs	One way slabs
		Two way slabs
		Continuous slabs

		IS code provisions
	Design examples	One way slabs
		Two way slabs
		Continuous slabs
		Reinforcement Detailing

Unit-IV: DESIGN OF COLUMNS

Columns: Different types of columns – Design of short and long columns – Columns subjected to axial load – Columns subjected to uni-axial and bi axial bending – IS code provisions– Reinforcement detailing.

Unit	Module	Micro content
IV. Columns	Introduction	Different types of columns
	Design of columns	Short columns subjected to axial load
		Short columns subjected to uni-axial and bi-axial bending moments
		Design of long columns
		Reinforcement detailing

Unit-V: DESIGN OF FOOTINGS

Footings: Different types of footings – Design of isolated footings – Square, rectangular footings – Design of footings subjected to axial load and uni axial moment – Reinforcement Detailing.

Unit	Module	Micro content
V. Design of Footings	Introduction	Different types of footing
		Different loading conditions
	Design of isolated footings	Square and rectangular footings
		Footings subjected to axial load
		Footings subjected to uni axial moments
		Reinforcement detailing

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1								2	
CO2	2	3									3	
CO3	3	4									3	
CO4	2	4	5									5
CO5	6	1	3							6	3	

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III-Year-I Semester PC3103	SOIL MECHANICS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To enable the student to determine the index properties of the soil and classify it.
2. To impart the concept of seepage of water through soils and determine the discharge of water through soils.
3. To impart the principles of compaction and consolidation of soils and determine the magnitude and the rate of consolidation settlement.
4. To enable the student to understand the concept of shear strength of soils, determine the shear parameters of sands and clays and the areas of their application.

UNIT-I

INTRODUCTION AND INDEX PROPERTIES OF SOILS 10 HOURS

Soil formation– Soil structure and clay mineralogy, Adsorbed water, Mass- Volume relationships – Relative density. Grain size analysis– Sieve and Hydrometer methods – Consistency limits and indices– IS Classification of soils.

UNIT– II

PERMEABILITY & SEEPAGE THROUGH SOILS 12 HOURS

Soil water – Capillary rise – Flow of water through soils – Darcy's Law- Permeability – Factors affecting permeability, Capillary phenomenon in soils – Laboratory determination of coefficient of permeability – Permeability of layered systems. Total, neutral and effective stresses – Quick sand condition – Seepage through soils –Flow nets: Construction, Characteristics and Uses.

UNIT-III

STRESS DISTRIBUTION IN SOILS 12 HOURS

Boussinesq's and Westergaard's theories for point loads and areas of different shapes – Newmark's influence chart.

UNIT-IV

COMPACTION & CONSOLIDATION 13 HOURS

Mechanism of compaction – Factors affecting compaction– Effects of compaction on soil properties – Field compaction Equipment –compaction control. Stress history of clay; Compressibility of soils, Terzaghi's one dimensional consolidation theory, Consolidation test, pre-consolidation pressure, e - p and e-log p curves, total settlement.

UNIT-V

SHEAR STRENGTH OF SOILS 13 HOURS

Mohr – Coulomb failure theories – Types of laboratory strength tests– Strength tests based on drainage conditions – Shear strength of sands – Critical Void Ratio – Liquefaction- shear strength of clays, pore pressure coefficients.

TEXT BOOKS:

1. Arora. K.R., "Soil Mechanics and Foundation Engineering", 5th Edition, Standard

Publishers and Distributors, 2001.
2. Gopal Ranjan, Rao A.S.R., "Basic and Applied Soil Mechanics", 2nd Edition, New Age Intl. (P) Ltd., 2005.

REFERENCES:

1. Das. B.M., "Principles of Geotechnical Engineering", 7th Edition, Cengage Learning, 2010.
2. Murthy V. N. S., "Textbook of Soil Mechanics and Foundation Engineering", 1st Edition,
3. CBS Publishers, 2018.
4. Venkataramiah. C., "Geotechnical Engineering", 3rd Edition. New Age International Pvt. Ltd, 2008.
5.

Course Outcomes:

The students will be able to

CO1: ***Classify*** -soil and their engineering properties (Understanding)

CO2:***Explain***-the importance of permeability, seepage and its effects (Understanding, Applying)

CO3: ***Calculate*** -the stresses in soils under external loads (Analysing, Evaluating)

CO4: ***Analysis***- settlement behaviour of soils under compaction and consolidation (Analysing, Evaluating)

CO5: ***Explain***- the failure mechanism under the influence of different loading and drainage conditions (Understanding)

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro Syllabus-Soil Mechanics

UNIT-I: INTRODUCTION AND INDEX PROPERTIES OF SOILS

Soil formation– Soil structure and clay mineralogy, Adsorbed water, Mass- Volume relationships – Relative density. Grain size analysis– Sieve and Hydrometer methods – Consistency limits and indices– IS Classification of soils.

Unit	Module	Micro content
Ia. Introduction	Introduction	Soil formation– Soil structure-Adsorbed water
	Clay mineralogy	Structural units of clay minerals
		Important clay minerals
	Mass –volume relationships	Mass densities, weight densities, specific gravity, void ratio, porosity, degree of saturation, air content, percentage void ratio and their relations, relative density(concept and problems)
Ib. Index properties of soil	Grain size analysis, Atterberg's limits, I.S classification	Mechanical sieve analysis, hydrometer method(concept, no problems)
		Consistency limits-LL,PL and SL
		Indices
		I.S classification

Unit– II: PERMEABILITY & SEEPAGE THROUGH SOILS

Soil water – Capillary rise – Flow of water through soils – Darcy's Law- Permeability – Factors affecting permeability, Capillary phenomenon in soils – Laboratory determination of coefficient of permeability – Permeability of layered systems. Total, neutral and effective stresses – Quick sand condition – Seepage through soils –Flow nets: Construction, Characteristics and Uses.

Unit	Module	Micro content

II.a. Permeability	Introduction	Soil water – Capillary rise
	Flow of water through soils	Darcy's Law
		Permeability – Factors affecting permeability, Capillary phenomenon in soils
		Laboratory determination of coefficient of permeability (concept and problems)
		Permeability of layered systems (concept and problems)
II.b. Seepage through soils	Stresses in soil & Seepage through soils	Total, neutral and effective stresses
		problems
		Quick sand condition
		Flow nets, construction
		Flow net, Characteristics and uses

Unit-III: STRESS DISTRIBUTION IN SOILS

Boussinesq's and Westergaard's theories for point loads and areas of different shapes – Newmark's influence chart.

Unit	Module	Micro content
III. Stress distribution in soils	Introduction	Stress distribution of soils
	Boussinesq's theory	For point loads and different shapes(concept and problems)
	Westergaard's theory	For point loads and different shapes(concept and no problems)
	Newmark's influence chart	Construction procedure, Applications

Unit-IV: COMPACTION & CONSOLIDATION:

Mechanism of compaction – Factors affecting compaction– Effects of compaction on soil properties – Field compaction Equipment –compaction control. Stress history of clay; Compressibility of soils, Terzaghi's one dimensional consolidation theory, Consolidation test, pre-consolidation pressure, e - p and e-log p curves, total settlement.

Unit	Module	Micro content
IVa. Compaction	Introduction	Mechanism of compaction
	Compaction	Factors affecting compaction
		Effects of compaction on soil properties
		Field compaction Equipment
		Field compaction-Compaction control
IVb.Consolidation	Introduction	Difference between compaction and consolidation
	Consolidation	Stress history of clay
		Compressibility of soils
		Terzaghi's one dimensional consolidation theory, Assumptions
		Consolidation test
		pre-consolidation pressure, e - p and e-log p curves

		Types of settlements, total settlement, problems

Unit-V: SHEAR STRENGTH OF SOILS

Mohr – Coulomb failure theories – Types of laboratory strength tests– Strength tests based on drainage conditions – Shear strength of sands – Critical Void Ratio – Liquefaction- shear strength of clays, pore pressure coefficients.

Unit	**Module**	**Micro content**
V. Shear strength of soils	Introduction	Shear strength of soils
	Shear strength theories	Mohr – Coulomb failure theories
	Laboratory strength tests	Types of laboratory strength tests
		Strength tests based on drainage conditions
	Strength of soils	Shear strength of sands
		Critical Void Ratio
		Concept of liquefaction
		Shear strength of clays
		Pore pressure coefficients (concept only)

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3			2						1		
CO2	3			2						1		
CO3	3			2						1		
CO4	3			2						1		

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III-Year-I Semester PC3104	ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

1. Outline planning and the design of water supply systems for a community/ town/ city.
2. To impart the knowledge of selecting sources of water with reference to quality andquantity in a locality, for domestic usage.
3. Provide knowledge of characterization of water and wastewater.
4. To introduce various treatment options available and their design principles for water treatment and wastewater treatment at the household and municipal level.
5. To elucidate the various collection and disposal options available for water and wastewater, including the distribution networks, layout, construction and maintenance.

Unit-I: WATER DEMANDS- STANDARDS -SOURCES 10 HOURS

Aspects of Environmental Engineering – Protected water supply – Need – Water borne diseases –Water demands – Fluctuations – Design period-Population forecast – Water quality – Drinking water standards- Testing and significance – Quality and Quantity and other considerations of surface and sub- surface sources – Yield calculations – Intake works –Types of Intakes – Storage reservoir capacity – Systems of water supply – Requirements – Detection of leakages – Selection of pump – Economical diameter of pumping main.

Unit– II: TREATMENT OF WATER AND DISTRIBUTION 10 HOURS

Water treatment, conventional treatment flow diagram –Sedimentation types – Principles – Design factors – Coagulation –Design of Clariflocculator – Filtration – Slow, Rapid gravity filters and Pressure filters – Design principles-Disinfection – Theory of Chlorination– Distribution systems– Layouts – Design- and analysis, Hardy Cross method and Equivalent Pipe method. Valves – Other appurtenances.

Unit-III: WASTEWATER MANAGEMENT 12 HOURS

Introduction: Waste water treatment system – Definitions of terms – Collection and conveyance of sewage – Sewage flow rates – Storm water – Characteristics of sewage– Cycles of decay – BOD – COD – Ultimate disposal of sewage–self-purification of rivers– sewage farming.

Unit-IV: DESIGN OF SEWERS AND PRIMARY TREATMENT 14 HOURS

Layouts – Design of sewers – Sewers appurtenances – Sewage pumping -Conventional sewage treatment – Primary treatment: - Screens – Grit chamber – Sedimentation tanks – Design principles. Septic tanks and Imhoff tanks - rural latrines – House plumbing – Appurtenances.

Unit-V: SECONDARY BIOLOGICAL TREATMENT 14 HOURS

Secondary treatment – Biological treatment – Trickling filters – Activated Sludge Process – Low cost waste treatment methods – Design of Oxidation ponds – Aerobic and Anaerobic lagoons. Sludge Digestion– Disposal.

TEXT BOOKS:

1. B.C. Punmia B C, A.K. Jain and A.K. Jain, "Water Supply Engineering", LaxmiPublications.2nd Edition1995, Reprint 2005.
2. B.C. Punmia, A.K. Jain and A.K. Jain, "Wastewater Engineering", Laxmi Publications, 2nd Edition 1998, Reprint 2014.

REFERENCE BOOKS:

1. S.K. Garg, "Water Supply Engineering", Khanna Publishers, 26th revised Edition, New Delhi.2010.
2. S.K. Garg, "Sewage disposal and Air Pollution Enginering", Khanna Publishers New Delhi. 36thEdition, 2017.
3. H.S. Peavy, D. Rowe, and G. Tchobanoglous, "Environmental Engineering", McGraw HillPublishers, New Delhi. 1985.
4. G.S. Birdie and J.S. Birdie, "Water Supply and Sanitary Engineering" Dhanpat Rai PublishingCompany New Delhi, 6th Edition, 2002.
5. K.N. Duggal, "Elements of Environmental Engineering", S.Chand & Company Limited, NewDelhi, 2007.
6. P. N. Modi, "Sewage Treatment Disposal & Wastewater Engineering", Standard Book House,2016.
7. Manual on sewerage and sewage treatment, CPHEEO, Ministry of urban affairs andemployment, Govt. of India, New Delhi, 2001
8. Water and Wastewater Engineering, NPTEL video lectures and web notes

Course Outcomes:

The students will be able to

CO1: **Assess** the quality and quantity of water requirements for a city

CO2: **Design** of different treatment units and distribution systems for water supply

CO3: **Analyze** the characteristics, collection, conveyance and disposal of wastewater

CO4: **Design** of sewers and various units in a wastewater treatment plant

CO5: **Design** of secondary and biological treatment units

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Environmental Engineering

Unit-I: WATER DEMANDS- STANDARDS -SOURCES

Aspects of Environmental Engineering – Protected water supply – Need – Water borne diseases –Water demands – Fluctuations – Design period-Population forecast – Water quality – Drinking water standards- Testing and significance – Quality and Quantity and other considerations of surface and sub- surface sources – Yield calculations – Intake works — Storage reservoir capacity – Systems of water supply – Requirements – Detection of leakages – Selection of pump – Economical diameter of pumping main.

Unit	Module	Micro content
WATER	Water Demands	Per capita Demand and factors influencing it
		Types of water demands and its variations
		Factors affecting water demand
	Design period	Factors affecting the Design period
	Water borne diseases	Control of waterborne diseases

DEMANDS-STANDARDS - SOURCES	Aspects of Environmental Engineering	Role of Environmental Engineer
	Testing and significance	Characteristics & Analysis of water– Physical, Chemical and Biological
	Intake works	Types of Intakes
	Drinking water standards	IS 10500 2012 and WHO guidelines for drinking water
	Yield calculations	Wells

Unit– II: TREATMENT OF WATER AND DISTRIBUTION

Water treatment, conventional treatment flow diagram –Sedimentation types – Principles – Design factors – Coagulation –Design of Clariflocculator – Filtration – Slow, Rapid gravity filters and Pressure filters – Design principles-Disinfection – Theory of Chlorination– Distribution systems– Layouts – Design- and analysis, Hardy Cross method and Equivalent Pipe method. Valves – Other appurtenances.

Unit	Module	Micro content
TREATMENT OF WATER AND DISTRIBUTION	Disinfection	Other Disinfection methods
	Distribution systems	Requirements of Distribution systems
		Methods of Distribution system
	Valves	Sluice valves, air valves, scour valves and check valves
	Other appurtenances	Hydrants, and water meters

Unit-III: WASTEWATER MANAGEMENT

Introduction: Waste water treatment system – Definitions of terms – Collection and conveyance of sewage – Sewage flow rates – Storm water – Characteristics of sewage– Cycles of decay – BOD – COD – Ultimate disposal of sewage–self-purification of rivers– sewage farming.

Unit	Module	Micro content
WASTEWATER MANAGEMENT	Introduction	Systems of sanitation
	Waste water treatment system	Relative merits & demerits
	Characteristics of sewage	Physical, Chemical and Biological Examination
		Determination of bending stresses
	BOD – COD	BOD equations
		Problems
	Ultimate disposal of sewage	Methods of disposal Disposal into water bodies Oxygen Sag Curve Disposal into sea, disposal on land

Unit-IV: DESIGN OF SEWERS AND PRIMARY TREATMENT

Layouts – Design of sewers – Sewers appurtenances – Sewage pumping -Conventional sewage treatment – Primary treatment: - Screens – Grit chamber – Sedimentation tanks – Design principles. Septic tanks and Imhoff tanks - rural latrines – House plumbing – Appurtenances.

Unit	Module	Micro content
DESIGN OF SEWERS AND PRIMARY TREATMENT	Layouts	Types of sewers
	Design of sewers	Problems on design of sewers
	Sewers appurtenances	Cleaning and ventilation of sewers
	Sewage pumping	Pumping stations Location Components Types of pumps and their suitability with regard to wastewaters
	Septic tanks and Imhoff tanks - rural latrines	Working Principles and Design Reuse and disposal of septic tank effluent
	House plumbing	One pipe and two pipe systems
	Appurtenances	Sanitary fittings and other accessories

Unit-V: SECONDARY BIOLOGICAL TREATMENT

Secondary treatment – Biological treatment – Trickling filters – Activated Sludge Process – Low cost waste treatment methods – Design of Oxidation ponds – Aerobic and Anaerobic lagoons. Sludge Digestion – Disposal.

Unit	Module	Micro content
SECONDARY BIOLOGICAL TREATMENT	Biological treatment	Aerobic and anaerobic treatment process-comparison
	Trickling filters	Mechanism of impurities removal Classification Design, operation and maintenance problems
		Longitudinal strain
		Volumetric strain
		Changes in diameter, and volume of thin cylinders.
	Activated Sludge Process	Principles, designs, and operational problems modifications of Activated Sludge Processes
	Sludge Digestion	Characteristics SVI Handling and treatment of sludge Thickening Anaerobic digestion of sludge
		Radial stresses
		Thick cylinders (simple problems)
		Compound cylinders (simple problems)
	Disposal	Sludge Drying Beds. Centrifuge

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2									
CO2	3	2		2		1						
CO3	2	2										
CO4	2	2		2		2						
CO5	2	2		2		2						

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III-Year-I Semester	REPAIR AND REHABILITATION OF BUILDINGS	L	T	P	C
PE3101A		3	0	0	3

Course Objectives:

The objective of this course is

1. Familiarize Students with deterioration of concrete in structures
2. Equip student with concepts of NDT and evaluation
3. Understand failures and causes for failures in structures
4. Familiarize different materials for repairs and rehabilitation of structures.
5. Understand the different repair techniques.

Unit-I: **12 HOURS**

Deterioration of concrete in structures: Physical processes of deteriorationlike Freezing andThawing, Wetting and Drying, Abrasion, Erosion, Pitting,Chemical processes like Carbonation, Chloride ingress, Corrosion, Alkaliaggregate reaction, Sulphate attack Acid attack, temperature and their causes,Mechanism, Effect, preventive measures.

Cracks:Cracks in concrete, type,pattern, quantification, measurement & preventive measures,repair of cracks in concrete.

Unit– II: **11 HOURS**

Non-Destructive Testing- Non-destructive test methods for concreteincluding Rebound hammer, Ultrasonic pulse velocity, Rebar locator,Corrosion meter, Penetration resistance and Pull-out test, Core cutting-Corrosion: Methods for corrosion measurement and assessment includinghalf-cell potential and resistivity.

Unit-III: **13 HOURS**

Failure of buildings: Definition of building failure-types of failures- Causesof Failures- Faulty Design, Accidental over Loading, Poor quality of materialand Poor Construction practices- Fire damage - Methodology forinvestigation of failures-diagnostic testing methods and equipment.

Unit-IV: **12 HOURS**

Materials for repair and rehabilitation -Admixtures- types of admixturespurposesof using admixtures- chemical composition- Natural admixtures-Fibres- wraps- Glass and Carbon fibre wraps- Steel Plates-Concrete behaviourunder corrosion.

Unit-V: **12 HOURS**

Repair Techniques: Grouting, Jacketing, Shotcreting, externally bondedplates, Nailing, Underpinning and under water repair; Equipments,Precautions and Processes.

TEXT BOOKS:

1. 'Rehabilitation of Concrete Structures' by B. Vidivelli, Standard Publishers
2. 'Maintenance & Repair of Civil Structures' by B.L. Gupta & Amit Gupta.

REFERENCE BOOKS:

1. 'Concrete Structures- protection Repair and Rehabilitation' by R.Doodge Woodson, BH Publishers

Course Outcomes:

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

CO1: Explain deterioration of concrete in structures.
CO2: Carryout analysis using NDT and evaluate structures.
CO3: Assess failures and causes of failures in structures.
CO4: Carryout Physical investigation and asses the repair materials.
CO5: Asses the repair techniques.

IT-I

Deterioration of concrete in structures: Physical processes of deteriorationlike Freezing andThawing, Wetting and Drying, Abrasion, Erosion, Pitting,Chemical processes like Carbonation, Chloride ingress, Corrosion, Alkaliaggregate reaction, Sulphate attack Acid attack, temperature and their causes,Mechanism, Effect, preventive measures.

acks:Cracks in concrete, type,pattern, quantification, measurement & preventive measures,repair of cracks in concrete.

Unit	Module	Micro content
Ia.Deterioration of concrete in structures	Physical processes	Freezing andThawing
		Wetting and Drying
		Abrasion
		Erosion
		Pitting
	Chemical processes	Carbonation
		Chloride ingress
		Corrosion
		Alkaliaggregate reaction
		Sulphate attack Acid attack
	Temperature	Temperature
Ib. Cracks	Cracks	Types, pattern, quantification and preventive measures
	Repair of cracks	Types

Unit– II:

Non-Destructive Testing- Non-destructive test methods for concreteincluding Rebound hammer, Ultrasonic pulse velocity, Rebar locator,Corrosion meter, Penetration resistance and Pull-out test, Core cutting-Corrosion: Methods for corrosion measurement and assessment includinghalf-cell potential and resistivity.

Unit	Module	Micro content
II. Non-Destructive Testing	NDT Methods	Rebound hammer, Ultrasonic pulse velocity & rebar locator
		Corrosion meter, penetration resistance & Pull out test & core cutting
	Methods of corrosion measurement	Measurement and assessment using half cell potential

Unit-III:

Failure of buildings: Definition of building failure-types of failures- Causesof Failures- Faulty Design, Accidental over Loading, Poor quality of materialand Poor Construction practices- Fire damage - Methodology forinvestigation of failures-diagnostic testing methods and equipment.

Unit	Module	Micro content
III.Failure of buildings	Failures	Definition and types of failures
	Causes of failures	Faulty design
		Accidental over loading
		Poor quality of material
		Poor Construction practices
		Fire damage
	Methodology	Diagnostic testing methods and equipment

Unit-IV:

Materials for repair and rehabilitation -Admixtures- types of admixturespurposesof using admixtures- chemical composition- Natural admixtures-Fibres- wraps- Glass and Carbon fibre wraps- Steel Plates-Concrete behaviourunder corrosion.

Unit	Module	Micro content
IV.Materials for repair and rehabilitation	Admixtures	Introduction
		Types and chemical composition
	Fibres	Glass & carbon fibres
		Steel plates

Unit-V:

Repair Techniques: Grouting, Jacketing, Shotcreting, externally bondedplates, Nailing, Underpinning and under water repair; Equipments,Precautions and Processes.

Unit	Module	Micro content
V.Repair techniques	Repair techniques	Grouting
		Jacketing
		Shotcreting
		Nailing
		Externally bonded plates
		underpinning

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2				2		2					
CO2	2				2		2					
CO3	2				2		2					
CO4	2				2		2					
CO5	2				2		2					

	PSO1	PSO2	PSO3
CO1	1		1
CO2	1		1
CO3	1		1
CO4	1		1
CO5	1		1

III-Year-I Semester PE3101B	REINFORCED SOIL STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the history and mechanism of reinforced soil
2. To know the various types of geo-synthetics, their functions and applications.
3. To enable the design of reinforced soil retaining structures.

UNIT-I **10 HOURS**

PRINCIPLES, MECHANISMS AND MATERIALS:

Historical background, principles, concepts and mechanisms of reinforced earth. Materials used in reinforced soil structures, fill materials, reinforcing materials- metal strips, Geotextile, Geogrids, Geomembranes, Geocomposites and Geojute, Geofoam, Natural fibers, facing elements, properties and methods of Testing.

UNIT– II **10 HOURS**

DESIGN ASPECTS AND APPLICATION:

Design aspects of reinforced earth, Design and applications of reinforced earth of various structures, like retaining walls, foundations, pavements, embankments and slopes

UNIT-III **12 HOURS**

DURABILITY OF REINFORCEMENT MATERIALS:

Measurement of corrosion factors, resistivity, redox potential, water content, pH, electrochemical corrosion, bacterial corrosion – influence of environmental factors on the performance of Geosynthetic materials. Testing of geotextiles.

UNIT-IV **12 HOURS**

CASE HISTORIES AND APPLICATIONS:

Performance studies of reinforced dams, embankments, pavements, foundations and underground structure - case studies.

UNIT-V **12 HOURS**

SOIL NAILING:

Concept of soil nailing, methods of nailing, advantages of nailing, limitations of the system, comparison of soil nailing with reinforced soil, applications.

TEXT BOOKS:

1. Gray, D.H., and Sotir, R.B., Biotechnical and Soil Engineering Slope Stabilization: A Practical Guide for Erosion control, 3rd Edition, John Wiley & Sons, 1996.
2. Koerner, R. M., "Design with Geosynthetics", 3rd Edition Prentice Hall, 2002

3. RamanathaAyyar ,T.S., Ramachandran Nair, C.G. and Balakrishna Nair, N., Comprehensive reference book on Coir Geotextile, 1st Edition, Centre for Development for Coir Technology,2002.
4. SivakumarBabu, G.L., An Introduction to Soil Reinforcement and Geosynthetics, 1st Edition, University Press (India), Pvt. Ltd., 2006.
5. Swami Saran, Reinforced Soil and its Engineering Applications", 1st Edition, IK International Pvt. Ltd., 2006

REFERENCES:

1. Christopher, B. R., et al., Reinforced soil structures, Vol. 1: Design and Construction guidelines, Report FHWA-RD-89-043, Federal Highway Administration, USA, 1990.
2. Gerard P.T.M. Van Santvrot, Geo-textiles and Geomembranes in Civil Engineering, 1st Edition, A. A. Balkema,Oxford and IBH Publishing Company, 2006.
3. John, N.W.M., Geotextiles. 2nd Edition, Blackie, 2004.
4. Mandal, J. N., Reinforced Soil and Geo-textiles, Proc. of IGC-1988, Oxford and IBH Publishing Company PrivateLtd., 1988.
5. Mandal, J. N., Geosynthetics World, 1st Edition, Wiley Eastern Limited, 2002.
6. Muller, W.W., HDPE Geomembranes in Geotechnics, 3rd Edition, Springer, 2007.
7. Tarmat, R. J., Geosynthetics: Applications, Design and Construction, Proc. of 1st European Geosynthetics Conference, Netherlands, A. A. Balkema, 2004.

CODES:

1. Federal Highway Administration, Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, Vols. I & 2, Publication No. FHWA-NHI-10-024, 2009.
2. BS 8006-1:2010, Code of practice for strengthened/reinforced soils and other fills, 2010.
3. BS 8006-2:2011, Code of practice for strengthened/reinforced soils. Soil nail design, 2011.

Course Outcomes:

The students will be able to

CO1: **Explain** – the principles and mechanisms of reinforced soil (Understanding)

CO2: ***Evaluate*** the applications of reinforced soil (Understanding, Evaluating)

CO3: ***Explain*** the functions of geotextiles (Understanding)

CO4: ***Analyse*** the durability of reinforcing materials (Analysing)

CO5: ***Applying*** -Develop the applications of reinforced soil in civil engineering (Applying)

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro Syllabus **REINFORCED SOIL STRUCTURES**

UNIT-I: PRINCIPLES, MECHANISMS AND MATERIALS:

Historical background, principles, concepts and mechanisms of reinforced earth. Materials used in reinforced soil structures, fill materials, reinforcing materials- metal strips, Geotextile, Geogrids, Geomembranes, Geocomposites and Geojute, Geofoam, Natural fibers, facing elements, properties and methods of Testing.

Unit	Module	Micro content
I.Principles, Mechanisms and Materials	Introduction	Introduction to reinforced soil structures
		Mechanisms of reinforced earth
	Reinforced soil	Fill Materials, reinforcing materials- metal strips,

	structure	Geotextile, Geogrids, Geomembranes, Geocomposites and Geojute, Geofoam, Natural fibers
		Facing elements, properties and methods of testing.

UNIT– II: DESIGN ASPECTS AND APPLICATION:

Design aspects of reinforced earth, Design and applications of reinforced earth of various structures, like retaining walls, foundations, pavements, embankments and slopes

Unit	Module	Micro content
II. Designs aspects and applications	Introduction	Design aspects of reinforced earth
	Design and applications	Design and applications of reinforced earth
		Applications to retaining walls, foundations, pavements, embankments and slopes

UNIT-III: DURABILITY OF REINFORCEMENT MATERIALS:

Measurement of corrosion factors, resistivity, redox potential, water content, pH, electrochemical corrosion, bacterial corrosion – influence of environmental factors on the performance of Geosynthetic materials. Testing of geotextiles.

Unit	Module	Micro content
III. Durability of reinforcement materials	Introduction	Durability of reinforcing materials
	Measurement of corrosion factors	Resistivity, redox potential, water content, pH, electrochemical corrosion, bacterial corrosion
	Environmental factors	Environmental factors on the performance of Geosynthetic materials
	Testing of geotextiles	Various test methods of geotextiles

UNIT-IV: CASE HISTORIES AND APPLICATIONS:

Performance studies of reinforced dams, embankments, pavements, foundation and underground structure - case studies

Unit	Module	Micro content
IV. Case histories and applications	Introduction	Introduction to applications
	Performance studies	Reinforced dams, embankments, pavements, foundation and underground structure
		Case studies

UNIT-V: SOIL NAILING:

Concept of soil nailing, methods of nailing, advantages of nailing, limitations of the system, comparison of soil nailing with reinforced soil, applications.

Unit	Module	Micro content
V. Soil nailing	Introduction	Concept of soil nailing
	Soil nailing	Methods, advantages of nailing, limitations of the system, comparison of soil nailing with reinforced soil
		Applicatons

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			2						1		
CO2	3			2						1		
CO3	3			2						1		
CO4	3			2						1		

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III-Year-I Semester PE3101C	AIR POLLUTION & CONTROL	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The course will address the following:

- To know the sources of air pollutants
- To know the analysis of air pollutants
- To know the Threshold Limit Values (TLV) of various air pollutants
- To learn plume behaviour in different environmental conditions
- To acquire the design principles of particulate and gaseous control
- To learn plume behaviour in different environmental conditions

Unit –I Introduction **10 HOURS**

Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Environmental criteria for setting industries and green belts.

Unit –II Meteorology **10 HOURS**

Types of inversion, photochemical smog Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths.

Unit- III Ambient Air Quality Management **10 HOURS**

Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants (PM2.5, PM10, SOX, NOX, CO, NH3)

Development of air quality models-Gaussian dispersion model

Unit IV Control Techniques **10 HOURS**

Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP. **:**Control of NOx and SOx emissions – Environmental friendly fuels – In-plant Control Measures, process changes, methods of removal and recycling.

Unit V Air pollution due to automobiles **10 HOURS**

Air pollution due to automobiles, standards and control methods. Noise pollution causes, effects and control, noise standards.

Text Books:

1. Air Pollution and Control, K.V.S.G. Murali Krishna, Laxmi Publications, New Delhi, 2015

2. Air Pollution, M. N. Rao and H. V. N. Rao, Tata McGraw Hill Company

3. Air pollution" H. C. Perkins, Tata McGraw Hill Publication

4. Introduction t o Environmental Engineering" Mackenzie Davis and David Cornwell, "McGraw-Hill Co.

Course Outcomes:

Course Learning Outcomes: Upon successful completion of this course, the students will be able to:

CO1	Decide the ambient air quality based on the analysis of air pollutants
CO2	Ascertain and evaluate sampling techniques for atmospheric and stack monitoring
CO3	Judge the plume behaviour in a prevailing environmental conditions and estimation of plume rise
CO4	Choose and design control techniques for particulate and gaseous Emissions
CO5	Selection of appropriate control measures for Automobile pollution

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Air pollution and Control

Unit –I Introduction

Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Environmental criteria for setting industries and green belts.

Unit	**Module**	**Micro content**
I Introduction	Source of air pollution	Classification pollution based on source, nature, reaction with ambient air etc
	Characterization of air pollutants	Typical features of air pollutants, their sources
	Effects of air pollution	Impact of air pollutants on human health, animals, plants and materials
	Environmental criteria for industries	Various factors to be considered for a selection of site for Industries and gree belts

Unit –II Meteorology

Smog, environmental smog and photochemical smog Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths

Unit	**Module**	**Micro content**
Unit II Meterology	Smog	Types of smog-Environmental smog and photochemical smog

		Environmental impacts of smog
	Plume behaviour	Various types of plume based on climate conditions
		Typical features of different types of flumes
	Measurement of metrological l variables	Various metrological parameters measurement and their role in Air pollution control
	Plume Rise	Estimate of Plume rise and its significance in control of air pollution

Unit- III Ambient Air Quality Management

Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants (PM2.5, PM10, SOX, NOX, CO, NH3) Development of air quality models-Gaussian dispersion model

Unit	**Module**	**Micro content**
Unit III	Sampling	Various sampling techniques for particular matter, dust and gases pollutants
	Ambient air quality	Planning of Ambient air quality survey
		Preparation of report on air quality management
	Stack monitoring	Objectives of Stack monitoring and devices used in monitoring and their function
		Report on Stock monitoring results
	Air quality models	Objective of air quality models ,Gaussian dispersion model

Unit IV Control Techniques

Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP. **:**Control of NOx and SOx emissions – Environmental friendly fuels – In-plant Control Measures, process changes, methods of removal and recycling

Unit	**Module**	**Micro content**
Unit IV Control Techniques	Control of particulate matter	Various particulate matter control devices- working principle-construction-operation and maintenance
	Control of NOx and SOx emission	Various methods of control of NOx and SOx emissions from industrial air stream

Unit V Air pollution due to automobiles

Air pollution due to automobiles, standards and control methods. Noise pollution causes, effects and control, noise standards.

Unit	**Module**	**Micro content**
Unit V Air	Automobile	Causes and effects of Automobile

pollution due to automobiles	pollution	pollutants
		Various methods of Control of Automobile pollution
	Noise pollution	Cause, effects and control of Automobile pollution
		Causes, effects and control measures of Noise pollution

Mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**
CO 1	3	2										
CO 2	2	3			2							
CO 3	2	3										
CO 4	2	3										
CO 5	3	2			2							

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III-Year-I Semester
PE3101D

AIRPORT PLANNIG AND DESIGN

L	T	P	C
3	0	0	3

Course Objectives:

1. The module introduces the Airport planning issues along with the designing of Runway.

2. The visual aids required from Airport Traffic operating are dealt with the necessary inputs required for efficient drainage system has significance in maintenance the airport.

Course Outcomes:

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

1. Understand the regional planning concepts for an airport.

2. Design the runway length after considering the correction required for basic runway length.

3. Understand the Structural Design of Airport Pavements.

4. Understand the visual aids required for safe landing and takeoff operation of airport.

5. Analyze and design the Airport drainage.

UNIT - I **10 HOURS**

Airport Planning: General- Regional Planning- Development of New Airport- Data Required before Site Selection- Airport Site Selection- Surveys for Site Selection- Drawings to be prepared- Estimation of Future Air Traffic Needs.

UNIT - II **13 HOURS**

Runway Design: Runway Orientation- Basic Runway Length- Corrections for Elevation, Temperature and Gradient- Airport Classification- Runway Geometric Design- Airport Capacity- Runway Configurations- Runway Intersection Design.

UNIT - III **13 HOURS**

Structural Design Of Airport Pavements: Introduction- Various Design Factors- Design Methods for Flexible Pavement- Design Methods for Rigid Pavement- LCN System of Pavement Design- Joints in Cement Concrete Pavement- Airport Pavement Overlays- Design of an Overlay.

UNIT- IV **10 HOURS**

Visual Aids: General- Airport Marking- Airport Lighting.

UNIT - V **10 HOURS**

Airport Grading And Drainage: General- Computation of Earthwork- Airport Drainage- Special Characteristics and Requirements of Airport Drainage- Design Data- Surface Drainage Design Subsurface Drainage Design.

REFERENCE BOOKS:

1. Airport Planning And Designing by S.K. Khanna, M.G. Arora.

2. Highway Engineering including Expressways and Airport Engineering by Dr. L.R. Kadyali, Dr.N.B. Lal.

3. Highway Engineering including Airport Pavements by Dr. S.K. Sharma.

4. Transportation Engineering by S.P. Chandola.

III-Year-I Semester PE3101E	WATERSHED MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1. Introduce the concept of watershed management
2. Understand the watershed characteristics
3. Learn the principles of soil erosion and measures to control erosion
4. Appreciate various water harvesting techniques.
5. Learn land management practices for various land use/land cover.

Unit-I: **10 HOURS**

INTRODUCTION: Concept of watershed development, objectives of watershed development, need for watershed development, Integrated and multidisciplinary approach for watershed management.

Unit– II: **10 HOURS**

CHARACTERISTICS OF WATERSHEDS: Physiography - Size, shape, slope, drainage; climate, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.

Unit-III: **12 HOURS**

PRINCIPLES OF EROSION: Types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion- Universal soil loss equation.

MEASURES TO CONTROL EROSION: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams, rock-fill dams, brushwood dam, Gabion.

Unit-IV: **12 HOURS**

WATER HARVESTING: Techniques of rain water harvesting- rain water harvesting from roof top, surface flow harvesting, subsurface flow harvesting, stop dams, farm ponds and dugout ponds, percolation tanks.

Unit-V: **10 HOURS**

LAND MANAGEMENT: Land use and Land capability classification, management of forest, agricultural, grassland and wild land, land grading operation, Reclamation of saline and alkaline soils.

TEXT BOOKS:

1. 'Watershed Management' by Das MM and M.D Saikia, PHI Learning Pvt. Ltd, 2013.
2. 'Land and Water Management' by Murthy.VVN, Kalyani Publications, 2007.
3. 'Watershed Management' by Murthy J V S, New Age International Publishers, 2006.

REFERENCES:

1. 'Water Resource Engineering' by Wurbs R A and James R A, Prentice Hall Publishers, 2002.
2. 'Watershed Hydrology' by Black P E, Prentice Hall, 1996.

III-Year-I Semester	MANAGERIAL ECONOMICS AND	L	T	P	C
SH3101	FINANCIAL ANALYSIS	2	0	0	0

III-Year-I Semester	TRANSPORTATION ENGINEERING LABORATORY	L	T	P	C
PC3101L		0	0	3	1.5

Course Learning Objectives:

The objectives of this course are:

1. To test crushing value, impact resistance, specific gravity and water absorption, attrition value, abrasion value, flakiness index and elongation index for the given road aggregates.
2. To know penetration value, ductility value, softening point, flash and fire point, viscosity and stripping for the given bitumen grade.
3. To test the stability for the given bituminous mix
4. To carry out surveys for traffic volume, speed and parking.

Course outcomes:

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

a. Test aggregates and judge the suitability of materials for the road construction

b. Test the given bitumen samples and judge their suitability for the road construction

c. Obtain the optimum bitumen content for Bituminous Concrete

d. Determine the traffic volume, speed and parking characteristics.

e. Draw highway cross sections and intersections.

SYLLABUS

I. ROAD AGGREGATES:

1. Aggregate Crushing value Test
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption Test
4. Attrition Test
5. Abrasion Test.
6. Shape tests

II. BITUMINOUS MATERIALS:

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.
5. Stripping Test

6. Viscosity Test.

III. BITUMINOUS MIX:

1. Marshall Stability test.

IV. TRAFFIC SURVEYS:

1. Traffic volume study at mid blocks.
2. Traffic Volume Studies (Turning Movements) at intersection.
3. Spot speed studies.
4. Parking study.

LIST OF EQUIPMENT:

1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Pycnometers
4. Los angles Abrasion test machine
5. Deval's Attrition test machine
6. Elongation and thickness gauges
7. Bitumen penetration test setup.
8. Bitumen Ductility test setup.
9. Ring and ball apparatus
10. Viscometer.
11. Marshal Mix design apparatus.
12. Enoscope for spot speed measurement.
13. Stop Watches

TEXT BOOKS:

1. 'Highway Material Testing Manual' by S.K. Khanna, C.E.G Justo and A.Veeraraghavan, Neam Chan Brothers New Chand Publications, New Delhi.
2. Highway Material Testing & Quality Control by Rao Wiley India pvt. Ltd., Noida, New Delhi

REFERENCE BOOKS:

1. IRC Codes of Practice
2. Asphalt Institute of America Manuals
3. Code of Practice of B.I.S.

III-Year-I Semester	CONCRETE TECHNOLOGY LABORATORY	L	T	P	C
PC3102L		0	0	3	1.5

Course Learning Objectives:

The objectives of this course are:

- To test the basic properties ingredients of concrete, fresh and hardened concrete properties

Course outcomes:

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

CO1: Able to conduct experiment and determine the various Laboratory tests on cement

CO2: Able to conduct experiment and determine the properties of fine and course aggregate

CO3: Able to conduct experiment and determine the properties of fresh concrete

CO4: Able to conduct experiment and determine the properties of Hardened concrete

List of Experiments

At least 10 Experiments must be conducted

Tests on Cement

1. Determination of specific gravity of cement.
2. Determination of fineness of cement By dry sieving
3. Determination of normal Consistency of Cement
4. Determination of initial and final setting time of cement.
5. Determination of compressive strength of cement.
6. Determination of soundness of cement.
7. Determination of fineness of cement by air permeability method.

Tests on Aggregate

8. Determination of specific gravity of fine aggregate and coarse aggregate
9. Determination of grading and fineness modulus of fine aggregate and coarse aggregate by sieve analysis.
10. Determination of bulking of sand.

Tests on fresh Concrete

11. Determination of workability of concrete by slump test
12. Determination of workability of concrete by compaction factor method.
13. Determination of workability of concrete by Vee-bee consistency test.

Tests on hardened Concrete

14. Determination of compressive strength of concrete

15. Determination of split tensile strength of concrete.
16. Determination of young's modulus of concrete. (Demonstration)
17. Non-Destructive testing on concrete using rebound hammer

III-Year-II Semester	DESIGN AND DRAWING OF STEEL STRUCTURES	L	T	P	C
PC3201		3	0	0	3

Prerequisites:

1. Structural Analysis

Course Objectives:

The objective of this course is to:

- Familiarize Students with different types of Connections and relevant IS codes
- Equip student with concepts of design of flexural members
- Understand Design of tension and compression members
- Familiarize students with types of Columns, column bases and their Design
- Familiarize students with Design of Gantry Girder and Roof Trusses

UNIT – I **12 HOURS**

Introduction: Types of steel structures and components; Hot rolled structural steel; Grades of structural steel and Mechanical properties of steel; Loads and Load combinations; Concepts of limit State Design – Limit State of Collapse and Limit State of Serviceability; Plate / local buckling, Concept of Plasticity; Advantages and disadvantages of steel structures

Simple Connections: Behaviour of bolted connections; failures & Limit States of Strength; Design provisions for bolts as per IS 800:2007; Design of plate – plate bolted connections subjected to axial load; Introduction to welding – Types of welds & welded joints; weld defects; Design provisions for welding as per IS 800:2007; Design of welded plate – plate connections subjected to axial load; Advantages and disadvantages of bolted and welded connections.

Eccentric (Bracket) Connections: Bolted connection: Moment in-plane and perpendicular to plane of joint; Welded connection: Moment in-plane and perpendicular to plane of joint

UNIT – II **12 HOURS**

Tension Members: Net area; shear-lag; failure modes and limit states of strength - yielding, rupture and block Shear; Design provisions as per IS 800:2007; Design of Tension Members

Compression Members: Behaviour of short, long and Intermediate members under axial compression - Effective length and Slenderness ratio; Types of Buckling; Limit states of strength and Design provisions as per IS 800:2007; Design of Struts and Simple Columns. Design of laced and battened built-up compression members.

UNIT –III **12 HOURS**

Design of Beams: Behaviour of Laterally Supported Beams and Laterally Un-Supported Beams - Lateral – Torsional Buckling and Elastic Critical Moment; Classification of beams and failure modes; Shear behaviour; Design provisions as per IS 800: 2007; Web-Crippling; Web Buckling; Deflection limits; Design of Laterally Supported and Un-Supported Beams; Design of Simple Beam to Column Web-Angle connection

UNIT – IV **12 HOURS**

Design of Beam-Columns: Behaviour of beam-columns; P-delta effects; Equivalent moment factor; Failure modes; Limit states of strength and Design provisions as per IS 800:2007; Design of beam-column subjected to axial compression and bi-axial bending

Design of Column Splices and Bases: Design of column splices; Design of slab base and gusseted base

UNIT – V **12 HOURS**

Design of Gantry Girder: EOT cranes; Vertical, lateral and longitudinal loads; Impact factors, Design of Gantry girders.

Roof Trusses: Different types of trusses, Design loads – Dead, Live and Wind loads, Load combinations as per IS Codes, Design of simple Tubular roof trusses – purlin – rafter and joints.

NOTE: Welded connections should be used in Units III – V.

The students should prepare the following plates.

Plate 1 Detailing of Welded Lap Joint
Plate 2 Detailing of Beams
Plate 3 Detailing of Built-up Column including lacing and battens,
Plate 4 Detailing of Column bases – slab base and gusseted base
Plate 5 Detailing of steel roof trusses including joint details

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. Part A consists of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

TEXT BOOKS

1) K. S. Sai Ram, Design of Steel Structures, Pearson Education (India), 2020
2) N. Subramanian, Design of Steel Structures, Oxford University Press (India), 2015

REFERENCES / FURTHER READING

1) S. K. Duggal, Limit State Design of steel structures, Tata McGraw-Hill, New Delhi, 2019
2) M. L. Gambhir, Fundamentals of Structural Steel Design, Tata McGraw-Hill, 2013
3) L. J. Morris and D.R. Plum, Structural Steel Work Design to BS 5950, Prentice-Hall, 1996
4) D. Lam et al., Structural Steelwork: Design to Limit State Theory (BS 5950), CRC press, 2004
5) D. Lam et al., Structural Steelwork: Design to Limit State Theory (EC3), CRC press, 2014
6) A. S. Arya and J. L. Ajmani, Design of Steel Structures *(working stress method)*, Nem chand publishers, 2001

IS Codes:

1) IS 800:2007, Indian Standard Code for General Construction in Steel, 3rd revision, Indian Standards Institution, New Delhi.

2) IS – 875 Parts I- III, Code of practice for design loads (other than earth quake) for buildings and Structures (Part-1-Part 5), Bureau of Indian standards.
3) Steel Tables

These codes and steel tables are permitted for use in the examinations.

Course Outcomes:

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

CO1: Analyze and design welded and bolted connections

CO2: Design Tension members, Simple and Built-up compression members

CO3: Design Laterally-Supported and Laterally-Unsupported Beams

CO4: Design Beam-Columns, Column Splices and Bases

CO5: Analyze, Design and Detail Gantry girder and Roof Trusses

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analyzing, 5 – Evaluating, 6 - Creating

Micro-Syllabus

UNIT – I

Introduction: Types of steel structures and components; Hot rolled structural steel; Grades of structural steel and Mechanical properties of steel; Loads and Load combinations; Concepts of limit State Design – Limit State of Collapse and Limit State of Serviceability; Plate / local buckling, Concept of Plasticity; Advantages and disadvantages of steel structures

Simple Connections: Behaviour of bolted connections; failures & Limit States of Strength; Design provisions for bolts as per IS 800:2007; Design of bolted connections subjected to axial load; Introduction to welding – Types of welds & welded joints; weld defects; Design provisions for welding as per IS 800:2007; Design of welded connections subjected to axial load; Advantages and disadvantages of bolted and welded connections.

Eccentric (Bracket) Connections: Bolted connection: Moment in-plane and perpendicular to plane of joint; Welded connection: Moment in-plane and perpendicular to plane of joint

Unit	Module	Micro content
Ia. Simple Connections	Bolted Connections	Failures and limit states of strength; Design provisions
		Design of Plate to Plate Lap Joints - Ordinary bolts or HSFG bolts
		Design of Plate to Plate Double Cover Butt Joint – Ordinary Bolts only
	Welded connections	Introduction – Types of welds and welded joints, weld defects, design provisions, Advantages of bolted and welded connections

		Design of Plate to Plate Lap connection - Butt Weld and Fillet Welds
Ib. Eccentric (Bracket) Connections	Bolted Connections	Moment in-plane of joint and Moment perpendicular to Joint – Ordinary Bolts Only
	Welded connections	Moment in-plane of joint and Moment perpendicular to Joint – Fillet Welds Only

UNIT – II

Tension Members: Net area; shear-lag; failure modes and limit states of strength - yielding, rupture and block Shear; Design provisions as per IS 800:2007; Design of Tension Members

Compression Members: Behaviour of short, long and Intermediate members under axial compression - Effective length and Slenderness ratio; Types of Buckling; Limit states of strength and Design provisions as per IS 800:2007; Design of Struts and Simple Columns. Design of laced and battened built-up compression members**.**

Unit	**Module**	**Micro content**
IIa. Tension Members	Introduction	Net area; shear-lag; failure modes and limit states of strength - yielding, rupture and block Shear; Design provisions as per IS 800:2007
	Design of Tension Members (with End Connection)	Design of Single Angle connected to gusset plate – Ordinary bolts / Fillet Welds Connection
		Design of Double Angles connected Gusset Plate – Ordinary bolts / Fillet Welds Connection
IIb. Compression Members	Introduction	Behaviour of short, long and Intermediate members under axial compression - Effective length and Slenderness ratio; Types of Buckling; Limit states of strength and Design provisions as per IS 800:2007
	Design of Struts and Simple Columns	Design of Single Angle connected to gusset plate by one leg (Eccentrically Loaded) – Ordinary bolts / Fillet Welds
		Design of Double Angle connected to gusset plate – Ordinary Bolts / Fillet Welds
		Design of Hollow sections (CHS / SHS / RHS) – End connection by Fillet Welds Only
	Design of Built-Up Compression	Laced Column – Two Channels Back to Back – Ordinary bolts / Fillet weld Connection

	Members	Battened Column - Two Channels Back to Back – Ordinary bolts / Fillet weld Connection
Note: Welded Connections Should Only be Used for Units III - V		

UNIT – III Design of Beams: Behaviour of Laterally Supported Beams and Laterally Un-Supported Beams - Lateral – Torsional Buckling and Elastic Critical Moment; Classification of beams and failure modes; Shear behaviour; Design provisions as per IS 800: 2007; Web-Crippling; Web Buckling; Deflection limits; Design of Laterally Supported and Un-Supported Beams; Design of Simple Beam to Column Web-Angle connection

Unit	Module	Micro content
IIIa/b. Design of Beams	Introduction	Behaviour of Laterally Supported Beams and Laterally Un-Supported Beams - Lateral – Torsional Buckling and Elastic Critical Moment; Classification of beams and failure modes; Shear behaviour; Design provisions as per IS 800: 2007; Web-Crippling; Web Buckling; Deflection limits
	Design of Laterally Supported Beams	Design of simply supported I - beam subjected to simple loading
	Design of Laterally Un-supported Beams	Design of simply supported I - beam subjected to simple loading
	Design of Beam – Column connection	Web – Angle Connection (Fillet Weld Connection Only)

UNIT – IV

Design of Beam-Columns: Behaviour of beam-columns; P-delta effects; Equivalent moment factor; Failure modes; Limit states of strength and Design provisions as per IS 800:2007; Design of beam-column subjected to axial compression and bi-axial bending

Design of Column Splices and Bases: Design of column splices; Design of slab base and gusseted base

Unit	Module	Micro content
IVa. Design of Beam-Columns	Introduction	Behaviour of beam-columns; P-delta effects; Equivalent moment factor; Failure modes; Limit states of strength and Design provisions as per IS 800:2007
	Design of Beam-Column	Design of beam-column subjected to axial compression and bi-axial bending – I or SHS / RHS sections only
IVb. Design of Column Splices and Bases	Column Splices	Columns of same size / different size – Fillet Welded Connection Only

	Column Bases	Slab Base and Gusseted Bases for Simple I section columns Only – Fillet Welded Connection

UNIT – V

Design of Gantry Girder: EOT cranes; Vertical, lateral and longitudinal loads; Impact factors, Design of Gantry girders.

Roof Trusses: Different types of trusses, Design loads – Dead, Live and Wind loads, Load combinations as per IS Codes, Design of simple Tubular roof trusses – purlin – rafter and joints.

Unit	Module	Micro Content
Va. Design of Gantry Girder	Introduction	EOT cranes; Vertical, lateral and longitudinal loads; Impact factors
	Design of Gantry Girder	Design of Simply Supported Welded I-section Gantry Girder Only (Laterally Un-supported)
Vb. Design of Roof Trusses	Introduction	Different types of trusses, Design loads – Dead, Live and Wind loads, Load combinations as per IS Codes
	Design of Roof Truss	Design of simple Tubular roof trusses – purlin – rafter – lower chord – web members and joints

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	3							2		
CO2	1		3							2		
CO3	1	2	3							2		
CO4	1		3							2		
CO5	2	2	3							2		

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III-Year-II Semester PE3201	MANAGEMENT SCIENCE	L	T	P	C
		2	0	0	2

III-Year-II Semester PE3201A	EARTHQUAKE RESISTANT DESIGN	L	T	P	C
		3	0	0	3

Course Objectives:

1. To give preliminary concepts of engineering seismology and structural dynamics.
2. To impart concepts of design philosophies for seismic building designs for given loading conditions.
3. Equip student with concepts of Structural Dynamics.
4. Familiarize students with various IS codal provisions for seismic design of buildings, shear walls design and detailing.

UNIT-I: ENGINEERING SEISMOLOGY 8 HOURS

Introduction – rebound theory – plate tectonics – seismic waves - earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations.

Unit– II: INTRODUCTION TO STRUCTURAL DYNAMICS 10 HOURS

Fundamental objective of Dynamic analysis – Types of prescribed loadings – Formulation of the Equations of Motion– Elements of a Vibratory system – Free Vibrations of Single Degree of Freedom (SDOF) systems – Un damped and damped – Critical damping – Logarithmic decrement – Forced vibrations of SDOF systems – Harmonic excitation – Dynamic magnification factor.

Unit-III: SEISMIC DESIGN CONCEPTS 12 HOURS

EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) –Shear wall and design of shear wall.

Unit-IV: CODAL DESIGN PROVISIONS 12 HOURS

Review of the latest Indian seismic code IS:1893 – 2002 (Part-I) provisions for buildings – Earthquake design philosophy –Assumptions – Analysis by seismic coefficient and response spectrum methods – Displacements and drift requirements – Provisions for torsion – Analysis of a multi-storeyed building using Seismic Coefficient method.

CODAL DETAILING PROVISIONS: Review of the latest Indian codes IS: 4326 and IS: 13920 Provisions for ductile detailing of R.C buildings – Beam, column and joints

Unit-V: CALCULATION OF EQUIVALENT LATERAL FORCE 14 HOURS

Calculation of equivalent lateral force- Design Base Shear- Storey Shear, Estimation of Natural period of Structure, Computation of Response acceleration Coefficient- Zone factor- Seismic weight- Response reduction factors- Seismic Coefficient Method – response spectrum method

TEXT BOOKS:

1. 'Earthquake Resistant Design of Structures' -Pankaj Agarwal and Manish ShriKhande, Prentice – Hall of India, 2007, New Delhi..
2. S.K.Duggal, "Earth Quake Resistant Design of Structures", Oxford university Press, 1st Edition, 2012

REFERENCE BOOKS:

1. Clough & Penzien, "Dynamics of Structures", 4th Edition, McGraw Hill, International Edition, 2008.

2. Chopra A.K., "Dynamics of Structures", 5th Edition, Pearson Education, Indian Branch, Delhi, 2007

3. 'Earthquake Resistant Design of Building Structures' by Vinod Hosur, Wiley India Ltd.

4. IS Codes: IS: 1893, IS: 4326 and IS:13920, Bureau of Indian Standards, New Delhi.

Course Outcomes:

The students will be able to

CO1: ***Understand*** the fundamentals of Engineering Seismology. (Understanding)

CO2: ***Analyse*** the applications with the principles of Structural Dynamics. (Understanding, Analysing)

CO3: ***Apply*** different design methods and analyse the various Seismic designs according to IS standard provisions (Applying, Analysing)

CO4: ***Design*** of buildings subjected to earthquake loads and shear walls. (Designing)

CO5: ***drawing*** the reinforcement detailing of computed seismic designs as per IS codal provisions. (Applying, Analysing)

:

BL – Bloom's Taxonomy Levels

1- Understanding, 2 – Applying, 3 – Analysing, 4 – Designing, 5 - Drawing

Micro-Syllabus of Earthquake Resistant Design

UNIT-I: ENGINEERING SEISMOLOGY

Introduction – rebound theory – plate tectonics – seismic waves - earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations.

Unit	Module	Micro content
I: ENGINEERING SEISMOLOGY	Introduction	rebound theory
		plate tectonics
		seismic waves
	Seismology	earthquake size and various scales
		local site effects
		Indian seismicity
		seismic zones of India
		theory of vibrations

Unit– II: INTRODUCTION TO STRUCTURAL DYNAMICS:

Fundamental objective of Dynamic analysis – Types of prescribed loadings – Formulation of the Equations of Motion– Elements of a Vibratory system – Free Vibrations of Single Degree of Freedom (SDOF) systems – Un damped and Damped – Critical damping – Logarithmic decrement – Forced vibrations of SDOF systems – Harmonic excitation – Dynamic magnification factor.

Unit	Module	Micro content
II: INTRODUCTION	Dynamic analysis	Fundamental objective
		Types of prescribed loadings
		Formulation of the Equations of Motion

TO STRUCTURAL DYNAMICS	Vibratory system	Elements of a Vibratory system
		Free Vibrations of Single Degree of Freedom (SDOF) systems
		Forced vibrations of SDOF systems
		Harmonic excitation
	damping	Un damped and Damped
		Critical damping
		Logarithmic decrement
		Dynamic magnification factor

Unit-III: SEISMIC DESIGN CONCEPTS

EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) –Shear wall and design of shear wall.

Unit	Module	Micro content
III: SEISMIC DESIGN CONCEPTS	EQ load	EQ load on simple building
		load path
		floor and roof diaphragms
	seismic resistant building	seismic resistant building architecture
		plan configuration
		vertical configuration
		pounding effects
		mass and stiffness irregularities
	Provision of seismic code	Shear wall
		Design of shear walls

Unit-IV: CODAL DESIGN PROVISIONS

Review of the latest Indian seismic code IS:1893 – 2002 (Part-I) provisions for buildings – Earthquake design philosophy –Assumptions – Analysis by seismic coefficient and response spectrum methods – Displacements and drift requirements – Provisions for torsion – Analysis of a multi-storeyed building using Seismic Coefficient method.

CODAL DETAILING PROVISIONS: Review of the latest Indian codes IS: 4326 and IS: 13920 Provisions for ductile detailing of R.C buildings – beams, columns and joints

Unit	Module	Micro content
IV: CODAL DESIGN PROVISIONS	Indian seismic code IS:1893 – 2002	provisions for buildings
		Earthquake design philosophy
		Analysis by seismic coefficient and response spectrum methods
		Displacements and drift requirements
		Provisions for torsion
		Analysis of a multi-storeyed building using Seismic Coefficient method.
	Review of the latest Indian codes IS: 4326 and IS: 13920	Provisions for ductile detailing of R.C buildings
		Beam, column and joints

Unit V: CALCULATION OF EQUIVALENT LATERAL FORCE

Calculation of equivalent lateral force- Design Base Shear- Storey Shear, Estimation of Natural period of Structure, Computation of Response acceleration Coefficient- Zone factor- Seismic

weight- Response reduction factors- Seismic Coefficient Method – response spectrum method		
Unit	**Module**	**Micro content**
CALCULATION OF EQUIVALENT LATERAL FORCE	Calculation of equivalent lateral force	Design Base Shear
		Storey Shear
		Estimation of Natural period of Structure
		Computation of Response acceleration Coefficient
		Zone factor
		Seismic weight
		Response reduction factors
		Seismic Coefficient Method
		response spectrum method

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	2									2	
CO2	3	3									2	
CO3	2	2									4	1
CO4	3	4			1						2	1
CO5	5	5			2						3	5

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III-Year-II Semester PE3201B	EARTH RETAINING STRUCTURES	L	T	P	C
		3	0	0	3

Course Objectives:

5. To enable the student to understand the concepts of earth pressures and different theories.
6. To impart the concept of retaining walls, types of failures, stability requirements.
7. To impart the concept of sheet pile wall, cantilever, anchored sheet piles, location and forces in anchors.
8. To enable the student to understand the concepts of soil reinforcement braced cuts and cofferdams.

UNIT-I **10 HOURS**

EARTH PRESSURES

Different types and their coefficients- Classical Theories of Earth pressure – Rankine's and Coulomb's Theories for Active and Passive earth pressure- Computation of Lateral Earth Pressure in Homogeneous and Layered soils- Graphical solutions for Coulomb's Theory in active and passive conditions.

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UNIT– II **10 HOURS**

RETAINING WALLS

Different types - Type of Failures of Retaining Walls– Stability requirements – Drainage behind Retaining walls – Provision of Joints – Relief Shells.

UNIT-III **11 HOURS**

SHEET PILE STRUCTURES

Types of Sheet piles – Cantilever sheet piles in sands and clays – Anchored sheet piles – Free earth and fixed earth support methods – Row's moment reduction method – Location of anchors, Forces in anchors.

UNIT-IV **12 HOURS**

SOIL REINFORCEMENT

Reinforced earth - Different components – their functions – Mechanics of reinforced earth – Failure modes-Failure theories – Design of Embakments on problematic soils.

UNIT-V **13 HOURS**

BRACED CUTS AND COFFERDAMS:

Lateral Pressure in Braced cuts – Design of Various Components of a Braced cut – Stability of Braced cuts – Bottom Heave in cuts. – types of cofferdam, suitability, merits and demerits – Design of single – wall cofferdams and their stability aspects– TVA method and Cummins' methods.

TEXT BOOKS:

1. Principles of Foundation Engineering by Braja M. Das.
2. Foundation analysis and design – Bowles, JE – McGraw Hill

REFERENCES:

1. Soil Mechanics in Engineering Practice – Terzaghi, K and Rolph, B. peck 2nd Edn. – John Wiley & Co.,
2. Analysis and Design of Foundations and Retaining Structures, Prakash, S – Saritha Prakashan, Mearut.

Course Outcomes:

The students will be able to

CO1: ***Explain*** – the types of earth pressures and classical theories and computation of pressures in homogenous and layered soils (Understanding, analysing)

CO2:***Understanding***-the types and failure of retaining wall, stability requirements (Understanding, Evaluating)

CO3: ***Analyse*** –Cantilever and anchored sheet piles and evaluating location and forces in anchors (Analysing, Evaluating)

CO4: ***Understanding-*** the concept and mechanism of soil reinforcement and design of embankment (Understanding Applying)

CO5: ***Explain***- the concept of braced cuts and cofferdams (Understanding)

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro Syllabus **EARTH RETAINING STRUCTURES**

UNIT-I: EARTH PRESSURES

Different types and their coefficients- Classical Theories of Earth pressure – Rankine's and Coulomb's Theories for Active and Passive earth pressure- Computation of Lateral Earth Pressure in Homogeneous and Layered soils- Graphical solutions for Coulomb's Theory in active and passive conditions.

Unit	Module	Micro content
I. Earth pressures	Introduction	Different types of earth pressuresand their coefficients
	Theories of earth pressures	Rankine's theory for Active and Passive earth pressure (concept and problems)
		Coulomb's theory for Active and Passive earth pressure (concept and problems)
	Lateral earth pressures	Computation of Lateral earth Pressure in Homogeneous and Layered soils, problems
	Graphical solutions	Coulomb's theory in active and passive conditions.

UNIT– II: RETAINING WALLS

Different types - Type of Failures of Retaining Walls– Stability requirements – Drainage behind Retaining walls – Provision of Joints – Relief Shells.

Unit	Module	Micro content

II. Retaining walls	Introduction	Types of retaining walls
	Failures of Retaining Walls	Types of failures of Retaining Walls
	Stability of retaining walls	Stability requirements
		Drainage behind Retaining walls
		Provision of Joints – Relief Shells
UNIT-III: SHEET PILE STRUCTURES Types of Sheet piles – Cantilever sheet piles in sands and clays – Anchored sheet piles – Free earth and Fixed earth support methods – Row's moment reduction method – Location of anchors, Forces in anchors.		
Unit	**Module**	**Micro content**
III. Sheet pile wall structures	Introduction	Types of Sheet piles
	Cantilever sheet piles	Cantilever sheet piles in sands and clays (concept and problems)
	Anchored sheet piles	Free earth and Fixed earth support methods (concept and problems)
	Row's moment reduction method	Location of anchors, Forces in anchors.
UNIT-IV: SOIL REINFORCEMENT Reinforced earth - Different components – their functions – Mechanics of reinforced earth – Failure modes-Failure theories – Design of embankments on problematic soils.		
Unit	**Module**	**Micro content**
IV. Soil reinforceent	Introduction	Reinforced earth - Different components – their functions
	Mechanics of reinforced earth	Failure modes
		Failure theories
	Design of embankments	Design of embankments on problematic soils
UNIT-V: BRACED CUTS AND COFFERDAMS: Lateral Pressure in Braced cuts – Design of Various Components of a Braced cut – Stability of Braced cuts – Bottom Heave in cuts. – Types of cofferdam, suitability, merits and demerits – Design of single – wall cofferdams and their stability aspects– TVA method and Cummins' methods.		
Unit	**Module**	**Micro content**
V. Braced cuts and Coffer dams	Introduction	Concept of braced cuts and coffer dams
	Braced cuts	Lateral Pressure in Braced cuts
		Design of Various Components of a Braced cut
		Stability of Braced cuts, Bottom Heave in cuts
	Cofferdam	Types of cofferdam
		Suitability, merits and demerits
		Design of single – wall cofferdams and their stability aspects
		TVA method and Cummins' methods

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			2						1		
CO2	3			2						1		
CO3	3			2						1		
CO4	3			2						1		

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III-Year-II Semester	INDUSTRIAL WASTER AND WASTE WATER ENGINEERING	L	T	P	C
PE3201C		3	0	0	3

Course Objectives:

1. Enables the student to distinguish between the quality of domestic and industrial water requirements and wastewater quantity generation.
2. To impart knowledge on selection of treatment methods for industrial wastewater.
3. To know the common methods of treatment in different industries
4. To acquire knowledge on operational problems of effluent treatment plant.

Unit-I: INTRODUCTION **10 HOURS**

General Characteristics of Industrial effluents, Effects on Environment – ISI tolerance limits for discharging industrial effluents into surface water, into public sewers and on to land for irrigation.

Unit– II: TREATMENT OF INDUSTRIAL WASTE WATER **10 HOURS**

Necessity of treatment –Segregation – Process changes – Salvaging–Byproduct Recovery –Ion Exchange, Electro dialysis, Solvent Extraction, Floatation – Removal of Nitrogen and Phosphorus – Boiler water treatment methods and cooling water treatment methods.

Unit-III: FOOD INDUSTRIES **10 HOURS**

Sources, characteristics treatment and recycling of waste water from Sugar, Dairy and Distilleries, Food Processing industries, Aqua industry.

Unit-IV: MAJOR INDUSTRIAL EFFLUENTS **10 HOURS**

Sources, characteristics, treatment and recycling of waste water from Power plants, Oil refineries, Cement and Steel factories.

Unit-V: CHEMICAL INDUSTRIES **10 HOURS**

Sources, characteristics, treatment and recycling of waste water from Paper and pulp, Tanneries,Textiles, Fertilizers and Pharmaceutical industries.

TEXT BOOKS:

1. Rao, M.N. and Dutta, A.K., "Wastewater Treatment", 3rd Edition, IBH Publishers, 1982.
2. Patwardhan,"Industrial Wastewater Treatment"- PHI learning Pvt. Ltd, 2009.
3. Industrial Wastewater Treatment by KVSG Murali Krishna, Paramount Publishers, Visakhapatnam, 2019
4. Wastewater Treatment for Pollution Control and Reuse, by Soli. J Arceivala, Shyam R Asolekar, Mc-Graw Hill, New Delhi; 3rdEdition

REFERENCE BOOKS:

1. Nemerow. N.L., "Liquid Waste from industry – Theories, Practice and Treatment"Addison wisely, 1996.
2. Benefield L.D. and Randall C.D, "Biological Process Designs for Wastewater AdvancedWaste Treatment Methods "Removal Suspended solids – Dissolved solid Treatment", Prentice Hall Pub. Co., 1980.

3. Metcalf and Eddy. "Wastewater Engineering – Collection, Treatment, Disposal andReuse",McGraw Hill Pub. Co., 1995.
4. C. Fred Gurnham" Industrial WasteWater Control", (Revised for publication January 28,1977) 31 May, 2007.
5. Gurnham, C.F., "Principles of Industrial Waste Water: Wiley; New York, 1955.
6. Gurnham CF (Ed) "Industrial WasteWater Control"; Academic Press; New York, NY,1965.

Course Outcomes:

The students will be able to:

CO1: **Assess** the characteristics of industrial effluents and their effects on the environment including their tolerance limits

CO2: **Describe** the basic principles of industrial waste water treatment by physical methods.

CO3: **Discuss** the sources, characteristics and treatment of food industrial wastes.

CO4: **Identify** the sources, characteristics and treatment of major industrial waste of Thermal Power Plants, Oil Refineries, Steel mills and Cement industries.

CO5: **Identify** the sources, characteristics and treatment of Chemical industrial wastes.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Industrial Waste and Wastewater Engineering

Unit-I: INTRODUCTION

General Characteristics of Industrial effluents, Effects on Environment – ISI tolerance limits for discharging industrial effluents into surface water, into public sewers and on to land for irrigation.

Unit	Module	Micro content
INTRODUCTION	General Characteristics of Industrial effluents	Basic Definitions of industrial effluents
	Effects on Environment	Environmental problems with industrial waste waters

Unit– II: TREATMENT OF INDUSTRIAL WASTE WATER

Necessity of treatment –Segregation – Process changes – Salvaging–Byproduct Recovery –Ion Exchange, Electro dialysis, Solvent Extraction, Floatation – Removal of Nitrogen and Phosphorus – Boiler water treatment methods and cooling water treatment methods.

Unit	Module	Micro content
TREATMENT OF INDUSTRIAL WASTE WATER	Necessity of treatment	Need for Treatment of industrial waste water
		Importance of Treatment of industrial waste water
	Process changes	Different methods
	Removal of Nitrogen and Phosphorus	Different Techniques

Unit-III: FOOD INDUSTRIES

Sources, characteristics treatment and recycling of waste water from Sugar, Dairy and Distilleries, Food Processing industries, Aqua industry.

Unit	Module	Micro content
FOOD INDUSTRIES	Sources	Different industries generating food waste
	Sugar industry	Manufacturing Process and origin, characteristics, effects and treatment methods
	Dairy andDistilleries	Manufacturing Process and origin, characteristics, effects and treatment methods
	Food Processing industries	Characteristics, effects and treatment methods
	Aqua industry	Characteristics, effects and treatment methods

Unit-IV: MAJOR INDUSTRIAL EFFLUENTS

Sources, characteristics, treatment and recycling of waste water from Power plants, Oil refineries, Cement and Steel factories.

Unit	Module	Micro content
MAJOR INDUSTRIAL EFFLUENTS	Power plants	Manufacturing Process and origin, characteristics, effects and treatment methods
	Oilrefineries	Manufacturing Process and origin, characteristics, effects and treatment methods
	Cement and Steel factories	Manufacturing Process and origin, characteristics, effects and treatment methods

Unit-V: CHEMICAL INDUSTRIES

Sources, characteristics, treatment and recycling of waste water from Paper and pulp, Tanneries,Textiles, Fertilizers and Pharmaceutical industries.

Unit	Module	Micro content
CHEMICAL INDUSTRIES	Paper and pulp	Sources, characteristics, treatment and recycling of waste water
	Tanneries	Treatment and recycling of waste water
	Textiles	Treatment and recycling of waste water
	Fertilizers and Pharmaceutical industries.	Treatment and recycling of waste water

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2		2		2					
CO2	3	2	2		2			2				
CO3	2	2			2			2				
CO4	3	3	2		2		2	2	2			
CO5	3	3	2		2		2	2	2			

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III-Year-II Semester
PE3201D

ROAD SAFETY ENGINEERING

L	T	P	C
3	0	0	3

Course Objectives:

1. This module on the fundamental of traffic engineering, Highway safety factors, Road safety improvement strategies are discussed
2. The Analysis of Crash Data and some of the statistics methods to analysis the traffic safety.
3. The accident interrogations & risk involved and role of road safety in planning the urban Infrastructures design is discussed.
4. The Basic physics related to crash reconstruction & Variables involved in crashes are studied
5. The various mitigation measures that to be taken for avoiding the accidents are discussed.

UNIT I **10 HOURS**

Introduction to safety

Road accidents, Trends, causes, Collision diagrams; Highway safety; Human factors and road user limitations; Speed and its effect on road safety; Vehicle factors; Highway safety in India. Multi-causal dynamic systems approach to safety; Crash Vs Accident; Road safety improvement strategies; Elements of a road safety plan, Safety data Needs; Safe vehicle design.

UNIT II **10 HOURS**

Statistical Interpretation and Analysis of Crash Data

Before-after methods in crash analysis, Recording of crash data; Accident Investigation and Analysis; Statistical testing and the role of chance; Black Spot Identification and Investigations, Case Studies.

UNIT III **10 HOURS**

Road Safety Audits

Key elements of a road safety audit, Road Safety Audits & Investigations, Work zone safety audit; Crash investigation and analysis, Methods for identifying hazardous road locations, Case Studies.

UNIT IV **10 HOURS**

Crash Reconstruction

Describe the basic information that can be obtained from the roadway surface, understand basic physics related to crash reconstruction, speed for various skid, friction, drag, and acceleration scenarios, variables involved in jump and flip crashes, variables involved in pedestrian crashes, Case Studies.

UNIT V **10 HOURS**

Mitigation Measures

Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety; Safety in urban areas; Public transport and safety; Road safety policy making, Stakeholders involvement; Road safety law.

TEXT BOOKS:

1. Institute of Transportation Engineers (ITE), The Traffic Safety Toolbox: A Primer on Traffic Safety,

ITE, 1999.
2. Towards Safe Roads in Developing country, TRL – ODA, 2004.
3. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
4. Fundamentals of Transportation Engineering – C.S. Papacostas, Prentice Hall India.

REFERENCES:

1. Athelstan Popkess, Traffic Control and Road Accident Prevention, Chapman and Hall, 1997 (Digitized 2008)
2. Ezra Hauer, Observational Before-After Studies in Road Safety, Pergamon Press, 1997 (reprinted 2002).
3. Geetam Tiwari and Dinesh Mohan, Transport Planning and Traffic Safety: Making Cities, Roads, and Vehicles Safer, CRC Press, 2016.
4. Transportation Engineering – An Introduction, C.Jotinkhisty, B. Kent Lall
5. Fundamentals of Traffic Engineering, Richardo G Sigua
6. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson
7. Road Safety by NCHRP.

Course Outcomes:

The students will be able to

CO1: To remember and understand the fundamentals of Road Safety Engineering.

CO2: To investigate & analyze the collective factors for accident involved.

CO3: To understand & investigate road safety audit.

CO4: To understand and apply crash reconstruction process.

CO5: To apply mitigation measures by better designing of roads.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Strength of Materials-I

Unit-I:

Introduction to safety:

Road accidents, Trends, causes, Collision diagrams; Highway safety; Human factors and road user limitations; Speed and its effect on road safety; Vehicle factors; Highway safety in India. Multi-causal dynamic systems approach to safety; Crash Vs Accident; Road safety improvement strategies; Elements of a road safety plan, Safety data Needs; Safe vehicle design.

Unit	Module	Micro content
I. Introduction to safety	Road accidents	Trends, causes, Collision diagrams
	Highway safety factors	Human factors and road user limitations
		Speed and its effect on road safety
		Vehicle factors
	Highway safety in India & Multi-causal dynamic systems approach to safety	Conceptual theory

	Crash Vs Accident	Definition & Difference
	Road safety improvement strategies	Elements of a road safety plan
		Safety data Needs
		Safe vehicle design

Unit– II:
Statistical Interpretation and Analysis of Crash Data:
Before-after methods in crash analysis, Recording of crash data; Accident Investigation and Analysis; Statistical testing and the role of chance; Black Spot Identification and Investigations, Case Studies.

Unit	Module	Micro content
II. Statistical interpretation and analysis of crash data	Analysis of Crash Data	Before-after methods in crash analysis
		Recording of crash data
		Accident Investigation and Analysis
	Statistical Interpretation	Statistical testing and the role of chance
		Black Spot Identification and Investigations
	Case studies	A case study on interpretation & analysis of crash data

Unit-III:
Road Safety Audits:
Key elements of a road safety audit, Road Safety Audits & Investigations, Work zone safety audit; Crash investigation and analysis, Methods for identifying hazardous road locations, Case Studies.

Unit	Module	Micro content
III. Road Safety Audits	Introduction to RSA	Key elements of road safety audit
		Road safety audits & investigations
		Work zone safety audit
	Crash Investigation & Identification of hazard location	Crash investigation and analysis
		Methods for identifying hazardous road locations
	Case studies	A case study related to road safety audit

Unit-IV:
Crash Reconstruction:
Describe the basic information that can be obtained from the roadway surface, Understand basic physics related to crash reconstruction, speed for various skid, friction, drag, and acceleration scenarios, variables involved in jump and flip crashes, variables involved in pedestrian crashes, Case Studies.

Unit	Module	Micro content

IV. Crash Reconstruction	Introduction	Basic information obtained from roadway surface
	Basic physics related to crash reconstruction	Speed for various skid, friction, drag, and acceleration scenarios
	Variables involved in crashes	Variables involved in jump and flip crashes
		Variables involved in pedestrian crashes
	Case Studies	A case study related to crash reconstruction

Unit-V:
Mitigation Measures:
Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety; Safety in urban areas; Public transport and safety; Road safety policy making, Stakeholders involvement; Road safety law.

Unit	**Module**	**Micro content**
V. Mitigation Measures	Prevention of accidents	Accident prevention by better planning
		Accident prevention by better design of roads
	Crash Countermeasures	Conceptual theory
	Highway operation and accident control measures	Highway Safety Measures during construction
		Highway geometry and safety
		Safety in urban areas
		Public transport and safety
	Safety policy	Making of Road safety policy
		Stakeholders involvement
		Road safety law

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2		2								2	
CO2	1	2		2							2	
CO3	2			2							2	1
CO4	3			1							2	
CO5	2		2								2	

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III-Year-II Semester	GROUND WATER DEVELOPMENT & MANAGEMENT	L	T	P	C
PE3201E		3	0	0	3

Course Learning Objectives:

The course is designed to

- Appreciate groundwater as an important natural resource.
- Understand flow towards wells in confined and unconfined aquifers.
- Understand the principles involved in design and construction of wells.
- Create awareness on improving the groundwater potential using various recharge techniques.
- Know the importance of saline water intrusion in coastal aquifers and its control measures.

UNIT – I **12 HOURS**

Introduction:
Groundwater in the hydrologic cycle, ground water occurrence, aquifer parameters and their determination, general ground water flow equation.
Well Hydraulics: Steady radial flow and unsteady radial flow to a well in confined and unconfined aquifers, Theis solution, Jocob and Chow's methods, Leaky aquifers.

UNIT – II **12 HOURS**

Well Design:
Water well design-well diameter, well depth, well screen-screen length, slot size, screen diameter and screen selection, design of collector wells, infiltration gallery

UNIT –III **10 HOURS**
Well Construction and Development:
Water wells, drilling methods-rotary drilling, percussion drilling, well construction-installation of well screens-pull-back method, open- hole, bail- down and wash-down methods, well development-mechanical surging using compressed air, high velocity jetting of water, over pumping and back washing, well completion, well disinfection, well maintenance.

UNIT IV **10 HOURS**

Artificial Recharge:
Concept of artificial recharge of groundwater, recharge methods-basin, stream-channel, ditch and furrow, flooding and recharge well methods, recharge mounds and induced recharge

Saline Water Intrusion: Occurrence of saline water intrusion, Ghyben- Herzberg relation, Shape of interface, control of saline water intrusion.

UNIT – V **10 HOURS**

Groundwater Modelling and Management:
Basic principles of groundwater modelling- Analog models-viscous fluid models and membrane models, digital models-Finite difference and finite element models.
Concepts of groundwater management, basin management by conjunctive use-case studies.

Text Books:

1. Groundwater, Raghunath H M, New Age International Publishers, 2005.
2. Groundwater Hydrology, Todd D. K., Wiley India Pvt Ltd.,2014.
3. Groundwater Hydrology, Todd D K and L W Mays, CBS Publications,2005.

References:

1. Groundwater Assessment and Management, Karanth K R, Tata McGraw Hill Publishing Co., 1987.
2. Groundwater Hydrology, Bouwer H, McGraw Hill Book Company, 1978.
3. Groundwater Systems Planning and Management, Willis R and W.W.G. Yeh, Prentice Hall Inc., 1986.
4. Groundwater Resources Evaluation, Walton W C, McGraw Hill Book Company, 1978.

Course Outcomes:

The students will be able to

CO1: Estimate aquifer parameters, yield of wells and Analyse radial flow towards wells in confined and unconfined aquifers.
CO2: Design wells and understand the construction practices.
CO3: Determine the process of artificial recharge for increasing ground water potential.
CO4: Take effective measures for controlling saline water intrusion.
CO5: Apply appropriate measures for ground water management.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of GROUND WATER DEVELOPMENT & MANAGEMENT

UNIT – I Introduction:
Groundwater in the hydrologic cycle, ground water occurrence, aquifer parameters and their determination, general ground water flow equation.

Well Hydraulics: Steady radial flow and unsteady radial flow to a well in confined and unconfined aquifers, Theis solution, Jocob and Chow's methods, Leaky aquifers.

Unit	Module	Micro content
Introduction	Groundwater in the hydrologic cycle	Concept with the help of Sketch
	ground water occurrence	Concept
	aquifer parameters and their determination	Properties and problems
	general ground water flow equation	Concept & Derivation
Well Hydraulics	Steady radial flow in confined and unconfined aquifers	Derivations and simple problems
	Unsteady radial flow in confined and unconfined aquifers	Derivations and simple problems
	Theis solution, Jacob and Chow's methods	Derivations only
	Leaky aquifers	Concepts, Derivation of cases and simple problems

UNIT – II Well Design:
Water well design-well diameter, well depth, well screen-screen length, slot size, screen diameter and screen selection, design of collector wells, infiltration gallery

Unit	Module	Micro content
Well Design	Water well design-well diameter, well depth, well screen-screen length, slot size, screen diameter and screen selection	Concepts and recommendations
	design of collector wells	Working concepts with the help of sketch and Problems
	infiltration gallery	Working concepts with the help of sketch and Problems

UNIT –III Well Construction and Development:
Water wells, drilling methods-rotary drilling, percussion drilling, well construction-installation of well screens-pull-back method, open- hole, bail- down and wash-down methods, well development-mechanical surging using compressed air, high velocity jetting of water, over pumping and back washing, well completion, well disinfection, well maintenance.

Unit	Module	Micro content
Well Construction	Drilling methods: rotary drilling, Percussion drilling.	Concepts with the help of sketches
	installation of well screens: pull-back method, open- hole, bail- down and wash-down methods	Concepts with the help of sketches
Well Development	mechanical surging using compressed air, high velocity jetting of water, over pumping and back washing	Concepts with the help of sketches
	well completion	Concepts with the help of sketches
	well disinfection	Concepts with the help of sketches
	well maintenance	Concepts with the help of sketches

UNIT IV Artificial Recharge:
Concept of artificial recharge of groundwater, recharge methods-basin, stream-channel, ditch and furrow, flooding and recharge well methods, recharge mounds and induced recharge

Saline Water Intrusion: Occurrence of saline water intrusion, Ghyben- Herzberg relation, Shape of interface, control of saline water intrusion.

Unit	Module	Micro content
Artificial Recharge	Concept of artificial recharge of groundwater	Concept with the help of sketch

	recharge methods: basin method, stream-channel method, ditch and furrow method, flooding method and **recharge well methods**: recharge mounds and induced recharge	Concept with the help of sketch
Saline Water Intrusion	Occurrence of saline water intrusion	Concept and occurence
	Ghyben- Herzberg relation	Derivation and problems
	Shape of interface	Concept with the help of sketch
	control of saline water intrusion	Control measures

UNIT – V Groundwater Modelling and Management:

Basic principles of groundwater modelling- Analog models-viscous fluid models and membrane models, digital models-Finite difference and finite element models.

Concepts of groundwater management, basin management by conjunctive use-case studies.

Unit	**Module**	**Micro content**
Groundwater Modelling	Basic principles of groundwater modelling	Thin cylindrical shells
		Derivation of longitudinal and circumferential stresses
	Analog models viscous fluid models and membrane models, digital models	Concepts and working
	Finite difference and finite element models.	Concepts and working
Groundwater Management	Concepts of groundwater management	Concept
	basin management by conjunctive use	Concepts and working
	Case Studies	

Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2										
CO2	2		2				1					
CO3	1		2				1					
CO4	2		2									
CO5	2	1	2								1	

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III-Year-II Semester OE3201A	BUILDING SERVICES	L	T	P	C
		3	0	0	3

Course Objectives:

At the end course the student able to know the requirements of building services such as

1. Types of air conditioning,
2. Types of transportation system,
3. Firefighting, electrical services,
4. Concepts of green building and energy efficient systems

Unit-I **12 HOURS**

Introduction to Building Services:

Definitions - Objective and uses of services - Applications of services for different types building considering - Classification of services- Types of services and selection of services- Natural and artificial lighting principles and factors- Arrangement of luminaries, Distribution of illumination, Utilization factors- Necessity of Ventilation Types – Natural and Mechanical Factors to be considered in the design of Ventilation.

Unit II **12 HOURS**

Electrical Services and Layout:

Electrical services in the building -Technical terms and symbols for electrical installations and Accessories of wiring- Systems of wiring like wooden casing, cleat wiring, CTS wiring conduit wiring - Types of insulation- electrical layout for residence, small work shop, show room, school building, etc.

Unit III **12 HOURS**

Mechanical Services in Buildings:

Introduction of mechanical services - Lift - Definition, Types of Lifts, Design Considerations, Location, Sizes, Component parts - Lift Well, Travel, Pit, Hoist Way, Machine, Buffer, Door Locks, Suspended Rope, Lift Car. Elevators & Escalators -Different types of elevators and Escalators - Freight Elevators-Passenger elevators –Hospital elevators -Uses of different types of elevators and Escalators. Air Conditioning- Definition, Purpose, Principles, Temperature Control, Air Velocity Control, Humidity Control, Air Distribution system, Cleaners, Filters, Spray washers, Electric preceptors, Types of Air Conditioners (Central type, Split Unit).

Unit IV **12 HOURS**

Fire Protection, Acoustic and Sound Insulations:

Introduction- Causes of fire and Effects of fireGeneral Requirements of Fire Resisting building as per IS and NBC 2005-Characteristics of Fire resisting materials- Maximum Travel Distance-ire Fighting Installations for Horizontal Exit, Roof Exit / Fire Lifts, External Stairs- Requirement of good Acoustic -Various sound absolvent- Factors to be followed for noise control in residential building

Unit V **12 HOURS**

Miscellaneous Services and Green Buildings Provisions:

Rain water Harvesting for buildingsConcept of GREEN buildings -Components of GREEN building -Introduction and Significance to Grey water- Components of Grey water system - Management of Grey water system

TEXT BOOKS:

1. A text book on Building Services by R. Udaykumar, Eswar Press, Chennai
2. Building Services by S. M. Patil, Seema Publication, Mumbai Revised edition
3. Heating, Ventilating and Air Conditioning: Analysis and Design, 6th Edition", Faye C. McQuiston, Jerald D. Parker and Jeffrey D. Spitler, John Wiley & Sons

REFERENCE BOOKS:

1. SP 7: 2005 National Building Code of India, Bureau of Indian Standards, BIS, New Delhi
2. Building Construction by B. C. Punmia, Laxmi Publications (P) Ltd., New Delhi
3. IS 3534: 1976 "Outline dimensions of electric lifts"
4. IS1860: 1980 "Code of Practice for Installation, Operation and Maintenance of Electric Passenger and Goods Lifts"

III-Year-II Semester OE3201B	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

The subject provides different disasters, tools and methods for disaster management

Course Outcomes:

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

- Understanding Disasters, man-made Hazards and Vulnerabilities
- Understanding disaster management mechanism
- Understanding capacity building concepts
- Understanding coping Strategies
- Understanding planning of disaster managements

UNIT - I **10 HOURS**

Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional) Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards

UNIT - II **10 HOURS**

Disaster Management Mechanism: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

UNIT - III **10 HOURS**

Capacity Building: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

UNIT - IV **10 HOURS**

Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

UNIT - V **10 HOURS**

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India -

Organizational structure for disaster management in India - Preparation of state and district disaster management plans

TEXT BOOKS:

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.

2. Disaster Management by Mrinalini Pandey Wiley 2014.

3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

REFERENCES:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.

2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

III-Year-II Semester OE3201C	TRAFFIC SAFETY	L	T	P	C
		3	0	0	3

Course Objectives:

At the end course the student able to know the requirements of building services such as

1. This module on the fundamentals of traffic engg. & some of the statistical methods to analyse the traffic safety.
2. The accident interrogations and risk involved with measures to identify the causes are dealt.
3. The role of road safety in planning the urban infrastructures design is discussed.
4. Various mitigation measures to prevent the road accidents are dealt

Unit-I **10 HOURS**

Fundamentals of Traffic Engineering:

Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Traffic Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.

UNIT II **10 HOURS**

Accident Investigations and Risk Management: Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction.

UNIT III **10 HOURS**

Road Safety in Planning and Geometric Design: Vehicle And Human Characteristics, Road Design and Road Equipments, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care.

UNIT IV **10 HOURS**

Role of Urban infrastructure design in safety: Geometric Design of Roads; Design of Horizontal and Vertical Elements, Junctions, At Grade and Grade Separated Intersections, Road Safety in Urban Transport, Sustainable Modes and their safety.

UNIT V **10 HOURS**

Mitigation Measures: Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety; Safety in urban areas; Public transport and safety; Road safety policy making, Stakeholders involvement; Road safety law, Road safety audit.

TEXT BOOKS:

1. Institute of Transportation Engineers (ITE), The Traffic Safety Toolbox: A Primer on Traffic Safety, ITE, 1999. Towards Safe Roads in Developing country, TRL – ODA, 2004.
2. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
3. Fundamentals of Traffic Engineering, Richardo G Sigua

REFERENCE BOOKS:

5. Athelstan Popkess, Traffic Control and Road Accident Prevention, Chapman and Hall, 1997 (Digitized 2008)
6. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, TrulsVaa, Michael Sorenson
7. Ezra Hauer, Observational Before-After Studies in Road Safety, Pergamon Press, 1997 (reprinted 2002).
8. Geetam Tiwari and Dinesh Mohan, Transport Planning and Traffic Safety: Making Cities, Roads, and Vehicles Safer, CRC Press, 2016
9. Fundamentals of Transportation Engineering – C.S. Papacostas, Prentice Hall India.
10. Transportation Engineering – An Introduction, C.Jotinkhisty, B. Kent Lall
11. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson 8. Road Safety by NCHRP.

III-Year-II Semester OE3201D	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

The objective of this course is

1. Able to plan, coordination, and control of a project from beginning to completion.
2. Adopting the most effect method for meeting the requirement in order to produce a functionally and financially viable project.

Unit-I: **10 HOURS**

Management process- Roles. Management theories. Social responsibilities. Planning and strategic management. Strategy implementation. Decision making: tools and techniques – Organizational structure. Human resource management- motivation performance- leadership.

Unit– II: **12 HOURS**

Classification of Construction projects, Construction stages, Resources- Functions of Construction Management and its Applications. Preliminary Planning- Collection of Data- Contract Planning – Scientific Methods of Management.

Unit-III: **14 HOURS**

Network Techniques in construction management - Bar chart, Gant chart, CPM, PERT- Cost & Time optimization.Resource planning - planning for manpower, materials, costs, equipment. Labour -Scheduling - Forms of scheduling - Resource allocation.

Unit-IV: **10 HOURS**

Contract - types of contract, contract document, and specification, important conditions of contract – tender and tender document, Deposits by the contractor– Arbitration- negotiation – M-Book - Muster roll -stores.

Unit-V: **10 HOURS**

Management Information System - Labour Regulations: Social Security - welfare Legislation - Laws relating to Wages, Bonus and Industrial disputes, Labour Administration - Insurance and Safety Regulations - Workmen's Compensation Act -other labour Laws

Safety in construction: Occupational and safety hazard assessment. Human factors in safety.

TEXT BOOKS:

3. Punmia,B,C., Project Planning and Control with PERT and CPM, Laxmi Publications, New Delhi,1987
4. Ghalot, P.S., Dhir, D.M., Construction Planning and Management, Wiley Eastern Limited,1992.

REFERENCE BOOKS:

2. ‘Construction technology and management by S.Seetharaman.

Unit-I:

nagement process- Roles. Management theories. Social responsibilities. Planning and strategic management. Strategy implementation. Decision making: tools and techniques – Organizational structure. Human resource management- motivation performance- leadership.

Unit	Module	Micro content
I. Management process	Introduction	Roles & management theories
		Social responsibilities
		Planning and strategic management
		Decision making: tools and techniques
		Organizational structure
		Human resource management

Unit– II:

Classification of Construction projects, Construction stages, Resources- Functions of Construction Management and its Applications. Preliminary Planning- Collection of Data-Contract Planning – Scientific Methods of Management.

Unit	Module	Micro content
Unit-II	Construction Projects	Classification of Construction projects
		Construction stages
	Resources	Functions of Construction Management and its Applications
	Planning	Preliminary Planning
		Collection of Data
		Contract Planning

Unit-III:

Network Techniques in construction management - Bar chart, milestone chart, CPM, PERT-Cost & Time optimization.Resource planning - planning for manpower, materials, costs, equipment. Labour -Scheduling - Forms of scheduling - Resource allocation

Unit	Module	Micro content
III. Network Techniques in construction management	Scheduling techniques	Bar chart, Milestone chart, CPM & PERT
	Resource Planning	Manpower, materials, cost, labour & equipment
	Scheduling	Forms of scheduling
	Resource allocation	Resource allocation

Unit-IV:

Contract - types of contract, contract document, and specification, important conditions of contract – tender and tender document, Deposits by the contractor– Arbitration- negotiation – M-Book - Muster roll -stores.

Unit	Module	Micro content
IV. Contract	Contract	Types
		Contract document
		Specification
		Important conditions
	Tender	Introduction and tender document
	Deposits	Arbitration
		Negotiation
		M-Book
		Muster roll stores
Management Information System - Labour Regulations: Social Security - welfare Legislation - Laws relating to Wages, Bonus and Industrial disputes, Labour Administration - Insurance and Safety Regulations - Workmen's Compensation Act -other labour Laws **Safety in construction**: Occupational and safety hazard assessment. Human factors in safety.		
Unit	**Module**	**Micro content**
V.Management Information System	Acts & regulations	Labour Regulations
		welfare Legislation
		Laws relating to Wages
		Insurance and Safety Regulations
		Workmen's Compensation Act
	Safety in construction	Occupational and safety hazard assessment
		Human factors in safety

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2				2						3	
CO2	2				2						3	

	PSO1	PSO2	PSO3
CO1	1		2
CO2	1		2

III-Year-II Semester OE3202A	GREEN TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The objective of this course is:

1. To present different concepts of green technologies.
2. To acquire principles of Energy efficient technologies.
3. To impart knowledge on the methods of reducing CO2 levels in atmosphere.
4. To gain knowledge of the importance of life cycle assessment
5. To learn the importance of green fuels and its impact on environment.

UNIT- I **10 HOURS**

Introduction: Green Technology – definition- Importance – Historical evolution – advantages and disadvantages of green technologies-factors affecting green technologies- Role of Industry, Government and Institutions – Industrial Ecology – role of industrial ecology in green technology. Cleaner Production (CP): Definition – Importance – Historical evolution - Principles of Cleaner Production–Benefits–Promotion – Barriers – Role of Industry.

UNIT- II **10 HOURS**

Cleaner Production Project Development and Implementation: Government and Institutions – clean development mechanism, reuse, recovery, recycle, raw material substitution-Wealth from waste, case studies.

Overview of CP Assessment Steps and Skills, Process Flow Diagram, Material Balance, CP Option Generation – Technical and Environmental Feasibility analysis – Economic valuation of alternatives - Total Cost Analysis – CP Financing – Preparing a Program Plan – Measuring Progress- ISO 14000.

UNIT- III **10 HOURS**

Pollution Prevention and Cleaner Production Awareness Plan – Waste audit – Environmental Statement, carbon credit, carbon sequestration, carbon trading, Life Cycle Assessment - Elements of LCA – Life Cycle Costing – Eco Labelling.

UNIT -IV **10 HOURS**

Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Non-conventional energy sources: Solar Energy-solar energy conversion technologies and devices, their principles, working and application.

UNIT- V **10 HOURS**

Green Fuels – Definition-benefits and challenges – comparison of green fuels with conventional fossil fuels with reference to environmental, economical and social impacts- public policies and

market-driven initiatives. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in Indian context; tidal and geothermal energy.

TEXT BOOKS:

1. 'Pollution Prevention: Fundamentals and Practice' by Paul L Bishop (2000), McGraw Hill International.
2. 'Cleaner Production Audit' by Prasad Modak, C.Visvanathan and Mandar Parasnis (1995), Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok 3. 'Non-conventional Energy Sources' by Rai G.D.

REFERENCES:

1. 'Pollution Prevention and Abatement Handbook – Towards Cleaner Production' by World Bank Group (1998), World Bank and UNEP, Washington D.C.

2. 'Handbook of Organic Waste Conversion' by Bewik M.W.M.

3. 'Energy, The Solar Hydrogen Alternative' by Bokris J.O.

4. 'Solar Energy' by Sukhatme S.P.

5. 'Waste Energy Utilization Technology' by Kiang Y. H.

III-Year-II Semester OE3202B	ALTERNATIVE ENERGY SOURCES	L	T	P	C
		3	0	0	3

Course Objectives:

To impart the necessity of finding alternative energy sources for automobiles. To understand merits and demerits, performance characteristics of various sources of fuels and their comparison.

Unit-I: **10 HOURS**

INTRODUCTION: Need for non-conventional energy sources. Energy alternative: solar, photo- voltaic, Hydrogen, Bio mass, Electrical - their merits and demerits.

Solar photo-voltaic conversion, Collection and storage of solar energy, Collection devices, flat plate collectors, concentrating type collectors, Principles and working of photo-voltaic Conversion, Applications to automobiles.

Unit– II: **10 HOURS**

ENERGY FROM BIO MASS: Photosynthesis, Photosynthetic oxygen production, Energy plantation. Bio gas production from organic waste, Description and types of Bio gas plants, Application and limitations -Merits and demerits performance characteristics and their comparison.

Unit-III: **10 HOURS**

HYDROGEN ENERGY: Properties of hydrogen, Sources of Hydrogen, Thermodynamics of water splitting, production of hydrogen- Electrolysis of water, Thermal decomposition of water, Thermo-chemical production, Biochemical production.

Unit-IV: **10 HOURS**

HYDROGEN FUEL: Storage and transportation methods, Applications to engines modifications necessary, precautions and safety measures - Performance characteristics in engine and their comparison.

ELECTRIC AUTOMOBILES: Design considerations, limitations, Opportunities for improvement Batteries, problems. Future possibilities, capacities, types, material requirement.

Unit-V: **10 HOURS**

ELECTRIC AUTOMOBILES: Applicability of electric cars, major parts, battery charging, HVAC, requirements, comparative use of fuel and energy, Availability of energy for recharging; Impacts on use of fuel and energy; Impact on urban air quality, impact on price, material requirement traction motors and types.

TEXT BOOKS:

1. Non-conventional Sources of Energy, G.D. Rai, Khanna Publications.
2. Electric Automobiles, William Hamilton,PHI.
3. Alternative Fuel Technology, Erjavec and Arias, CengageLearning.

REFERENCE BOOKS:

1. Solar Energy, S.P. Sukhatme, Tata McGrawHill.
2. Energy Technology, S. Rao & B.B. Larulekar, KhammaLab.
3. Principles of Solar Engineering, Frank Kreith& Jan F. Krieder, McGrawHill.
4. Solar Energy -thermal Process, J.A. Duffie&W.A. Beckman, McGrawHill.

Course Outcomes:

The students will be able to

CO1: Understand solar photo-voltaic conversion and working principles.

CO2: Understand the different techniques for production of bio gas.

CO3: Understand the production of hydrogen energy

CO4: Design and study of future possibilities of electric automobiles.

CO5: Understand the utilization of energy in various forms.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro-Syllabus of Alternative Energy Sources

Unit-I: INTRODUCTION: Need for non-conventional energy sources. Energy alternative: solar, photo- voltaic, Hydrogen, Bio mass, Electrical - their merits and demerits.

Solar photo-voltaic conversion, Collection and storage of solar energy, Collection devices, flat plate collectors, concentrating type collectors, Principles and working of photo-voltaic Conversion, Applications to automobiles.

Unit	Module	Micro content
Ia. Introduction	Classification of Energy sources	Based on Traditional use
		Based on long-term availability
		Based on origin
	Common forms of energy	Mechanical Energy
		Thermal Energy
		Electrical Energy
		Chemical Energy
	Merits and Demerits	Conventional energy sources (Non-Renewable Energy sources)
		Non-Conventional Energy sources (Renewable energy sources)
	Need for Non-Conventional energy sources	
Ib. Energy Alternative	Merits and De-merits	Solar energy
		Solar-photo voltaic
		Bio-mass
		Electricity
		Hydrogen
Ic. Classification of solar energy collectors	Non- concentrating type solar collector	Solar water heater, solar air heaters
	Concentrating type solar collector	Parabolic trough collector, Mirror strip reflector, Fresnel lens collector, Flat plate collectors with adjustable mirrors, compound parabolic concentrator
Id. Solar energy storage systems	Thermal energy storage	Sensible heat, latent heat
	Electrical energy storage	Capacitor, inductor, battery storage
	Chemical energy storage	Chemical, thermo chemical
	Mechanical energy	Pumped hydro electric storage, compressed air

	storage	
	Electro –magnetic energy storage	Energy storage vie superconducting magnets
Id. Photo-voltaic conversion	Principle, working, construction, Application to automobiles	N-type semiconductor, P-type semi conductor, p-n junction diode

Unit– II: ENERGY FROM BIO MASS: Photosynthesis, Photosynthetic oxygen production, Energy plantation. Bio gas production from organic waste, Description and types of Bio gas plants, Application and limitations -Merits and demerits performance characteristics and their comparison.

Unit	Module	Micro content
IIa. Introduction	Introduction	Biomass definition
		Sources of biomass
		Photosynthesis, Photosynthetic oxygen production
		Energy Plantation
IIb. Energy conversion technologies	Direct combustion	Incineration process
	Thermo chemical conversion	Gasification, Pyrolysis Process
	Bio-chemical conversion	Fermentation, anaerobic digestion of biomass
IIc. Bio gas Production	anaerobic digestion of biomass	Factors effecting generation of gas
IId. bio gas plants	Classification of bio gas plants, applications, advantages and disadvantages	Continuous, batch type, Floating drum and fixed dome type bio gas plants. Comparison of floating drum and fixed dome type bio gas plant. Site selection for bio gas plants.

Unit-III: HYDROGEN ENERGY: Properties of hydrogen, Sources of Hydrogen, Thermodynamics of water splitting, production of hydrogen- Electrolysis of water, Thermal decomposition of water, Thermo-chemical production, Biochemical production.

Unit	Module	Micro content
IIIa. Introduction	Introduction	Properties of hydrogen
		Sources of hydrogen
IIIb. Production of hydrogen	Electrolysis or electrolytic production of hydrogen	Tank type electrolyzer, filter press electrolyzer
	Thermo-chemical methods	Westinghouse electrochemical thermal sulphur cycle, Ispra mark 13 cycle, Iodine-Sulphur cycle
	Solar energy methods	Biophotolysis, photoelectrolysis

Unit-IV: HYDROGEN FUEL: Storage and transportation methods, Applications to engines modifications necessary, precautions and safety measures - Performance characteristics in engine and their comparison.

ELECTRIC AUTOMOBILES: Design considerations, limitations, Opportunities for improvement Batteries, problems. Future possibilities, capacities, types, material requirement.

Unit	Module	Micro content
IVa. Hydrogen fuel	storage	Compressed gas storage, liquid storage, line packing, underground storage, metal hydrides
	Transportation	Pipe lines, liquid hydrogen transportation, metal hydride transportation
	Utilization of hydrogen energy	Residential uses, industrial uses, road vehicles, air craft applications, electric power generation
	Precautions and safety measures	Precautions and safety measures, performance characteristics in engines
IVb. Electric Automobiles	Introduction	Design considerations, limitations, Opportunities for improvement Batteries, problems, Future possibilities, capacities, types, material requirement.
	Future possibilities, capacities	Future possibilities, capacities
	Types, material requirement.	types, material requirement.
Unit-V: ELECTRIC AUTOMOBILES: Applicability of electric cars, major parts, battery charging, HVAC, requirements, comparative use of fuel and energy, Availability of energy for recharging; Impacts on use of fuel and energy; Impact on urban air quality, impact on price, material requirement traction motors and types.		
Unit	**Module**	**Micro content**
Va. Electric Automobiles	Electric cars	Applications, major parts, battery charging
Vb. HVAC	HVAC	Requirements, comparative use of fuel and energy, Impact on urban air quality, impact on price, material requirement traction motors and types.
	Availability of energy for recharging; Impacts on use of fuel and energy	Availability of energy for recharging; Impacts on use of fuel and energy
	Impact on urban air quality, impact on price	Impact on urban air quality, impact on price
Vc. Traction motors	Traction motors	Material requirement traction motors and types.

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2						2					
CO2	2						2					
CO3	2						2					
CO4	1		2				2					
CO5	2						2					

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III-Year-II Semester	ELEMENTS OF CIVIL ENGINEERING	L	T	P	C
OE3202C		3	0	0	3

Course Objectives:

The objectives of this course are to make students to learn about

1. Basics of Civil Engineering concepts
2. The surveying, elevations and mapping
3. The construction materials and elements
4. Water resource development

Unit-I **12 HOURS**

Scope of Civil Engineering: **Introduction**: Impact of Infrastructural Development on the Economy of a Country, Role of Civil Engineers, Importance of Planning, Scheduling and Construction Management.

Surveying: Introduction: Surveying and levelling, Object and uses, Primary divisions, Fundamental principles, Classification of surveying, Plans and maps, Scales, Units of measure.

Unit-II **14 HOURS**

Compass surveying:

Types and uses of compass, Bearings, Whole Circle Bearings, and Reduced Bearings, Computation of angles; Meridians; declinations and dip of needle; Local attraction; compass surveying field work.

Elevation measurements:

Levelling, object and uses, terms used in levelling, levelling instruments, methods of levelling, recording and methods of reducing, errors in levelling, contours; characteristics and applications.

Modern Tools of Surveying and Mapping:

Introduction to Theodolite, Electronic Distance Measurement Instruments, Total Station, Global Positioning System, Remote Sensing and Geographic Information System.

Unit-III **10 HOURS**

Construction Materials Requirement, types, uses, properties and importance of Civil Engineering materials like Stone, Bricks, Lime, Cement, Ferrous and Non-Ferrous Metals, Ceramic Materials, Timber, Sand, Aggregate, Mortar and Concrete, Paints and Varnishes, Glass, Plastic, Conducting, Magnetic, and Miscellaneous Materials.

Unit-IV **10 HOURS**

Elements of Building Construction:

Planning: Elementary principles and basic requirements of a building planning, layout of residential & industrial buildings.

Construction: Classification of buildings based upon occupancy and structure, Design Loads, Common building components, their functions, and nominal dimensions. Elements of building drawing. Introduction to building byelaws.

Unit-V **10 HOURS**

Water Resources Development Elementary:

Hydrology, Sources of water, Watershed Development, water requirements and its conservation, Hydraulic Structures of Storage, Water Conveyance System: Canals; Water Conduits.

TEXT BOOKS:

1. Surveying Vol. I & II, Dr. B. C. Punamia Laxmi Publication, Delhi

2. Building Construction, Dr. B. C. Punamia Laxmi Publication, Delhi

3. Engineering Material, Dr. S.C. Rangwal, Charotar Pub. House

4. Irrigation Engineering and Hydraulic Structures, Santoshkumar Garg, : Khanna Publishers Delhi

5. Elements of Civil Engineering (IV Edition) by S.S. Bhavikatti, New Age International Publisher, New Delhi, 3rd edition

REFERENCE BOOKS:

1. Civil Engineering Material, Jakson and Dhir, ELBS Publishing London

2. Civil Engg. Drawing, S. C. Rangwal, Charotar Pub. House Anand

III-Year-II Semester OE3202D	GEO-SPATIAL TECHNOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the fundamentals of GIS and Coordinate systems
2. To study about data acquisition and data management process.
3. To impart knowledge about the data modeling and GIS analysis and its functions
4. To deal with the various applications of GIS in Civil Engineering
5. To give an introduction about remote sensing and its applications

UNIT –I **10 HOURS**

Introduction – Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems.

Projections and Coordinate Systems – Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations, map
analysis.

UNIT –II **10 HOURS**

Data Acquisition: Data Types, Spatial, Non-Spatial (Attribute) Data, Data Format – Vector and Raster Data, Manual Digitizing, Scanner, Aerial Photographic Data, Remotely Sensed Data, Digital
Data, Cartographic Database, Digital Elevation Data.

Data Management: Data Storage and Maintenance, Data Compression, Data Quality and Standards, Precision, Accuracy, Error – Geometric errors and corrections, Radiometric errors and corrections, types of Systematic and Non-systematic errors.

UNIT –III **12 HOURS**

Data Modeling: Spatial Data Analysis, Data Retrieval Query, Simple Analysis, Recode Overlay, Vector Data Model, Raster Data Model, Digital Elevation Model, Cost and Path Analysis, Knowledge Based System.

GIS Analysis and Functions: Organizing data for analysis, analysis function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching
and editing, maintenance and analysis of spatial and non-spatial data.

UNIT –IV **12 HOURS**

Applications of GIS: Environmental and Natural Resource Management, Soil and Water Resources, Agriculture, Land Use Planning, Geology and Municipal Applications, Urban Planning and Project Management, GIS for decision making under Uncertainty, standard GIS packages, Introduction to Global Positioning Systems (GPS) and its applications.

UNIT – V **12 HOURS**

Introduction to Remote Sensing: General background of Remote Sensing Technology, Objectives
and Limitations of Remote Sensing, Electro-Magnetic Radiation, Characteristics, Interaction with
Atmosphere and Earth Surface, Remote Sensing Platforms and Sensors, Satellite Characteristics, Digital Image Processing, IRS Series and High Resolution Satellites, Remote Sensing

Applications to Watershed Modeling, Environmental Modeling, Urban Planning and Management.

TEXT BOOKS:

1. Demers, M.N, (2013). *'Fundamentals of Geographic Information Systems'* Wiley India Pvt. Ltd,.
2. Burrough, P. A., and McDonnell R. A. (1998). *Principles of Geographical Information Systems.* Oxford University Press, New York.
3. Kang-tsung Chang. (2006). *Introduction to Geographical Information Systems.* Tata McGraw- Hill Publishing Company Ltd., Third Edition, New Delhi.
4. George Joseph, (2013). *'Fundamentals of Remote Sensing'* Universities Press.

REFERENCE BOOKS:

1. Sabins F.F. Jr. (1978). *Remote Sensing Principles and Interpretations.* W.H. Freeman and Company, San Francisco.
2. Tor Bernhardsen. (2002). *Geographical Information System.* Wiley India (P) Ltd., Third Edition, New Delhi.
3. Hoffman-Wellenhof, B, et al. (1997). *GPS Theory and Practice.* Fourth Edition, Springer Wein, New York.
4. Lilysand T.M., and Kiefer R.W. (2002). *Remote Sensing and Image Interpretation*. John Wiley and Sons, Fourth Edition, New York.
5. Choudhury S., Chakrabarti, D., and Choudhury S. (2009). *An Introduction to Geographic Information Technology.* I.K. International Publishing House (P) Ltd, New Delhi.

COURSE OUTCOMES:

The students will be able to

CO1: To understand and remember the concepts of GIS, Projections and Coordinate systems

CO2: To classify and explain various data acquisition and data management techniques.

CO3: To study, model and analyze various data collected.

CO4: To apply the knowledge of GIS in Civil Engineering stream

CO5: To understand the concepts of Remote sensing and its applications.

BL – Bloom's Taxonomy Levels

1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating

Micro- Syllabus of Geo-Spatial Technology

UNIT –I

Introduction **–** Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems.

Projections and Coordinate Systems – Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations, map analysis.

Unit	Module	Micro content
Ia. Introduction	Introduction to GIS	Fundamentals of GIS
		History of GIS
		Components of GIS
Ib. Projections and Coordinate Systems	Maps, Projections and Coordinate system	Map definitions
		Representations of point, line, polygon, common coordinate system
		Geographic coordinate system
		Map projections, transformations, map analysis.

UNIT –II

Data Acquisition: Data Types, Spatial, Non-Spatial (Attribute) Data, Data Format – Vector and Raster Data, Manual Digitizing, Scanner, Aerial Photographic Data, Remotely Sensed Data, Digital
Data, Cartographic Database, Digital Elevation Data.

Data Management: Data Storage and Maintenance, Data Compression, Data Quality and Standards, Precision, Accuracy, Error – Geometric errors and corrections, Radiometric errors and corrections, types of Systematic and Non-systematic errors.

Unit	Module	Micro content
IIa. Data Acquisition	Data types	Spatial data
		Non-Spatial data
	Data Format	Vector and Raster Data, Manual Digitizing, Scanner, Aerial Photographic Data, Remotely Sensed Data, Digital Data, Cartographic Database, Digital Elevation Data.
IIb. Data Management	Data Management	Data Storage and Maintenance, Data Compression, Data Quality and Standards
	Precision, Accuracy and Error	Geometric errors and corrections, Radiometric errors and corrections, types of Systematic and Non-systematic errors.

UNIT –III

Data Modeling: Spatial Data Analysis, Data Retrieval Query, Simple Analysis, Recode Overlay, Vector Data Model, Raster Data Model, Digital Elevation Model, Cost and Path Analysis, Knowledge Based System.

GIS Analysis and Functions: Organizing data for analysis, analysis function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching
and editing, maintenance and analysis of spatial and non-spatial data.

Unit	Module	Micro content
IIIa. Data modelling	Data analysis	Spatial Data Analysis, Data Retrieval Query, Simple Analysis, Recode Overlay

	Data model	Vector Data Model, Raster Data Model, Digital Elevation Model.
	Cost and Path Analysis and Knowledge Based System.	Conceptual theory
IIIb. GIS Analysis and Functions	Organizing and maintenance of data	Organizing data for analysis, analysis function, maintenance and analysis of spatial data
	GIS Analysis	Buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non-spatial data.

UNIT –IV

Applications of GIS: Environmental and Natural Resource Management, Soil and Water Resources, Agriculture, Land Use Planning, Geology and Municipal Applications, Urban Planning and Project Management, GIS for decision making under Uncertainty, standard GIS packages, Introduction to Global Positioning Systems (GPS) and its applications.

Unit	**Module**	**Micro content**
IV. Applications of GIS	Applications	Environmental and Natural Resource Management, Soil and Water Resources, Agriculture
		Land Use Planning, Geology and Municipal Applications, Urban Planning and Project Management
	GIS and GPS	GIS for decision making under Uncertainty, standard GIS packages, Introduction to Global Positioning Systems (GPS) and its applications.

UNIT – V

Introduction to Remote Sensing: General background of Remote Sensing Technology, Objectives and Limitations of Remote Sensing, Electro-Magnetic Radiation, Characteristics, Interaction with Atmosphere and Earth Surface, Remote Sensing Platforms and Sensors, Satellite Characteristics, Digital Image Processing, IRS Series and High Resolution Satellites, Remote Sensing Applications to Watershed Modeling, Environmental Modeling, Urban Planning and Management.

Unit	**Module**	**Micro content**
V. Introduction to remote sensing	Introduction	General background of Remote Sensing Technology, Objectives and Limitations of Remote Sensing
		Electro-Magnetic Radiation, Characteristics, Interaction with Atmosphere and Earth Surface, Remote Sensing Platforms and Sensors

	Characteristics	Satellite Characteristics, Digital Image Processing, IRS Series and High Resolution Satellites
	Applications	Watershed Modeling, Environmental Modeling, Urban Planning and Management

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2										2	
CO2	2			2							2	
CO3	2	2		2							2	
CO4	2				1						2	1
CO5	2				1						2	1

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III-Year-II Semester	ENVIRONMENTAL ENGINEERING LAB	L	T	P	C
PC3201L		0	0	3	1.5

Course Objectives:

This course deals with the laboratory approaches of determining certain major parameters related to water and wastewater quality and analyzing the laboratory data with respect topermissible limits and field conditions.

Course Outcomes:

At the end of the course the students can able to

CO1: Assess physical parameters of water as turbidity and colour
CO2: Determine the chemical characteristics as pH, TDS
CO3: Assess pollution characteristics of waste water by analyzing DO, BOD and COD
CO4: Assess the total hardness of a given water sample
CO5: Calculate the amount of coagulant required for optimum sedimentation for a given turbid sample

LIST OF EXPERIMENTS

The following tests are to be performed on a water/wastewater sample.

1. Determination of pH value and Conductivity.
2. Determination of Turbidity of water sample.
3. Determination of TDS in water sample.
4. Determination of Total, temporary and permanent hardness of water sample.
5. Determination of Total, Calcium and Magnesium hardness of water sample.
6. Determination of Chloride concentration of water sample.
7. Determination of Acidity of water sample.
8. Determination of Alkalinity of water sample.
9. Determination of Fluorides in water sample.
10. Determination of Iron.
11. Determination of Sulphates in water sample.
12. Determination of Residual chlorine in water sample.
13. Determination of Dissolved Oxygen of water sample.
14. Determination of Optimum dose of coagulant.
15. Determination of Settleable solids using Imhoff cone in sewage sample.
16. Determination of Suspended, fixed and volatile solids in sewage sample.
17. Determination of Total, fixed and volatile solids in sewage sample.
18. Determination of Biochemical Oxygen Demand (BOD) of sewage.
19. Determination of Chemical Oxygen Demand (COD) of sewage.

Note: A minimum of twelve (12No) shall be done and recorded

TEXT BOOK/REFERENCE

Laboratory manual prepared by Civil Engineering Department

REFERENCES:

1. National Environmental Engineering Research Institute, "Laboratory manual on water analysis", NEERI, Nagpur, India, 1987.
2. Sawyer and Mc Carty, "Chemistry for Environmental Engineering" McGraw-Hill, 1978.

3. Relevant IS Codes.
4. Chemistry for Environmental Engineering by Sawyer and McCarty.

Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		2								
CO2	3	2		2								
CO3	3	3		2								
CO4	3	2		2								
CO5	3	2		2	3							

III-Year-II Semester PC3202L	GEOTECHNICAL ENGINEERING LAB	L	T	P	C
		0	0	3	1.5

Course Outcomes:

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

CO1: Identify index properties of soils for classification purposes
CO2: Estimate the soil permeability
CO3: Determine the settlement characteristics of soils
CO4: Determine the compaction characteristics of soils
CO5: Estimate the strength parameters of soils

Note: A minimum of **10** experiments are to be performed from the following

List of Experiments:

1. Sieve Analysis
2. Sedimentation Analysis
3. Specific Gravity Test
4. Field density- Core cutter and Sand Replacement Methods
5. Atterberg's Limits.
6. Permeability of soil using Constant Head test and Variable Head test
7. Compaction Test
8. CBR Test
9. Consolidation Test (Demonstration)
10. Unconfined Compression Test
11. Direct Shear Test.
12. Vane Shear Test
13. Triaxial Test(UU)

TEXT BOOK/REFERENCE

Laboratory manual prepared by Civil Engineering Department

REFERENCES:

1. IS 2720 all parts.
2. IS 9198-1979, Specification for compaction hammer for soil testing.
3. IS:10074-1982, Specification for compaction mould assembly for light and heavy compaction test for soils.
4. Braja.M.Das, "Geotechnical Engineering Handbook", Cengage Learning, 1st Edition, 2014.

Mapping

Mapping	PO1	PO4	PO10
CO1	3	2	1
CO2	3	2	1
CO3	3	2	1
CO4	3	2	1
CO5	3	2	1

TEXT BOOK:

1. American Public Health Association, "Standard Methods for Analysis of Water and Wastewater", APHA, Washington, 1992.
2. Chemical Analysis of Water and Soil by KVSG Murali Krishna, Reem Publications, New Delhi, 2010.
3. Laboratory Manual developed by Civil Engineering Department.

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III-Year-II Semester PROJ3201	MINI PROJECT	L	T	P	C
		0	0	3	1.5

III-Year-II Semester MC3201	EMPLOYABILITY SKILLS - I	L	T	P	C
		2	0	0	0