# Curriculum for UG Degree Course in Civil Engineering

## Regulation 2022

CHENNAI INSTITUTE OF TECHNOLOGY

**Document Version**

| Version Number | Date | Author | Major Updates | Approved by |
|---|---|---|---|---|
| 1 | 28.03.2024 | Dr P.Vasanthi | Format and Font needs to be changed | Dr.P.Partheeban |
| 2 | 24.04.2024 | Mr.C.Hariharasudhan | Credits, Course code and Appendix list updated | Dr.P.Partheeban |
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## Section 1: General Course Structure

### A. Definition of Credit:

| | |
|---|---|
| 1 Hour Lecture (L) per week | 1 Credit |
| 1 Hour Tutorial (T) per week | 1 Credit |
| 1 Hour Practical (P) per week | 0.5 Credit |

### B. Structure of Program

| S. No. | Category | Credits |
|---|---|---|
| 1 | Humanities & Social Science Courses (HSMC) | 11 |
| 2 | Basic Science Courses (BSC) | 24 |
| 3 | Engineering Science Courses (ESC) | 20 |
| 4 | Program Core Courses (PCC) | 70 |
| 5 | Professional Elective Courses (PEC) | 18 |
| 6 | Open Elective Courses (OEC) | 06 |
| 7 | Employability Enhancement Skills (EEC) | 20 |
| 8 | Mandatory Course (MC) | - |
| | **TOTAL** | **169** |

### C. Course code and definition

| Code | Definition |
|---|---|
| L | Lecture |
| T | Tutorial |
| P | Practical |
| C | Credits |
| CE | Professional core courses |
| CEPE | Professional Elective courses |
| CEOE | Open Elective Courses |
| MC | Mandatory Courses |

- **Course level coding scheme:** Four-digit number used as suffix with the Course Code for identifying the level of the course. Thousand's place denotes regulation number (we use "3" for 2022-23 Regulation) Digit at hundred's place signifies the semester in which course is offered. Last two digits represent the serial order of course within the semester. For example, 3101, 3102, … are courses offered during first semester.

### D. Category-wise Courses

**Humanities & Social Science Courses (HSMC)**

| S. No. | Course Title | Semester | L-T-P-C |
|---|---|---|---|
| 1. | Communicative English - I | I | 3-0-0-3 |

| | | | |
|---|---|---|---|
| 2. | தமிழர் மரபு /Heritage of Tamils | III | 1-0-0-1 |
| 3. | தமிழரும் தொழில் நுட்பமும் / Tamils and Technology | IV | 1-0-0-1 |
| 4. | Total Quality Management | VII | 3-0-0-3 |
| | | **Total Credits** | **08** |

**Basic Science Courses (BSC)**

| S. No. | Course Title | Semester | L-T-P-C |
|---|---|---|---|
| 1. | Matrices and Calculus | I | 3-1-0-4 |
| 2. | Engineering Physics | I | 3-0-0-3 |
| 3. | Engineering Chemistry | I | 3-0-0-3 |
| 4. | Physics and Chemistry Laboratory | I | 0-0-4-2 |
| 5. | Differential Geometry and Complex Analysis | II | 3-0-0-3 |
| 5. | Applied Physics for Civil Engineering | II | 3-0-0-3 |
| 6. | Transforms and Partial Differential Equations | III | 3-1-0-3 |
| 7. | Statistics and Numerical Methods | IV | 3-0-0-3 |
| | **Total Credits** | | **24** |

**Engineering Science Courses (ESC)**

| S. No. | Course Title | Semester | L-T-P-C |
|---|---|---|---|
| 1. | Problem Solving using C- Programing | I | 3-0-2-4 |
| 2. | Engineering Graphics | II | 2-0-4-4 |
| 3. | Engineering Mechanics | II | 3-1-0-4 |
| 4. | Fundamentals of Electrical and Electronics Engineering | II | 3-0-2-4 |
| 5 | Problem Solving using Python Programing | II | 3-0-2-4 |
| | | **Total Credits** | **20** |

**Program Core Courses (PCC)**

| S. No. | Course Title | Semester | L-T-P-C |
|---|---|---|---|
| 1. | Applied Structural Mechanics | III | 3-0-0-3 |
| 2. | Fluid Mechanics | III | 3-0-0-3 |
| 3. | Civil Engineering Materials and Construction | III | 3-0-2-4 |
| 4. | Surveying and Levelling | III | 3-0-0-3 |
| 5. | Principles and Techniques of Data Sciences | III | 3-0-0-3 |
| 6. | Surveying Laboratory | III | 0-0-4-2 |

| | | | |
|---|---|---|---|
| 7. | Application of IOT in Civil Engineering | III | 0-0-2-1 |
| 8. | Computer Aided Building Design Project | III | 0-0-4-2 |
| 9. | Theory of Structures -I | IV | 3-0-0-3 |
| 10. | Soil Mechanics | IV | 3-0-0-3 |
| 11. | Open Channel Hydraulics and Fluid Machinery | IV | 3-0-0-3 |
| 12. | Highway and Railway Engineering | IV | 3-0-0-3 |
| 13. | Advanced Surveying (Drone, GIS, Astronomy) | IV | 3-0-0-3 |
| 14. | Hydraulics Machinery Laboratory | IV | 0-0-4-2 |
| 15. | Strength of Materials Laboratory | IV | 0-0-4-2 |
| 16. | Project Work Using Drone and GIS | IV | 0-0-2-1 |
| 17. | Theory of Structures – II | V | 3-0-0-3 |
| 18. | Foundation Engineering | V | 3-0-0-3 |
| 19. | Design of Steel Structures | V | 3-0-0-3 |
| 20. | Design of Reinforced Concrete Structures Elements | V | 3-0-0-3 |
| 21. | Water Supply and Wastewater Engineering | V | 3-0-0-3 |
| 22. | Soil Mechanics Laboratory | V | 0-0-2-2 |
| 23. | Water Quality Analysis Laboratory | V | 0-0-2-2 |
| 24. | Data Sciences -Application Project | V | 0-0-2-1 |
| 25. | Estimation, Costing and Valuation Engineering | VI | 3-0-2-4 |
| 26. | Building Information Modelling | VI | 3-0-2-4 |
| 27. | Analysis and Design Software | VI | 0-0-4-2 |
| 28. | Prestressed Concrete Structures | VII | 3-0-0-3 |
| 29. | Project Work Phase -I | VII | 0-0-2-2 |
| 30. | Project Work Phase -II | VIII | 0-0-2-10 |
| | | **Total Credits** | **86** |

**Professional Elective courses**

| S. No. | Course Title | Semester | L-T-P-C |
|---|---|---|---|
| 1 | Professional Elective – I | V | 3-0-0-3 |
| 2 | Professional Elective – II | V | 3-0-0-3 |
| 3 | Professional Elective – III | VI | 3-0-0-3 |
| 4 | Professional Elective – IV | VI | 3-0-0-3 |
| 5 | Professional Elective – V | VII | 3-0-0-3 |
| 6 | Professional Elective – VI | VII | 3-0-0-3 |
| | | **Total Credits** | **18** |

**Open Elective Courses (OEC)**

| S. No. | Course Title | Semester | L-T-P-C |
|---|---|---|---|
| 1 | Open Elective – I | VI | 2-0-2-3 |
| 2 | Open Elective – II | VII | 2-0-2-3 |
| | | **Total Credits** | **06** |

**Mandatory Course (MC)**

| S. No. | Course Title | Semester | L-T-P-C |
|---|---|---|---|
| 1. | Universal Human Values | III | 3-0-0-0 |
| 2. | Introduction to Women and Gender Studies | III | 3-0-0-0 |
| 3. | Well Being with Traditional Practices - Yoga, Ayurveda and Siddha | III | 3-0-0-0 |
| 4. | Elements of Literature | III | 3-0-0-0 |
| 5. | Film Appreciation | III | 3-0-0-0 |
| 6. | Disaster Risk Reduction and Management | IV | 3-0-0-0 |
| 7. | History of Science and Technology in India | IV | 3-0-0-0 |
| 8. | Political and Economic Thought for a Humane Society | IV | 3-0-0-0 |
| 9. | State, Nation Building and Politics in India | IV | 3-0-0-0 |
| 10. | Industrial Safety | IV | 3-0-0-0 |
| | | **Total Credits** | **0** |

**Employability Enhancement Courses (EEC)**

| S. No. | Course Title | Semester | L-T-P-C |
|---|---|---|---|
| 1. | Communicative English Laboratory - I | I | 0-0-2-1 |
| 2. | Employability Enhancement Skills I | I | 0-0-2-1 |
| 3. | Communicative English II | II | 2-0-2-3 |
| 4. | Employability Enhancement Skills II | II | 0-0-2-1 |
| 5. | Project - Introduction with Industry (During Summer Vacation) | IV | 0-0-2-1 |
| | | **Total Credits** | **07** |

## E. Induction Program

- ***Catapult*** is a dynamic week-long event designed for our incoming first-year students, offering an immersive introduction to the diverse array of clubs and activities across the college campus. In addition to familiarizing them with our labs and Centers of Excellence (COEs),

- Catapult aims to acclimate first-year students to college life, ensuring they feel at ease with the forthcoming experiences of their four-year journey.
- This initiative fosters meaningful connections between seniors and juniors, providing a platform for them to explore departmental projects and engage in collaborative activities, thereby enhancing camaraderie and knowledge sharing within the college community.

**F. Evaluation Scheme**

**a. For Theory Courses:**

The weightage of Internal assessment is 40% and for End Semester Exam is 60%
The student has to obtain at least 50% marks individually both in internal assessment and end semester exams to pass.

**b. For Practical Courses:**

The weightage of Internal assessment is 60% and for End Semester Exam is 40%
For Theory cum Lab
The student has to obtain at least 50% marks individually both in internal assessment and end semester exams to pass.

**c. For Theory Cum Practical Courses:**

The weightage of Internal assessment is 50% and for End Semester Exam is 50%
The student has to obtain at least 50% marks individually both in internal assessment and end semester exams to pass

**Note**: The internal assessment is based on the student's performance in 3 Internal Assessment (IA) exams, quizzes, assignments, class performance, attendance, etc.

**d. For Project works:**

Assessment of project works comprises three internal reviews and an end-of-semester evaluation. Internal reviews, worth 40 marks in total, encompass assessment criteria such as Project Synopsis/Proposal Evaluation, Methodology and Design of Existing System, Feasibility of Project Proposal, Planning of Project Work, and TeamWork. At the conclusion of the semester, 20 marks are designated for assessing the quality of the report, while the remaining 40 marks are reserved for evaluating performance in viva-voce, demonstration of the work, and other relevant factors.

**G. Learning Beyond Class Room**

a. Students should be encouraged to visit Centers of Excellence (COEs) in the campus and learn additional technical skills
b. Students should be encouraged to participate in internal / external competitions, hackathons, etc. on a regular basis

**Section 2: Semester wise Structure and Curriculum for UG Course in CIVIL ENGINEERING**

| Semester I | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **Theory/ Practical / T&P** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1. | T | IP2100 | Induction Programme | | | | |
| 2. | T | HS2101 | Communicative English - I | 3 | 0 | 0 | 3 |
| 3. | T | MA2102 | Matrices and Calculus | 3 | 1 | 0 | 4 |
| 4. | T | PH2103 | Engineering Physics | 3 | 0 | 0 | 3 |
| 5. | T | CH2104 | Engineering Chemistry | 3 | 0 | 0 | 3 |
| 6. | T | CS2105 | Problem Solving using Python | 3 | 0 | 0 | 3 |
| 7. | T | ES2106 | Employability Enhancement Skills I | 3 | 0 | 0 | 1 |
| 8. | P | BS2107 | Physics and Chemistry Laboratory | 0 | 0 | 2 | 2 |
| 9. | P | CS2108 | Problem Solving using Python Laboratory | 0 | 0 | 2 | 2 |
| 10. | P | HS2109 | Communicative English Laboratory - I | 0 | 0 | 2 | 1 |
| | | | | | | **Total** | **22** |

| Semester II | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **Theory/ Practical / T&P** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1. | T | MA2204 | Vector Calculus and Complex Analysis | 3 | 0 | 0 | 3 |
| 2. | T | PH2203 | Applied Physics for Civil Engineering | 3 | 0 | 0 | 3 |
| 3. | T | ME2201 | Engineering Mechanics | 3 | 0 | 0 | 3 |
| 4. | T | EE2211 | Fundamentals of Electrical and Electronics Engineering | 3 | 0 | 0 | 3 |
| 5. | T & P | ME2202 | Engineering Graphics | 2 | 0 | 4 | 4 |
| 6. | T & P | CS2211 | Fundamentals of C Programing | 2 | 0 | 2 | 3 |
| 7. | T & P | HS2201 | Communicative English II | 2 | 0 | 2 | 3 |
| 8. | T | ME2203 | Engineering Practice Laboratory | 0 | 0 | 4 | 2 |
| 9. | P | ES2201 | Employability Enhancement Skills II | 0 | 0 | 2 | 1 |
| | | | | | | **Total** | **25** |

| Semester III | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **Theory/ Practical / T&P** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1. | T | MA2301 | Transforms and Partial Differential Equations | 3 | 1 | 0 | 3 |
| 2. | T | CE2301 | Applied Structural Mechanics | 3 | 0 | 0 | 3 |
| 3. | T& P | CE2302 | Fluid Mechanics | 3 | 0 | 0 | 3 |
| 4. | T& P | CE2303 | Surveying and Levelling | 3 | 0 | 0 | 3 |
| 5. | T & P | AD2304 | Principles and Techniques of Data Sciences | 3 | 0 | 0 | 3 |
| 6. | T | MC23** | Mandatory Course -I | 1 | 0 | 0 | 0 |
| 7. | T | HS2301 | தமிழர்மரபு /Heritage Of Tamils | 1 | 0 | 0 | 1 |
| 8. | T & P | CE2305 | Civil Engineering Materials and Construction | 3 | 0 | 2 | 4 |
| 9. | P | CE2306 | Computer Aided Building Design Project | 0 | 0 | 4 | 2 |
| 10. | P | CE2307 | Surveying Laboratory | 0 | 0 | 4 | 2 |
| 11. | P | CE2308 | Application of IOT in Civil Engineering | 0 | 0 | 2 | 1 |
| | | | | | | **Total** | **25** |

| Semester IV | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **Theory/ Practical / T&P** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1. | T | MA2402 | Statistics and Numerical Methods | 3 | 0 | 0 | 3 |
| 2. | T | CE2401 | Theory of Structures -I | 3 | 0 | 0 | 3 |
| 3. | T | CE2402 | Soil Mechanics | 3 | 0 | 0 | 3 |
| 4. | T | CE2403 | Open Channel Hydraulics and Fluid Machinery | 3 | 0 | 0 | 3 |
| 5. | T | CE2404 | Highway and Railway Engineering | 3 | 0 | 0 | 3 |
| 6. | T | CE2405 | Advanced Surveying (Drone, GIS, Astronomy) | 3 | 0 | 0 | 3 |
| 7. | T | MC24** | Mandatory Course -II | 1 | 0 | 0 | 0 |
| 8. | T | HS2401 | தமிழரும் தொழில்நுட்பமும் / Tamils and Technology | 1 | 0 | 0 | 1 |
| 9. | P | CE2406 | Hydraulics Machinery Laboratory | 0 | 0 | 4 | 2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10. | P | CE2407 | Strength of Materials Laboratory | 0 | 0 | 4 | 2 |
| 11 | P | CE2408 | Project Work Using Drone and GIS | 0 | 0 | 2 | 1 |
| 12. | P | CE2409 | Project - Introduction with Industry (During Summer Vacation) | 0 | 0 | 1 | 1 |
| | | | | | | **Total** | **25** |
| | | | | | | | |

| **Semester V** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **Theory/ Practical / T&P** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1. | T | CE2501 | Theory of Structures – II | 3 | 0 | 0 | 3 |
| 2. | T | CE2502 | Design of Reinforced Concrete Structures Elements | 3 | 0 | 0 | 3 |
| 3. | T | CE2503 | Foundation Engineering | 3 | 0 | 0 | 3 |
| 4. | T | CE2504 | Design of Steel Structures | 3 | 0 | 0 | 3 |
| 5. | T | CE2505 | Water Supply and Wastewater Engineering | 3 | 0 | 0 | 3 |
| 6. | T | CEPE3*** | Professional Elective -I | 3 | 0 | 0 | 3 |
| 7. | T | CEPE3*** | Professional Elective -II | 3 | 0 | 2 | 3 |
| 8. | P | CE2506 | Soil Mechanics Laboratory | 0 | 0 | 2 | 2 |
| 9. | P | CE2507 | Data Sciences -Application Project | 0 | 0 | 2 | 1 |
| 10. | P | CE2508 | Water Quality Analysis Laboratory | 0 | 0 | 2 | 2 |
| **Total** | | | | | | | **26** |

| **Semester VI** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **Theory/ Practical / T&P** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1. | T & P | CE2601 | Estimation, Costing and Valuation Engineering | 3 | 0 | 2 | 4 |
| 2 | T & P | CE2602 | Building Information Modelling | 3 | 0 | 2 | 4 |
| 3. | T | CEPE3*** | Professional Elective -III | 3 | 0 | 0 | 3 |
| 4. | T | CEPE3*** | Professional Elective -IV | 3 | 0 | 0 | 3 |
| 5. | T & P | CEOE3*** | Open Elective - I | 2 | 0 | 2 | 3 |
| 6. | P | CE2603 | Analysis and Design Software | 0 | 0 | 4 | 2 |
| | | | | | | **Total** | **19** |

| Semester VII | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **Theory/ Practical / T&P** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1. | T | CE2701 | Prestressed Concrete Structures | 3 | 0 | 0 | 3 |
| 2. | T | HS2702 | Total Quality Management | 3 | 0 | 0 | 3 |
| 3. | T | CEPE3*** | Professional Elective- V | 3 | 0 | 0 | 3 |
| 4. | T | CEPE3*** | Professional Elective- VI | 3 | 0 | 0 | 3 |
| 5. | T& P | CEOE3*** | Open Elective - II | 2 | 0 | 2 | 3 |
| 6. | P | CE2702 | Project Work Phase -I | 0 | 0 | 2 | 2 |
| | | | | | | **Total** | **17** |

| Semester VIII | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **Theory/ Practical / T&P** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1. | P | CE2801 | Project Work Phase-II | 0 | 0 | 20 | 10 |
| | | | | | | **Total** | **10** |

| Course Code | Communicative English - I | L | T | P | C |
|---|---|---|---|---|---|
| HS2101 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To enhance vocabulary competency.
- To learn to use basic grammatical structures in suitable contexts.
- To identify syntax errors in a written text.
- To make learners write instructions, recommendations, and product descriptions.
- To develop learners' ability to write summaries, articles, blogs, definitions and essays.

**UNIT I (a) INTRODUCTION TO EFFECTIVE COMMUNICATION 1**

What is effective communication? Why is communication critical for excellence during Study, research, and work? What are the seven C's of effective communication?

**UNIT I (b) FUNDAMENTALS OF COMMUNICATION 8**

**Vocabulary** – Synonyms & Antonyms and One Word Substitutes,
**Grammar** – Parts of speech Tenses and Active and Passive Voice
**Writing** – E-mail writing, Letter of Introduction and Paragraph Writing

**UNIT II DEFINITIONS AND INSTRUCTIONS 9**

**Vocabulary –** Abbreviation & Acronyms. Word Forms (Prefixes and Suffixes),
**Grammar –** Question Types Prepositions and Imperatives.
**Writing –** Instructions and Definitions

**UNIT III DESCRIPTION OF A PROCESS / PRODUCT 9**

**Vocabulary** – Homonyms & Homophones, Phrasal Verbs and Compound Nouns.
**Grammar** – Adjectives, Degrees of Comparison and Articles.
**Writing** – Product Description, Process Description and Recommendations

**UNIT IV DECODING NON-VERBAL DATA 9**

**Vocabulary** – Fixed & Semi-fixed expressions, Discourse Markers and Collocation.
**Grammar** – Possessive & Relative Pronouns and Punctuation.
**Writing** – Decoding Pictorial Data

**UNIT V EXPOSITION 9**

**Vocabulary** – Cause & Effect Expressions, Content words and Function Words.
**Grammar** – Negation, Types of Sentences & Error Spotting.
**Writing** – Descriptive Essay, Argumentative Essay & Repository Essays

**COURSE OUTCOMES**

At the end of the course, learners will be able
CO 1 : To use appropriate words in a professional context
CO 2 : To gain an understanding of basic grammatical structures and use them in the right context.
CO 3 : To communicate and write without syntax errors.

CO 4 : To write recommendations, instructions, and product descriptions.
CO 5 : To write summaries, articles, blogs, definitions, and essays

**TEXT BOOKS:**

1. English for Engineers & Technologists Orient Blackswan Private Ltd.Department of English, Anna University, (2020 edition)
2. English for Science & Technology Cambridge University Press, 2021.Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University

**REFERENCES:**

1. Technical Communication – Principles And Practices By Meenakshi Raman &Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi
2. A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.

**TOTAL: 45 PERIODS**

| Course Code | **Matrices and Calculus** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| MA2102 | | **3** | **1** | **0** | **4** |

**COURSE OBJECTIVES**

- To develop the use of matrix algebra techniques that is needed by engineers for Practical applications
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications

**UNIT I MATRICES 9+3**

Eigen values and Eigen vectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigen vectors–Cayley- Hamilton theorem Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms– Applications: Stretching of an elastic membrane

**UNIT II DIFFERENTIAL CALCULUS 9+3**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation – Applications :Maxima and Minima of functions of one variable

**UNIT III FUNCTIONS OF SEVERAL VARIABLES 9+3**

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

**UNIT IV INTEGRALCALCULUS 9+3**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals -Applications: Hydrostatic force and pressure, Arc length, Areas of surface of revolution.

**UNIT V MULTIPLEINTEGRALS 9+3**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications: Moments and centres Of mass, moment of inertia.

**COURSE OUTCOMES**

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

CO 1: Recalling the matrix algebra methods for solving the practical problems.

CO 2: Apply differential calculus tools in solving various application problems.

CO 3: Extending the differential calculus ideas on several variable functions.

CO 4: Understanding different methods of integration in solving practical problems.

CO 5: Developing the multiple integral ideas in solving areas, volumes and other practical problems.

**TEXT BOOKS:**


1. Kreyszig.E," Advanced Engineering Mathematics", John Wiley and Sons, 10thEdition,New Delhi,2016.
2. Grewal.B.S.,"Higher Engineering Mathematics", Hanna Publishers,NewDelhi,44thEdition,2018.
3. JamesStewart,"Calculus:EarlyTranscendentals",CengageLearning,8thEdition, NewDelhi,2015.[For Units II&IV-Sections1.1, 2.2,2.3, 2.5,2.7 (Tangents problems only), 2.8,3.1to3.6, 3.11,4.1,4.3, 5.1(Area problems only),5.2,5.3,5.4(excluding net change theorem),5.5, 7.1- 7.4and 7.8].


**REFERENCES:**


1. Anton. H,Bivens.IandDavis.S, "Calculus ",Wiley,10thEdition,2016
2. Bali.N.,Goyal.M.and Watkins.C," A d v a n c e d Engineering Mathematics", Firewall Media(An imprint of Lakshmi Publications Pvt .,Ltd.,),NewDelhi,7thEdition,2009.
3. Jain.R.K.and Iyengar.S.R.K.,"Advanced Engineering Mathematics", Narosa Publications, NewDelhi,5th Edition,2016.
4. Narayanan. S.and Manicavachagam Pillai.T.K."Calculus" Volume I and II, S.Viswanathan Publishers Pvt.Ltd. Chennai,2009.
5. Ramana.B.V.,"HigherEngineeringMathematics",McGrawHillEducationPvt.Ltd,NewDelhi,2016.
6. Srimantha Pal and Bhunia.S.C," Engineering Mathematics "OxfordUniversityPress,2015.
7. Thomas.G.B.Hass. J, andWeir.M.D,"ThomasCalculus", 14thEdition, PearsonIndia,2018


**TOTAL: 60 PERIODS**

| Course Code | Engineering Physics | L | T | P | C |
|---|---|---|---|---|---|
| PH2103 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of Properties of matter and its applications.
- To introduce the basics of Fibre optics.
- To motivate the students towards the applications of Laser.
- To equip the students to be successfully understand the importance of quantum physics

**UNIT I MECHANICS 9**

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia theorems of M.I – moment of inertia of continuous bodies (Ring, Disc)-moment of inertia of diatomic molecule torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule Gyroscope Torsional pendulum.

**UNIT II PROPERTIES OF MATTER 9**

Elasticity- Hooke's law - Relationship between three moduli of elasticity (quantitative) – stress strain diagram – Poisson's ratio - Factors affecting elasticity – bending of beams - Bending moment – Depression of a cantilever: theory and experiment - Young's modulus by uniform bending and non-uniform bending: theory and experiment I-shaped girders

**UNIT III FIBRE OPTICS 9**

Reflection and refraction of light waves – interference – Michelson interferometer Theory of air wedge and experiment - total internal reflection Fiber optics: Principle, Numerical aperture and acceptance angle – types of optical fibers (material, refractive index, mode)- fiber optic communication - losses associated with optical fibers - fiber optic sensors: pressure and displacement medical endoscope

**UNIT IV LASER 9**

Theory of laser - characteristics - Spontaneous and stimulated emission-Components of Laser-Pumping methods - Optical Resonator – Active medium and Active c entre Einstein's coefficients - population inversion – Types of laser -Nd-YAG laser, CO2 laser, Semiconductor lasers: homo junction and hetero junction laser – Applications of lasers in industry and military.

**UNIT V QUANTUM MECHANICS 9**

Photons and light waves Electrons and matter waves – Compton effect: theory and experimental verification - Concept of wave function and physical significance-The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function Normalization – Free particle-particle in a infinite potential well: 1D,2D and 3D Boxes – Barrier penetration and quantum tunneling(qualitative) Tunneling microscope.

**COURSE OUTCOMES**

After completion of this course, the students should be able to

CO 1: Understand the importance of mechanics.

CO 2: Express their knowledge in properties of matter.

CO 3: Demonstrate a strong foundational knowledge in fibre optics.

CO 4: Comprehend and apply laser principles.

CO 5: Understand the importance of quantum physics

**TEXT BOOKS:**


1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education(IndianEdition), 2017.
2. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics,McGraw-Hill (Indian Edition), 2017.
3. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai publishers, 2009


**REFERENCES:**


1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, ( Indian Edition), 2019.
3. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
4. Searls and Zemansky. University Physics, 2009


**TOTAL: 45 PERIODS**

| Course Code | **Engineering Chemistry** | L | T | P | C |
|---|---|---|---|---|---|
| CH 2104 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.
- To impart knowledge on the basic principles and preparatory methods of nonmaterial's
- To facilitate the understanding of different types of fuels, their preparation,
- To inculcate sound understanding of water quality parameters and water treatment properties and combustion characteristics
- The student should be conversant with the principles electrochemistry electrochemical cells, emf and applications of emf measurements. Principles of corrosion control.

**UNIT I WATER AND ITS TREATMENT 9**

Water: Sources and impurities, Water quality parameters: Definition and significance of pH, hardness, alkalinity, TDS, COD and BOD. Desalination of brackish water: Reverse Osmosis. Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment Ion exchange demineralization and zeolite process

**UNIT II NANO CHEMISTRY 9**

Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nano particle, nano cluster, nano rod, nanowire and nanotube. Preparation of nano materials: laser ablation, and electro spinning. An application of nano material's in medicine, agriculture, energy, electronics and catalysis.

**UNIT III FUELS AND COMBUSTION 9**

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel.

Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Flue gas analysis - ORSAT Method. CO2 emission and carbon foot print.

**UNIT IV ENERGY SOURCES AND STORAGE DEVICES 9**

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles-working principles; Fuel cells: H2-O2 fuel cell

**UNIT V ELECTRO CHEMISTRY AND CORROSION 9**

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes –Calomel electrode – electrochemical series – significance Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods.

**COURSE OUTCOMES**

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

CO 1: To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.

CO 2: To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

CO 3: To apply the knowledge of phase rule and composites for material selection requirements.

CO 4: To recommend suitable fuels for engineering processes and applications.

CO 5: To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

**TEXT BOOKS:**

1. P. C. Jain and Monica Jain, “Engineering Chemistry”, 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, NewDelhi, 2008.
3. S.S. Dara, “A text book of Engineering Chemistry”, S. Chand Publishing, 12th Edition, 2018

**REFERENCES:**

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Text book of nanoscience and nanotechnology”, Universities Press-IIM Series in Metallurgy and MaterialsScience, 2018.
2. O.G. Palanna, “Engineering Chemistry” McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, “Engineering Chemistry”, Scientific International PVT, LTD, New Delhi, 2014. ShikhaAgarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge

University Press, Delhi, Second Edition, 2019.
4. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013

**TOTAL: 45 PERIODS**

| Course Code | Problem Solving Using Python | L | T | P | C |
|---|---|---|---|---|---|
| CS2105 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To understand the basics of algorithmic problem statements.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures-lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

**UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9**

Identification of Computational Thinking, Algorithms, building blocks of algorithms(statements, state, control flow, functions),Algorithmic representation (pseudocode, flowchart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).

**UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9**

Python interpreter and interactive mode, debugging; values and types: int, float, Boolean, string and list; variables, expressions, statements, tuple assignment, Boolean values and operators, precedence of operators, comments

**UNIT III CONTROLFLOW, FUNCTIONS, STRINGS 9**

Conditionals: conditional (if), alternative (if-else),chained conditional(if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module.

**UNIT IV LISTS, TUPLES, DICTIONARIES 9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing-list comprehension, List as arrays

**UNIT V FILES, MODULES & PACKAGES 9**

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, Modules, Packages.

**COURSE OUTCOMES**

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

CO 1: Develop algorithmic solutions to simple computational problems

CO 2: Develop and execute simple Python programs.

CO 3: Implement programs in Python using conditionals loops and functions for solving problems..

CO 4: Process compound data using Python data structures.

CO 5: Utilize Python packages in developing software applications.

**TEXT BOOKS:**


1. Reema Thareja "Python Programming Using Problem Solving Approach" 2 nd Edition, Oxford University Press,2017
2. KarlBeecher,"ComputationalThinking:ABeginner'sGuide to Problem Solving and Programming",1st Edition, BCS Learning & Development Limited,2017.
3. AllenB.Downey,"ThinkPython:HowtoThinklikeaComputerScientist",2ndEdition,O'ReillyPublishers, 2016.


**REFERENCES:**


1. JohnVGuttag,"Introduction to Computation and Programming Using Python:With Applications to Computational Modeling and Understanding Data",ThirdEdition,MITPress,2021
2. Paul Deitel and HarveyDeitel,"Python for Programmers",Pearson Education,1st Edition,2021.
3. GVenkatesh and Madhavan Mukund," Computational Thinking:A Primer for Programmers and Data Scientists",1st Edition,Notion Press, 2021.
4. https://www.python.org/ Martin C.Brown,"Python:The Complete Reference",4th Edition,Mc-GrawHill,2018
5. Eric Matthes,"Python Crash Course,A Hands on Project Based Introduction to Programming", 2nd Edition, No Starch Press,2019.


**TOTAL: 45 PERIODS**

| Course Code | **Employability Enhancement Skills- I** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| ES2106 | | **3** | **0** | **0** | **1** |

**COURSE OBJECTIVES**

- To categorise, apply and use thought processes to understand the concepts of Quantitative methods to enhance problem solving skills.
- To prepare and explain the fundamentals related to various possibilities with numeric ability and probabilities related to quantitative aptitude.
- To critically evaluate numerous possibilities related to puzzles.

**UNIT I NUMBERS 9**

Introduction - Classification of numbers- Formation of Numbers (Small & Large) –Place Value – Face Value – Divisibility Rule – Prime, Composite Numbers - Prime Factorization- Number of factors – Number of factors (Odd & Even) –Sum of factors – Successors and Predecessors – Greatest Integer Value - Vedic Mathematics- Trailing Zeroes- Unit Digits–Remainder Theorem- Real Number - Rational Numbers: Integers, Fractions – Comparison of Numbers - Operations on fractions- Scientific Notation

**UNIT II PROBLEMS ON LETTERS, NUMBERS AND SYMBOLS 9**

Factors and Multiples, LCM and HCF- Relationship between LCM and HCF - Factorial- Simplification- VBODMAS – Square , Square Root – Cube, Cube Root – Exponents & Powers (Surds and Indices) -

Sequence & Series:Arithmetic Progression -Geometric Progression- Special Progression,Letter Series, Number Series, Alpha-Numeric Series, Continuous Pattern Series

**UNIT III VERBAL AND NON - VERBAL REASONING 9**

Verbal Reasoning - Analogy: Completing the Analogous pair, Direct Analogy, Choosing the Analogous pair, Double Analogy, Choosing a Similar Word, Detecting Analogies, Multiple word Analogy, Number Analogy, Alphabet Analogy – Classification: Odd Words and Numerals – Coding and Decoding: Letter, Number, Symbol, Matrix, Substitution, Deciphering Message Word, Number and Symbols Non - Verbal Reasoning Figure Series –Missing figure, Incorrect figure – Analogy: Similarity Related Pair, Similarity Related figures, un related figures, Group of figures.

**UNIT IV RATIO AND PROPORTION 9**

Introduction - Ratio – Proportion: Direct and Indirect – Unitary Method- Problems on Ages – Chain Rule- Partnership - Mixture or Allegation-Time and Work: Individual, Group, Efficiency, Wages - Pipes and Cistern: Inlet, Outlet, and Leakage.

**UNIT V PERCENTAGE 9**

Introduction – Percentages in real life – Profit and Loss – Discount - Simple Interest – Compound Interest – Relationship between Simple Interest and Compound Interest – Overhead Expenses and GST

**COURSE OUTCOMES**

The student will be able to

CO 1 Understand and improve the arithmetic ability and properties of numbers that we use in day to day life

CO 2 Understand the logic behind the formation of numbers, alphabets series.

CO 3 Can think logically to apply the reasoning methods and evaluate complex relationships between the variables and numbers

CO 4 Apply the concept of ratios and proportion in ages and partnership problems

CO 5 Can apply the short cuts of the mathematical tricks to reduce the time duration in problem solving

**TEXT BOOKS:**

1. "Quantitative Aptitude for Competitive Examinations" by R.S. Aggarwal – 2022" 2. "Teach Yourself Quantitative Aptitude" by Arun Sharma – 2017
2. "A modern approach verbal and non -verbal reasoning" by R.S. Aggarwal – 2017

**REFERENCES:**

1. "Shortcuts in Mathematics" by Akhilesh Khare – 2016
2. "Vedic maths for competitive exams" by Ravi Shankar – 2016
3. "Quantitative Aptitude for Competitive Examination" by Abhijit Guha - 2017

**TOTAL: 45 PERIODS**

| Course Code | **Physics and Chemistry Laboratory (Any Five Experiments** to be conducted**)** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| BS2107 | | **0** | **0** | **4** | **2** |

**PHYSICS LABORATORY**

**COURSE OBJECTIVES**

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Non-uniform bending - Determination of Young's modulus
3. Uniform bending – Determination of Young's modulus
4. Laser- Determination of the wave length of the laser using grating
5. Air wedge - Determination of thickness of a thin sheet/wire
6. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES**

On completion of the course, the student is expected to

CO 1: Understand the functioning of various physics laboratory equipment.

CO 2: Use graphical models to analyze laboratory data.

CO 3: Use mathematical models as a medium for quantitative reasoning and describing physical reality.

CO 4: Access, process and analyze scientific information.

CO 5: Solve problems individually and collaboratively

**CHEMISTRY LABORATORY:**

**(Any Five experiments to be conducted)**

**COURSE OBJECTIVES:**

- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electro analytical techniques such as, pH metry,.potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nano particles

**LIST OF EXPERIMENTS**

1. Determination of types and amount of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of chloride content of water sample by Argentometric method.
4. Determination of strength of given hydrochloric acid using pH meter.
5. Determination of HCl acid using conductivity meter.
6. Conducto metric titration of barium chloride against sodium sulphate (precipitation titration)
7. Estimation of iron content of the given solution using potentiometer.

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES**

On completion of the course, the student is expected to

CO 1 To analyze the quality of water samples with respect to their acidity, alkalinity, hardness.

CO 2 To learn the amount of chloride present in the water sample by quantitative analysis

CO 3 To quantitatively analyze the impurities in solution by electro analytical techniques

**TEXT BOOKS:**

1. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis (2009).

**TOTAL: 60 PERIODS**

| Course Code | **Problem Solving Using Python Laboratory** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| CS2108 | | **0** | **0** | **4** | **2** |

**COURSE OBJECTIVES**

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

**EXPERIMENTS:**

1. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
2. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race .

**COURSE OUTCOMES**

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

CO 1: Develop algorithmic solutions to simple computational problems

CO 2: Develop and execute simple Python programs.

CO 3: Implement programs in Python using conditionals loops and functions for solving problems.

CO 4: Process compound data using Python data structures.

CO 5: Utilize Python packages in developing software applications

**TEXT BOOKS:**


**1.** Reema Thareja “Python Programming Using Problem Solving Approach” 2 nd Edition, Oxford University Press, 2017.

**2.** Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016

**3.** Karl Beecher, “Computational Thinking: A Beginner's Guide to Problem Solving andProgramming”,1st Edition, BCS Learning & Development Limited, 2017


**REFERENCES:**


1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st

Edition, 2021.

2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data“, Third Edition, MIT Press , 2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019
5. https://www.python.org/
6. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.

**TOTAL: 60 PERIODS**

| Course Code | Communicative English Laboratory I | L | T | P | C |
|---|---|---|---|---|---|
| HS2109 | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

- To improve the communicative competence of learners
- To learn to use basic grammatical structures in everyday communication.
- To listen and comprehend meaning in reference to the context.
- To acquire lexical competence and understand their meaning in a text
- To develop learners' ability to read complex texts, summaries, articles, blogs, definitions, essays, and user manuals..

**MODULE- I SPEAKING 20**

Self-Introduction, Introducing Others, Product Description and Sales, Narrating Personal Experience, Panel Discussion, Just a Minute, and Movie Review

**MODULE- II LISTENING 5**

Best of TED Talks, Podcasts, Celebrity Interviews, Speech by Native Speakers, and Short Films

**MODULE- III READING 5**

Brochure, User Manual, Biography, Autobiography, Novel, Short Story, News Paper, Gadget Review, and Blogs

**COURSE OUTCOMES**

At the end of the course, learners will be able

CO 1: To introduce oneself and others.

CO 2: To narrate and discuss ideas

CO 3: To describe and communicate persuasively.

CO 4: To understand a conversation and reply accordingly.

CO 5: To read and infer the denotative and connotative meanings of technical and Non-technical texts.

**TEXT BOOKS:**

1. Effective Communication Skill, Kulbhusan Kumar ,R S Salaria, Khanna Publishing House

**REFERENCES:**

1. English for Engineers & Technologists Orient Blackswan Private Ltd.Department of English, Anna University, (2020 edition)
2. Learning to Communicate–Dr.V.Chellammal, Allied Publishing House

**TOTAL: 40 PERIODS**

**SEMESTER II**

| Course code | Vector Calculus and Complex Analysis | L | T | P | C |
|---|---|---|---|---|---|
| MA2204 | | 3 | 1 | 0 | 4 |

**COURSE OBJECTIVES**

- This course aims at providing the required skill to apply the concept of Differential equations in engineering problems.
- To acquaint the knowledge of Vector spaces.
- To introduce the basic concepts of analytic functions.
- To acquaint the knowledge of Complex integration.
- To introduce the basic concepts of Laplace transforms

**UNIT I DIFFERENTIAL EQUATIONS 12**

Higher order linear differential equations with constant coefficients-Method of variation of parameters Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients-Method of undetermined coefficients.

**UNIT II VECTOR CALCULUS 12**

Gradient and directional derivative–Divergence and curl-Vector identities–Irrotational and Solenoidal vector fields– Line integral over a plane curve–Surface integral - Area of a curved surface-Volume integral- Green's, Gauss divergence and Stoke's theorems–Verification and application in evaluating line, surface and volume integrals.

**UNIT III ANALYTIC FUNCTIONS 12**

Analytic functions–Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates-Properties–Harmonic conjugates–Construction of analytic function-Conformal mapping-Bilinear transformation.

**UNIT IV COMPLEX INTEGRATION 12**

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula. Taylor's and Laurent's series expansions. Singular points – Residues – Cauchy's residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

**UNIT V LAPLACE TRANSFORMS**

**12**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems-Transforms of derivatives and integrals Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

**COURSE OUTCOMES**

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

CO 1: Apply various techniques in solving differential equations

CO 2: Gradient, divergence and curl of a vector point function and related identities.

CO 3: Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.

CO 4: Analytic functions, conformal mapping and complex integration.

CO 5: Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

**TEXT BOOKS:**


1 Grewal B.S.,"Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014

2. Kreyszig Erwin,"Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, NewDelhi, 2016.


**REFERENCES:**


1. Weir, M.D and Joel Hass, "Thomas Calculus",12th Edition, Pearson India, 2016.

2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, NewDelhi, 3rdEdition, 2007

3 O'Neil, P.V. "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

4 Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, NewDelhi, 2014

5. Wylie,R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, NewDelhi,2012


**TOTAL : 60 PERIODS**

| Course Code | **Applied Physics for Civil Engineering** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| PH2203 | | **3** | **0** | **0** | **3** |

**COURSE OBJECTIVES**

- To introduce the basics of heat transfer through different materials, thermal performance of building and various thermal applications
- To impart knowledge on the ventilation and air conditioning of buildings
- To introduce the concepts of sound insulation and lighting designs
- To give an introduction to the processing and applications of new engineering materials
- To create an awareness on natural disasters and safety measures

**UNIT I THERMAL APPLICATIONS 9**

Principles of heat transfer, steady state of heat flow, conduction through compound media-series and parallel-conductivity of rubber tube and powder materials - heat transfer through fenestrations, thermal insulation and its benefits - heat gain and heat loss estimation - factors affecting the thermal performance of buildings, thermal measurements, thermal comfort, indices of thermal comfort, climate and design of solar radiation, shading devices - central heating.

**UNIT II VENTILATION AND REFRIGERATION 9**

Requirements, principles of natural ventilation - ventilation measurements, design for natural ventilation - Window types and packaged air conditioners - chilled water plant - fan coil systems - water piping - cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C.Systems.

**UNIT III ACOUSTICS AND LIGHTING DESIGNS 9**

Methods of sound absorptions - absorbing materials - noise and its measurements, sound insulation and its measurements, impact of noise in multistored buildings. Visual field glare, colour- day light calculations - day light design of windows, measurement of day-light and use of models and artificial skies, principles of artificial lighting, supplementary artificial lighting.

**UNIT IV NEW ENGINEERING MATERIALS 9**

Composites - Definition and Classification - Fibre reinforced plastics (FRP) and fiber reinforced metals (FRM) - Metallic glasses - Shape memory alloys - Ceramics - Classification - Crystalline - Non-Crystalline - Bonded ceramics, Manufacturing methods - Slip casting - Isostatic pressing - Gas pressure bonding - Properties - ferroelectric and ferromagnetic ceramics - High Aluminium ceramics.

**UNIT V NATURAL DISASTERS 9**

Seismology and Seismic waves - Earth quake ground motion - Basic concepts and estimation techniques - site effects - Probabilistic and deterministic Seismic hazard analysis - Cyclone and flood hazards - Fire hazards and fire protection, fire-proofing of materials, fire safety regulations and firefighting equipment - Prevention and safety measures

**COURSE OUTCOMES**

After completion of the course, the students should be able to

CO 1: Acquire knowledge about heat transfer through different materials, thermal performance of building and thermal insulation.

CO 2: Gain knowledge on the ventilation and air conditioning of buildings

CO 3: Understand the concepts of sound absorption, noise insulation and lighting designs

CO 4: Know about the processing and applications of composites, metallic glasses, shape memory alloys and ceramics

CO 5: Get an awareness on natural disasters such as earth quake, cyclone, fire and safety measures

**TEXT BOOKS:**

1 Marko Pinteric, Building Physics, Springer 2017

.

2 D.S.Mathur. Elements of Properties of Matter. S Chand & Company, 2010
.
3 Hugo Hens, Building Physics: Heat, Air and Moisture, Wiley, 2017
.

**REFERENCES:**

1 W.R. Stevens. Building Physics: Lighting. Pergamon Press, 2013
.
2 Hugo Hens, Applied Building Physics, Wiley, 2016
.
3 K.G.Budinski and M.K.Budinski. Engineering Materials: Properties and Selection. Pearson
. Education, 2016
4 Peter A. Claisse, Civil Engineering Materials, Elsevier, 2016.
.
5 Patrick L. Abbott, Natural Disasters, McGraw-Hill, 2017
.

**TOTAL : 60 PERIODS**

| Course Code | **Engineering Mechanics** | L | T | P | C |
|---|---|---|---|---|---|
| ME2201 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To Learn the use scalar and vector analytical techniques for analysing forces in statically determinate structures.
- To introduce the equilibrium of rigid bodies, vector methods and free body diagram.
- To study and understand the distributed forces, surface, loading on beam and intensity.
- To learn the principles of friction, forces and to determine the apply the concepts of frictional forces at the contact surfaces of various engineering systems.
- To develop basic dynamics concepts – force, momentum, work and energy;

**UNIT I STATICS OF PARTICLES 9**

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles - Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space

**UNIT II EQUILIBRIUM OF RIGID BODIES 9**

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

**UNIT III DISTRIBUTED FORCES 9**

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes by Integration. Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

**UNIT IV FRICTION 9**

The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction, Rolling Resistance, Ladder friction

**UNIT V DYNAMICS OF PARTICLES 9**

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact of bodies

**COURSE OUTCOMES**

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

CO 1: Illustrate the vector and scalar representation of forces and moments

CO 2: Analyse the rigid body in equilibrium

CO 3: Evaluate the properties of distributed forces

CO 4: Determine the friction and the effects by the laws of friction

CO 5: Calculate dynamic forces exerted in rigid body

**TEXT BOOKS:**

1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 12thEdition, 2019

2. Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018

**REFERENCES:**

1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008

2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013

3. Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4thEdition, Pearson Education Asia Pvt. Ltd., 2005

4. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.

5. Timoshenko S, Young D H, Rao J V and Sukumar Pati, Engineering Mechanics, 5thEdition, McGraw Hill Higher Education, 2013

**TOTAL : 45 PERIODS**

| Course Code | **Fundamentals of Electrical and Electronics Engineering** | L | T | P | C |
|---|---|---|---|---|---|
| EE2211 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

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

**UNIT I ELECTRICAL CIRCUITS 9**

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

**UNIT II ELECTRICAL MACHINES 9**

Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, working principle and Applications of Transformer, three phase Alternator, Synchronous motor and Three Phase Induction Motor.

**UNIT III ANALOG ELECTRONICS 9**

Semiconductor Materials: Silicon& Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET,IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters.

**UNIT IV DIGITAL ELECTRONICS 9**

Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only)

**UNIT V MEASUREMENTS AND INSTRUMENTATION 9**

Functional elements of an instrument, Standards and calibration, Operating Principle, types - Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT, DSO- Block diagram- Data acquisition

**COURSE OUTCOMES**

After completing this course, the students will be able to

CO 1: Compute the electric circuit parameters for simple problems

CO 2: Explain the working principle and applications of electrical machines

CO 3: Analyse the characteristics of analog electronic devices

CO 4: Explain the basic concepts of digital electronics

CO 5: Explain the operating principles of measuring instruments.

**TEXT BOOKS:**


1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020

2. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017

3. Sedha R.S., "A textbook book of Applied Electronics", S. Chand & Co., 2008

4. James A .Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018

5. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015


**REFERENCES:**


1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.

2. Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017

3. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017

4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.

5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010


**TOTAL : 45 PERIODS**

| Course Code | **Engineering Graphics** | L | T | P | C |
|---|---|---|---|---|---|
| ME2202 | | 2 | 0 | 4 | 4 |

**COURSE OBJECTIVES**

The main learning objective of this course is to prepare the students for:

- Drawing engineering curves.
- Drawing freehand sketch of simple objects.
- Drawing orthographic projection of solids and section of solids.
- Drawing development of solids
- Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

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

**UNIT I PLANE CURVES 6+12**

Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12**

Orthographic projection- principles-Principal Planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method

**UNIT III PROJECTION OF SOLIDS AND FREEHAND SKETCHING 6+12**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

**UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+12**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12**

Principles of isometric projection — isometric scale - lsometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination)

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

CO 1: Use BIS conventions and specifications for engineering drawing.

CO 2: Construct the conic curves, involutes and cycloid.

CO 3: Solve practical problems involving projection of lines.

CO 4: Draw the orthographic, isometric and perspective projections of simple solids

CO 5: Draw the development of simple solids.

**TEXT BOOKS:**

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar PublishingHouse, 53 Edition, 2019.
2. Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
3. Parthasarathy, N. S. and Vela Murali, "Engineering Drawing", Oxford University Press, 2015.

**REFERENCES:**

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2 nd Edition, 2019.
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.
6. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.

**TOTAL : 75 PERIODS**

| Curse Code | **Fundamentals of C Programming** | L | T | P | C |
|---|---|---|---|---|---|
| CS2211 | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES**

- To understand the constructs of C Language.
- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop modular applications in C using functions
- To develop applications in C using pointers and structures
- To do input/output and file handling in C

**UNIT I BASICS OF C PROGRAMMING 9**

Introduction to programming – Structure of C program - C programming: Data Types - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements.

Lab Experiments:

1. Write programs to get some input, perform some operation and display the output using I/O statements
2. Write a program to execute some specific statements based on the test condition
3. Write programs to implement nested loop.

**UNIT II ARRAYS AND STRINGS 9**

Introduction to Arrays: One dimensional array: Declaration – Initialization – Accessing elements - Operations: Traversal, Insertion, Deletion, Searching – Two dimensional arrays: : Declaration - Initialization – Accessing elements – Operations: Read – Print – Sum – Transpose - Introduction to Strings - Reading and writing a string - String operations (without using built-in string functions): Length – Compare – Concatenate – Copy – Reverse – Substring – Insertion – Indexing – Deletion – Replacement.

Lab Experiments

1. One Dimensional array (Sorting, Searching)
2. Two-Dimensional array (Martix Addition, Subtraction, Multiplication, Transpose)
3. Strings: operations

**UNIT III FUNCTIONS AND POINTERS 9**

Introduction to Functions – Types - Function prototype - Function definition - Function call - Parameter passing: Pass by value - Pass by reference - Built-in functions (string functions, math functions) – Recursion, – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers Lab Experiments

1. Display all prime numbers between two intervals using functions.
2. Sum of digits, Factorial, Fibonacci series, Binary Search using recursion.
3.To store and print the array elements using pointer

**UNIT IV STRUCTURES AND UNION 9**

Introduction to structures – Declaration – Initialization – Accessing the members – Nested Structures – Array of Structures – Structures and functions –Pointer and Structures – typedef – Union – Storage classes and Visibility.

Lab Experiments

1. Write a C program to Store Student Information in Structure and Display it.
2. To read and print the employee details using array of structure.

To declare, initialize and access the union members

**UNIT V FILE PROCESSING 9**

Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file - Command line arguments.

Lab Experiments

1. C program to read name and marks of n number of students and store them in a file.
2. Write a program in C to create and store information in a text file.

Write a program in C to Find the Number of Lines in a Text File

**COURSE OUTCOMES**

After completion of the course, the students should be able to

CO 1: Demonstrate knowledge on C Programming constructs

CO 2: Develop simple applications in C using basic constructs

CO 3: Design and implement applications using arrays and strings

CO 4: Develop and implement modular applications in C using functions

CO 5: Develop applications in C using structures and pointers.

CO 6: Design applications using sequential and random-access file processing

**TEXT BOOKS:**


1. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2015.


**REFERENCES:**


1. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020
3. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996
4. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.
5. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013


**TOTAL :45 PERIODS**

| Course Code | **Communicative English II** | L | T | P | C |
|---|---|---|---|---|---|
| HS2201 | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES**

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To be able to communicate effectively through writing.

**UNIT I THERMAL APPLICATIONS 12**

Speaking-Role Play Exercises Based on Workplace Contexts, - talking about competition- discussing progress toward goals-talking about experiences- talking about events in life- discussing past events-Writing: writing emails (formal & semi-formal)

**UNIT II 12**

Speaking: discussing news stories-talking about frequency-talking about travel problems- discussing travel procedures- talking about travel problems- making arrangements-describing arrangements-discussing plans and decisions- discussing purposes and reasons- understanding common technology terms-Writing: - writing different types of emails.

**UNIT III 12**

Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios- talking about purchasing-discussing advantages and disadvantages- making comparisons- discussing likes and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters

**UNIT IV** **12**

Speaking: discussing the natural environment-describing systems-describing position and movement-explaining rules-(example- discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article

**UNIT V** **12**

Speaking: describing things relatively-describing clothing-discussing safety issues (making recommendations) talking about electrical devices-describing controlling actions- Writing: job application (Cover letter + Curriculum vitae)-writing recommendations

**LEARNING OUTCOMES**

After completion of the course, the students should be able to

CO 1: Speak effectively in group discussions held in a formal/semi formal contexts.

CO 2: Write emails and effective job applications

**Assessment Pattern**

- One online / app based assessment to test speaking and writing skills
- Proficiency certification is given on successful completion of speaking and writing.

**TOTAL : 60 PERIODS**

| Course Code | **Engineering Practices Laboratory** | L | T | P | C |
|---|---|---|---|---|---|
| ME2203 | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

The main learning objective of this course is to provide hands on training to the students in:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipment; Making a tray out of metal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

**GROUP – A (CIVIL & ELECTRICAL**

**PART I CIVIL ENGINEERING PRACTICES** **15**

**PLUMBING WORK:**

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

**WOOD WORK:**

a) Sawing,
b) Planing and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

**Wood Work Study:**

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models..

**PART II ELECTRICAL ENGINEERING PRACTICES 15**

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
g) Study of emergency lamp wiring/Water heater

**GROUP – B (MECHANICAL AND ELECTRONICS)**

**PART III MECHANICAL ENGINEERING PRACTICES 15**

**WELDING WORK:**

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

**BASIC MACHINING WORK:**

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

**ASSEMBLY WORK:**

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an air conditioner.

**SHEET METAL WORK:**

a) Making of a square tray

**FOUNDRY WORK:**

a) Demonstrating basic foundry operations.

**PART IV ELECTRONIC ENGINEERING PRACTICES 15**

**SOLDERING WORK:**

a) Soldering simple electronic circuits and checking continuity.

**ELECTRONIC ASSEMBLY AND TESTING WORK:**

a) Assembling and testing electronic components on a small PCB.

**ELECTRONIC EQUIPMENT STUDY:**

(a) Study an element of smart phone.
(b) Assembly and dismantle of LED TV.
(c) Assembly and dismantle of computer/ laptop

**COURSE OUTCOMES**

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

CO 1: Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.

CO 2: Wire various electrical joints in common household electrical wire work.

CO 3: Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.

CO 4: Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

**TOTAL: 60 PERIODS**

| Course Code | **Employability Enhancement Skills II** | L | T | P | C |
|---|---|---|---|---|---|
| ES2201 | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

- Monitor, understand and create idea for problem solving.
- To analyse and examine the problems related to quantitative aptitude.
- To critically evaluate numerous possibilities related to puzzles.

**UNIT I TIME AND DISTANCE 9**

Introduction – Speed: Late / Early / Usual Time – Average Speed – Chasing – Problems on Train: Crossing Pole, Crossing Platform, Train moving in same and different direction – Boats and Streams: Upstream, Downstream – Clock – Calendar

**UNIT II PROBABILITY AND STATISTICS 9**

Introduction – Algebra of Events – Addition theorem of Probability – Permutation and Combinations – Problems based on choosing the objects – Statistics: Range – frequency, Arithmetic Mean – Median - Mode - Variance - Standard Deviation – Measures of Dispersion – Coefficient of Variation

**UNIT III ARITHMETIC AND LOGICAL REASONING 9**

Introduction – Mathematical Operations – Blood Relations: Direct, Indirect, Coded Problems on Cubes and Dices: Face identification – Folding and cutting Images Counting technique of figures – Distance & Direction

**UNIT IV APPLIED MATHEMATICS 9**

(2D&3D): Square, Rectangle, Triangle, Circle, Parallelogram, Rhombus, Trapezoid, Quadrilateral, Cube, Cuboid, Cylinder, Cone, Sphere, Miscellaneous – Trigonometry: Ratio, Identities, Heights and Distances - Algebra - Logarithm- Geometry

**UNIT V VERBAL AND LOGICAL REASONING 9**

Introduction - Venn Diagram – Syllogism – Data Sufficiency – Decision Making – Puzzle: Number Puzzle, Letter Puzzle – Ranking Test – Data Arrangement: Linear, Circular, Miscellaneous – Critical Reasoning

**COURSE OUTCOMES**

After completion of the course, the students should be able to

CO 1: Use their logical thinking and analytical abilities to solve reasoning questions from company specific and other competitive tests.

CO 2: Solve questions related to permutation & combinations and probabilities from company specific and other competitive tests.

CO 3: Understand and solve puzzle related questions from specific and other competitive tests.

**TEXT BOOKS:**

1. "Quantitative Aptitude for Competitive Examinations" by R.S. Aggarwal – 2022"
2. "Teach Yourself Quantitative Aptitude" by Arun Sharma – 2017
3. "A modern approach verbal and non -verbal reasoning" by R.S. Aggarwal – 2017

**REFERENCES:**

1. "Shortcuts in Mathematics" by Akhilesh Khare – 2016
2. "Vedic maths for competitive exams" by Ravi Shankar – 2016
3. "Quantitative Aptitude for Competitive Examination" by Abhijit Guha – 2017

**TOTAL: 45 PERIODS**

## SYLLABUS FOR III SEMSTER

| MA 2301 | TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 1 | 0 | 3 |

**COURSE OBJECTIVES**

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems
- To introduce the basic concepts of PDE for solving standard partial differential equations.

**UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9+3**

Formation of partial differential equations –Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types- Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types

**UNIT II FOURIER SERIES 9+3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval's identity – Harmonic analysis.

**UNIT III APPLICATION OF PARTIAL DIFFERENTIAL EQUATION 9+3**

Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only).

**UNIT IV FOURIER TRANSFORMS 9+3**

Statement of Fourier integral theorem– Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9+3**

Z-transforms - Elementary properties – Convergence of Z-transforms - – Initial and final value theorems - Inverse Z-transform using partial fraction and convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES**

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

CO 1: Understand how to solve the given standard partial differential equations.

CO 2: Solve differential equations using Fourier series analysis which plays a vital role in Engineering applications.

CO 3: Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.

CO 4: Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

CO 5: Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

**TEXT BOOKS:**


**1.** Grewal B.S, "Higher Engineering Mathematics" 44thEdition, Khanna Publishers,New Delhi, 2018

**2.** Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2016.


**REFERENCES:**


**1.** Andrews. L.C and Shivamoggi. B, "Integral Transforms for Engineers" SPIE Press, 1999.

**2.** Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt. Ltd, 2015

**3.** James. G., "Advanced Modern Engineering Mathematics", 4thEdition, Pearson Education, New Delhi, 2016.

**4.** Narayanan. S., ManicavachagomPillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

**5.** Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2018.

**6.** Wylie. R.C. and Barrett . L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.


**TOTAL :45 PERIODS**

| Course Code | **Applied Structural Mechanics** | L | T | P | C |
|---|---|---|---|---|---|
| CE 2301 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

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

**UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9**

Simple Stresses and strains – Elastic constants - Relationship between elastic constants – Stress Strain Diagram – Ultimate Stress – Yield Stress – Deformation of axially loaded member - Composite Bars - Thermal Stresses – State of Stress in two dimensions – Stresses on inclined planes – Principal Stresses and Principal Planes – Maximum shear stress - Mohr's circle method.

**UNIT II BENDING OF BEAMS 9**

Types of beams and transverse loadings– Shear force and bending moment for simply supported, cantilever and over-hanging beams - Theory of simple bending – Bending stress distribution – Shear stress distribution..

**UNIT III DEFLECTION OF BEAMS 9**

Double Integration method – Macaulay's method – Area moment method – Conjugate beam method - Strain energy method for determinate beams.

**UNIT IV INDETERMINATE BEAMS 9**

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

**UNIT V ADVANCED TOPICS 9**

Unsymmetrical bending of beams - shear center applied - Thick and Thin cylinders - Theories of failure – Principal stress, principal strain, shear stress, strain energy and distortion energy theories – application problems.

**COURSE OUTCOMES**

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

CO 1: Understand the concepts of stress and strain, principal stresses and principal planes.

CO 2: Determine Shear force and bending moment in beams and understand concept of theory of simple bending.

CO 3: Calculate the deflection of beams by different methods and selection of method for determining slope or deflection.

CO 4: Analyze propped cantilever, fixed beams and continuous beams for external loadings and support settlements.

CO 5: Determine the stresses due to Unsymmetrical bending of beams, locate the shear center, and study the various theories of failure.

**TEXT BOOKS:**


1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 2018.
2. Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017.
3. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain,"Theory of Structures" (SMTS) Vol - II, Laxmi Publishing Pvt Ltd, New Delhi 2017.
4. Basavarajiah and Mahadevapa, Strength of Materials, University press, Hyderabad, 2016
5. Vazirani.V.N, Ratwani.M.M, Duggal.S.K Analysis of Structures: Analysis, Design and Detailing of Structures-Vol.1, Khanna Publishers, New Delhi 2014.


**REFERENCES:**


1. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2017
2. William A .Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw Hill Publishing company, 2017.
3. Singh. D.K., "Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2021
4. Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015
5. IrwingH.Shames, James M.Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 2002

6. Beer. F.P. &Johnston.E.R. “Mechanics of Materials”, Tata McGraw Hill, Sixth Edition, New Delhi 2010.
7. James M.Gere., Mechanics of Materials, Thomas Canada Ltd., Canada, 2006.
8. Egor. P.Popov, Engineering Mechanics of Solids, Prentice Hall of India, Second Edition New Delhi 2015.

**TOTAL :45 PERIODS**

| Course Code | **Fluid Mechanics** | L | T | P | C |
|---|---|---|---|---|---|
| CE 2302 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To understand the basic properties of the fluid, fluid kinematics, fluid dynamics and to analyze and appreciate the complexities involved in solving the fluid flow problems.

**UNIT I FLUID PROPERTIES AND FLUID STATICS 9**

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers-forces on planes – centre of pressure – buoyancy and floatation.

**UNIT II FLUID KINEMATICS AND DYNAMICS 9**

Fluid Kinematics – Classification and types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- stream line-streak line-path line- stream function - velocity potential function - flow net. Fluid dynamics - equations of motion -Euler's equation along a streamline - Bernoulli's equation – applications - venturi meter, orifice meter and Pitot tube- linear momentum equation and its application to pipe bend.

**UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES 9**

Fundamental dimensions - dimensional homogeneity - Rayleigh’s method and Buckingham Pi-theorem - dimensionless parameters - similitudes and model studies - distorted models.

**UNIT IV FLOW THROUGH PIPES 9**

Reynold’s experiment - laminar flow through circular pipe (Hagen poiseulle's) - hydraulic and energy gradient – flow through pipes - Darcy - Weisbach's equation - pipe roughness -friction factor- Moody's diagram- major and minor losses of flow in pipes - pipes in series and in parallel.

**UNIT V BOUNDARY LAYER 9**

Boundary layer – definition- boundary layer on a flat plate – laminar and turbulent boundary layer-displacement, energy and momentum thickness – Momentum integral equation-Boundary layer separation and control – drag on flat plate

**COURSE OUTCOMES**

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

CO 1: Get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.
CO 2: Understand and solve the problems related to the equation of motion.
CO 3: Gain knowledge about dimensional and model analysis.
CO 4: Learn types of flow and losses of flow in pipes.
CO 5: Understand and solve the boundary layer problems

**TEXT BOOKS:**


1. Modi P.N and Seth "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2009.
2. Jain.A.K.., "Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2016.
3. Subramanya.K " Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.
4. Bansal.R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Ltd., New Delhi, 2013.


**REFERENCES:**


1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw Hill, 2000.
2. Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 2013.
3. White, F.M., "Fluid Mechanics", Tata McGraw Hill, 5th Edition, New Delhi, 2017.
4. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press, New Delhi, 2015.
5. Rajput.R.K. "Fluid Mechanics", S.Chand and Co, New Delhi, 2008.


**TOTAL : 45 PERIODS**

| Course Code | **Surveying & Levelling** | L | T | P | C |
|---|---|---|---|---|---|
| CE 2303 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To introduce the rudiments of plane surveying and geodetic principles to Civil Engineers.
- To learn the various methods of plane and geodetic surveying to solve the real world Civil Engineering problems.
- To introduce the concepts of Control Surveying
- To introduce the basics of Astronomical Surveying.
- To Introduce Modern Surveying Equipment's like Total Station and GPS.

**UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING AND LEVELLING 9**

Classifications and basic principles of surveying-Equipment and accessories for ranging and chaining-Methods of ranging - Compass-Types of Compass - Basic Principles- Bearing –Types-True Bearing-Magnetic Bearing-Levelling-Principles and theory of Levelling–Datum - Bench Marks – Temporary and Permanent Adjustments- Methods of Levelling-Booking –Reduction-Sources of errors in Levelling- Curvature and refraction

**UNIT II THEODOLITE AND TACHEOMETRIC SURVEYING 9**

Horizontal and vertical angle measurements-Temporary and permanent adjustments-Heights and distances-Tacheometer-Stadia Constants-Analytic Lens-Tangential and Stadia Tacheometry surveying-Contour– Contouring– Characteristics of contours– Methods of contouring–Tacheometric contouring-Contour gradient –Uses of contour plan and map

**UNIT III CONTROL SURVEYING AND ADJUSTMENT 9**

Horizontal and vertical control – Methods – specifications – triangulation- baseline – satellite stations – reduction to centre- trigonometrical levelling – single and reciprocal observations – traversing–Gale's table.-Errors Sources-precautions and corrections–classification of errors – true and most probable values - weighed observations – method of equal shifts – principle of least squares- normal equation–correlates-level nets- adjustment of simple triangulation networks

**UNIT IV ADVANCED TOPICS IN SURVEYING 9**

Hydrographic Surveying – Tides – MSL – Sounding methods – Three point problem – Strength of fix – astronomical Surveying – Field observations and determination of Azimuth by altitude and hour angle methods –.Astronomical terms and definitions-Motion of sun and stars-Celestial coordinate systems-different time systems-Nautical Almanac-Apparent altitude and corrections-Field observations and determination of time, longitude, latitude and azimuth by altitude and hour angle method

**UNIT V MODERN SURVEYING 9**

Total Station : Advantages - Fundamental quantities measured -Parts and accessories –working principle-On board calculations-Field procedure-Errors and Good practices in using Total Station GPS Surveying : Different segments-space, control and user segments-satellite configuration -signal structure-Orbit determination and representation-Anti Spoofing and Selective Availability-Task of control segment-Hand Held and Geodetic receivers-data processing-Traversing and triangulation.

**COURSE OUTCOMES**

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

CO 1: The use of various surveying instruments and mapping
CO 2: Measuring Horizontal angle and vertical angle using different instrument
CO 3: Methods of Levelling and setting Levels with different instruments
CO 4: Concepts of astronomical surveying and methods to determine time, longitude, latitude and azimuth
CO 5: Concept and principle of modern surveying.

**TEXT BOOKS:**


1. Kanetkar.T.P and Kulkarni.S.V, Surveying and Levelling,Parts 1&2,PuneVidyarthi Griha Prakashan,Pune,2008
2. Punmia.B.C.,Ashok K.Jain and Arun K Jain, Surveying Vol.I&II, Lakshmi Publications Pvt Ltd,NewDelhi,2005
3. James M.Anderson and EdwardM.Mikhail,"Surveying, Theory and Practice",7th Edition, Mc Graw Hill,2001.
4. BannisterandS.Raymond,"Surveying",7th Edition,Longman 2004
5. Laurila,S.H."Electronic Surveying in Practice", JohnWiley and SonsInc,1993
6. Venkatramaiah, "Text book of Surveying",University press,NewDelhi,2014


**REFERENCES:**


1. Alfred Leick,"GPS satellite surveying", JohnWiley&Sons Inc.,3rd Edition,2004.
2. GuochengXu, "GPS Theory Algorithms and Applications" Springer–Berlin, 2003.
3. SatheeshGopi, Rasathishkumar, N.madhu, "Advanced Surveying, Total Station GPS and Remote Sensing" Pearson education,2007
4. Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2004.
5. Arora K.R.," Surveying Vol I & II", Standard Bookhouse,10th Edition 2008

| Course Code | Principles and Techniques of Data Science | L | T | P | C |
|---|---|---|---|---|---|
| AD 2304 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To understand the techniques and processes of data science
- To apply descriptive data analytics
- To visualize data for various applications
- To understand inferential data analytics
- To analysis and build predictive models from data

**UNIT I INTRODUCTION TO DATA SCIENCE 8**

Need for data science – Benefits and uses – Facets of data – Data science process – Setting the research goal – retrieving data – Cleansing, Integrating, and Transforming data – Exploratory data analysis – Build the models – Presenting and building applications.

**UNIT II DESCRIPTIVE ANALYTICS 10**

Frequency distributions – Outliers –interpreting distributions – graphs – averages - describing variability – Interquartile range – Variability for qualitative and ranked data - Normal distributions – z scores –correlation – Scatter plots – Regression – Regression line – least squares regression line – Standard error of estimate – Interpretation of $r^2$ – Multiple regression equations – Regression toward the mean.

**UNIT III INFERENTIAL STATISTICS 9**

Populations – Samples – Random sampling – Sampling distribution- Standard error of the mean - Hypothesis testing – z-test – z-test procedure –Decision rule – Calculations – Decisions – Interpretations -One-tailed and two-tailed tests – Estimation – Point estimate – Confidence interval – level of confidence – Effect of sample size.

**UNIT IV ANALYSIS OF VARIANCE 9**

t-test for one sample – Sampling distribution of t – t-test procedure – t-test for two independent samples – p-value – Statistical significance – t-test for two related samples. F-test – ANOVA – Two-factor experiments – three f-tests – two-factor ANOVA –Introduction to chi-square tests.

**UNIT V PREDICTIVE ANALYTICS AND APPLICATIONS IN CIVIL ENGINEERING 9**

Regression -Linear Regression-Multiple regression – Logistic regression – Estimating parameters – Time series analysis – Introduction to survival analysis. Data science in civil Engineering-Structural Health Monitoring-Geotechnical Engineering-Transportation Planning-Water Resources Management-Construction Project Management-Environmental Impact Assessment-Energy Efficiency and Sustainability.

**COURSE OUTCOMES**

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

CO 1: Explain the data analytics pipeline
CO 2: Describe and visualize data
CO 3: Perform statistical inferences from data
CO 4: Analyze the variance in the data

CO 5: Build models for predictive analytics

**TEXT BOOKS:**


1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016


**REFERENCES:**


1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.
2. Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, "Fundamentals of Data Science", CRC Press, 2022.
3. Chirag Shah, "A Hands-On Introduction to Data Science", Cambridge University Press, 2020.
4. Vineet Raina, Srinath Krishnamurthy, "Building an Effective Data Science Practice: A Framework to Bootstrap and Manage a Successful Data Science Practice", A press, 2021.


**TOTAL: 45 PERIODS**

| Course Code | தமிழர்மரபு /**HERITAGE OF TAMILS** | L | T | P | C |
|---|---|---|---|---|---|
| HS2301 | | 1 | 0 | 0 | 1 |

**COURSE OBJECTIVES:**

The main objectives of this course are to:

- To enhance Tamil.

**Course Description**

This course aims to enhance proficiency in the Tamil language, covering various aspects of Tamil grammar, vocabulary, writing, reading, and speaking.

**Prerequisites**

- Interest and enthusiasm to improve Tamil language skills
- Access to Tamil language resources (books, online materials, audio/video resources)

**UNIT I LANGUAGE AND LITERATURE 3**

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

**UNIT II HERITAGE ROCK ART PAINTINGS TO MODERN ART SCULPTURE 3**

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

**UNIT III FOLK AND MARTIAL ARTS 3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance – Sports and Games of Tamils.

**UNIT IV THINAI CONCEPT OF TAMILS** **3**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram Concept of Tamils – Education and Literacy during Sangam Age – Ancient Cities and Ports of Sangam Age – Export and Import during Sangam Age – Overseas Conquest of Cholas.

**UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE** **3**

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

**Assessments & Grading**

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

**COURSE OUTCOMES:**

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

CO1: To use appropriate words in a professional context

CO2: To gain an understanding of basic grammatical structures and use them in the right context.

CO3: To communicate and write without syntax errors.

CO4: To write recommendations, instructions, and product descriptions.

CO5: To write summaries, articles, blogs, definitions, and essays.

**TEXT CUM REFERENCE BOOKS:**

1. Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils – The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr. S.V. Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi – Sangam City Civilization on the banks of river Vaigai (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K.Pillay) (Published by: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
8. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL).

**YouTube Resources**:

1. https://youtu.be/RKK7wGAYP6k?t=2
2. https://youtu.be/Ge7c7otG2mk?t=1
3. https://youtu.be/d0yGdNEWdn0?t=2
4. https://youtu.be/Ti_gFEe1XNY?t=3
5. https://youtu.be/RKK7wGAYP6k?t=2

**15 PERIODS**

| Course Code | Civil Engineering Materials and Construction | L | T | P | C |
|---|---|---|---|---|---|
| CE 2305 | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES**

- To introduce students about various construction materials and the techniques that are commonly practicing in civil engineering construction.

**UNIT I STONES - BRICKS - CONCRETE BLOCKS - LIME 9**

Stone as building material – Criteria for selection – Tests on stones – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive strength – Water Absorption –Efflorescence – Lime – Preparation of lime mortar – Concrete hollow blocks – Lightweight concrete blocks.

**UNIT II CEMENT – AGGREGATES – MORTAR – CONCRETE 9**

Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Compressive strength – Tensile strength – Fineness– Soundness and consistency – Setting time – fine aggregates – river sand – crushed stone sand – properties – coarse Aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance - Concrete – Ingredients – Manufacturing Process.

**UNIT III OTHER MATERIALS 9**

Timber – Market forms – Plywood – Veneer – False ceiling materials – Steel – Mechanical treatment – Aluminium – Uses – Market forms – Glass – Ceramics – Refractories – Composite Materials –Types and applications – FRP – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement.

**UNIT IV CONSTRUCTION PRACTICES & SERVICE REQUIREMENTS 9**

Types of Foundations – Shallow and Deep Foundations – Stone Masonry – Brick Masonry –Plastering and Pointing – Cavity Walls – Diaphragm Walls – Formwork – Centering and Shuttering – Shoring – Scaffolding – Underpinning – Roofing – Flooring – Joints in concrete – Contraction / Construction/Expansion joints - Damp Proofing

**UNIT V CONSTRUCTION EQUIPMENTS 9**

Selection of equipment for earthwork excavation, concreting, material handling and erection of structures – Dewatering and pumping equipment

**COURSE OUTCOMES**

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

CO 1: Identify the good quality brick, stone and blocks for construction

CO 2: Recognize the market forms of timber, steel, aluminium and applications of various composite materials.

CO 3: Identify the best construction and service practices such as thermal insulations and air Conditioning of the building

CO 4: Select various equipment's for construction works conditioning of building

CO 5: Understand the construction planning and scheduling techniques

**TEXT BOOKS:**

1. Varghese.P.C, Building Materials, Second Edition PHI Learning Ltd., 2015.

2. Arora S.P and Bindra S.P Building construction, Dhanpat Rai and sons, 2013.

**REFERENCES:**

1. Varghese.P.C, Building Construction, Second Edition PHI Learning ltd., 2016.
2. Punmia, B.C Building construction, Laxmi publication (p) ltd.., 2008.
3. Peurifoy R.L., Schexnayder,C.J., Shapira A., Schmitt.R., Construction Planning Equipment and Methods, Tata McGraw-hill, 2011
4. Srinath L.S., PERT and CPM -Principles and applications, Affliated East West Press 2001

| Course Code | **Computer Aided Building Design Project** | L | T | P | C |
|---|---|---|---|---|---|
| CE 2306 | | 3 | 0 | 0 | 2 |

**COURSE OBJECTIVES**

- To Provide Knowledge on symbols and sign conventions used in building drawings
- To enable the students to create plan, Elevation and sectional views of buildings using software
- To impart knowledge on execution of plan in accordance with development and control rules safety orientation and functional requirements as per National Building code

**INTRODUCTION:**

Introduction to building Plan – Symbols, Sign Convention, Specification of a building – Introduction to bye laws – Study on AutoCAD Commands and annotations

**LIST OF EXPERIMENTS: (Manual & Using AutoCAD)**

1. Following drawings are to be prepared for the given data
   - **I** Cross section of Foundation, Masonry Wall, RCC Columns with isolated & Combined footings
   - **II** Different types of bonds in brick Masonry
   - **II** Different types of staircases – Dog legged, Open Well
   - **I**
   - **IV** Septic Tank
   - **V** Steel Roof Truss
2. Sketching the plan for a given area
3. Drafting of Plan, Elevation and sectional view for the given specification of a single storied residential building
4. Drafting of Plan, Elevation and sectional view for the given specification of buildings with masonry wall and sloped roof
5. Drafting of Plan, Elevation and sectional view for the given specification of RCC two storied building
6. Drafting of Plan, Elevation and sectional view for the given specification of a hospital building
7. Plotting of plan, Elevation and Sectional views for the given specification of a School building

**COURSE OUTCOMES**

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

CO1 Plan a building according to requirements of National Building Code

CO2 Prepare the layout and sectional views of a building manually

CO3 Familiarize in the usage of AUTOCAD
CO4 Draft the Plan, Elevation and Sectional Views of the given structure using AUTOCAD
CO5 Develop technical communication skills in the form of communicative drawing

**TEXT BOOKS:**

1. Sikka. V. B., A Course in Civil Engineering Drawing,5th Edition, S. K. Kataria and sons, 2021
2. George Omura, Brian C. Benton, "Mastering AutoCAD 2019 and AutoCAD LT2019", Wiley – An Autodesk Official Press, 2019

**REFERENCES:**

1. Shah M.G. Kale C.M. &Patki S.Y., "Building Drawing with an Integrated Approach to Built Environment", 6th edition, Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2019.
2. Verma.B.P., Civil Engineering Drawing and House Planning, Khanna Publishers, 11th edition 2016.
3. National Building Code (2016), BIS, New Delhi.

**TOTAL : 60 PERIODS**

| Course Code | **Surveying Laboratory** | L | T | P | C |
|---|---|---|---|---|---|
| CE 2307 | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

- At the end of the course the student will possess knowledge about Survey field techniques

**LIST OF EXPERIMENTS:**

**Chain Survey**

**1** Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset

**2** Setting out works – Foundation marking using tapes single Room and Double Room

**Compass Survey**

**3** Compass Traversing–Measuring Bearings & arriving included angles

**Levelling-Study of levels and leveling staff**

**4** Fly levelling using Dumpy level & Tilting level

**5** Check levelling

**Theodolite-Study of Theodolite**

**6** Measurements of horizontal angles by reiteration and repetition and vertical angles

**7** Determination of elevation of an object using single plane method when base is accessible / inaccessible.

**Tacheometry – Tangential system – Stadia system**

**8** Determination of Tacheometric Constants

**9** Heights and distances by stadia Tacheometry

**10** Heights and distances by Tangential Tacheometry

**Total Station -** Study of Total Station, Measuring Horizontal and vertical angles

**11** Traverse using Total station and Area of Traverse

12 Determination of distance and difference in elevation between two inaccessible points using Total station

**COURSE OUTCOMES**

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

**TOTAL : 60 PERIODS**

| Course Code | **Application of IOT in Civil Engineering** | L | T | P | C |
|---|---|---|---|---|---|
| CE 2308 | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

- Assess the vision and introduction of IoT and understanding how M2M is connected to internet of things
- Identify the appropriate Hardware and software components of IoT for Civil engineering
- Gain knowledge on Cloud Storage models, web servers and how to integrate device, data and cloud management framework for IoT.

**LIST OF EXPERIMENTS:**

1. Getting started with IoT (Arduino)
2. Write an IoT (Arduino) to measure the distance (in cm) of a certain objects.
3. Write a Program to send the humidity and temperature data to Cloud (Thing Speak)
4. Write a program to alert the user through SMS and Email notification if humidity is greater than a threshold value using IFTTT and Thing speak cloud.
5. Design of Structural and non-structural health monitoring system, Measurement of parameters such as vibration, temperature, and strain to detect any potential structural issues.
6. Design of an Environmental monitoring system, Measurement of air quality, noise level
7. Design of an Environmental monitoring system, Measurement of Temperature and Humidity
8. Design of a Water Quality Monitoring System measurement of pH, turbidity, TDS and dissolved oxygen levels in water bodies.
9. Design of a Ground Water Table Monitoring System in water storage structures
10. Design and implement a smart irrigation system for agricultural purposes.
11. Design of a Smart Waste Management System monitor the fill levels of waste bins in different locations.
12. Design of a simple Building Automation System
13. Write a program to measure and store the Soil moisture values in mobile monitoring systems
14. Write a program to alert the user through mobile call for Water level monitoring in overhead water tank in houses

**COURSE OUTCOMES**

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

CO 1: Interpret the vision of IoT from a global context, compare and contrast M2M and IoT Technology

CO 2: Relate the appropriate Hardware and software components of IoT for providing the communication among the devices

CO 3: Implement device, data and cloud management services for IoT applications.

CO 4: Explore various data analytical techniques and operational security for IoT applications

CO 5: Comprehend the need of Cloud Computing and Edge Computing-IoT

**TEXT BOOKS:**

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, CISCO Press, 2017
2. Samuel Greengard, The Internet of Things, The MIT Press, 2015

**TOTAL: 60 PERIODS**

## SYLLABUS FOR IV SEMSTER

| Course Code | Statistics and Numerical Methods | L | T | P | C |
|---|---|---|---|---|---|
| MA 2401 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

**UNIT I TESTING OF HYPOTHESIS 9+3**

Sampling distributions - Tests for single mean and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

**UNIT II DESIGN OF EXPERIMENTS 9+3**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design.

**UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3**

Solution of algebraic and transcendental equations – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by Power method

**UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9+3**

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single integration using Trapezoidal and Simpson's 1/3 rules.

**UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS** **9+3**

Single step methods: Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Multi step method: Milne's predictor corrector methods for solving first order differential equations.

**COURSE OUTCOMES**

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

CO 1: Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO 2: Apply the basic concepts of classifications of design of experiments in the field of agriculture.

CO 3: Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.

CO 4: Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.

CO 5: Sole the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

**TEXT BOOKS:**


1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.


**REFERENCES:**


1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4. Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
6. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010


**TOTAL: 60 PERIODS**

| Course Code | **Theory of Structures – I** | L | T | P | C |
|---|---|---|---|---|---|
| CE2401 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To introduce the students to the basic theory and concepts of classical methods of structural analysis.

**UNIT I ANALYSIS OF TRUSSES 9**

Determinate and indeterminate trusses- analysis of determinate trusses-method of joints-method of sections - Deflections of pin-jointed plane frames - lack of fit - change in temperature method of tension coefficient- space trusses.

**UNIT II SLOPE DEFLECTION METHOD 9**

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

**UNIT III MOMENT DISTRIBUTION METHOD 9**

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

**UNIT IV FLEXIBLITY METHOD 9**

Primary structures –Compatibility conditions– Formation flexibility matrices-Analysis of indeterminate pin- jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach.

**UNIT V STIFFNESS METHOD 9**

Restrained structure–Formation of stiffness matrices-equilibrium condition-Analysis of Continuous beams,Pin-jointed plane frames and rigid frames by direct stiffness method.

**COURSE OUTCOMES**

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

CO 1 Analyze the pin-jointed plane and space frames.

CO 2 Analyse the continuous beams and rigid frames by slope defection method.

CO 3 Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.

CO 4 Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.

CO 5 Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

**TEXT BOOKS:**

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

**REFERENCES:**

1. WilliamWeaver,Jrand James M.Gere, Matrix analysis of framed structures,CBS Publishers & Distributors,SecondEdition,Delhi,2004

2. Reddy.C.S,"Basic Structural Analysis",Tata Mc Graw Hill Publishing Company,2005.
3. NegiL.S.and Jangid R.S.,Structural Analysis, Tata Mc Graw Hill Publishing.Co.Ltd.2004
4. Bhavikatti,S.S,Matrix Method of Structural Analysis, I.K. International Publishing House Pvt.Ltd.,New Delhi-4,2014.

**TOTAL: 45 PERIODS**

| Course Code | Soil Mechanics | L | T | P | C |
|---|---|---|---|---|---|
| CE2402 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- This course is aimed at teaching the students the concepts of soil engineering, including the science and technology of soils and their application to problems in Civil engineering. The course emphasizes the fundamentals and relevant principles of soil mechanics, gives an overall picture of the behaviour of soils and describes the nature of some of the soil problems encountered in Civil engineering.

**UNIT I INTRODUCTION – SOLIDS - WATER – AIR RELATIONS AND INDEX PROPERTIES OF SOILS** **9**

Preview of Geotechnical problems in civil Engineering and infrastructure Development - Historical development of soil mechanics - Soil formation and soil type- Phase diagram - Simple definitions and their relationships - Index properties of soils - Determinations of various index properties.

**UNIT II SOIL IDENTIFICATIONS AND CLASSIFICATION- SOIL STRUCTURE - CLAY MINERALS – COMPACTION** **9**

Introduction - Field Identification of soil- Soil classification-Textural, ISSCS, MIT, BSCS, USCS and AASHTO soil classification system - Application of soil classification system – Introduction- Clay minerals-Clay particle interaction-Soil structure and fabrics - Laboratory tests - Factors affecting compaction -Structure and Engineering behaviour of compacted cohesive soils - Compaction specification and field control.

**UNIT III PRINCIPLE OF EFFECTIVE STRESS, CAPILLARITY AND PERMEABILITY SEEPAGE THROUGH SOILS** **9**

Principle of effective stress-Physical meaning of effective stresses-Capillarity in soils-Permeability of soils-Determinations of coefficient of permeability: Laboratory and field methods-Types of Head, Seepage forces and quick sand conditions-Two dimensional flow – Lap laces equation-Flow nets-Unconfined flow-Seepage in Anisotropic soil condition-Seepage through an earth dam on an impervious base-Flow through non – homogeneous sections-Prevention of Erosion- Protective filters.

**UNIT IV VERTICAL STRESSES BELOW APPLIED LOADS AND COMPRESSIBILITY OF SOIL** **9**

Introduction-Boussinesq equation and Westergaard's equation-Vertical Stress Distribution Diagrams-Vertical stress beneath loaded Areas-New marks influence chart-Approximate stress distribution methods for Loaded Areas- Contact pressure and Settlement profile-Fundamentals of Consolidation-One –Dimensional Laboratory consolidation Test-Void Ratio – Pressure plots - Normally consolidated and over consolidated clay-Effect of Disturbance on Void Ratio –Pressure Relationship-Calculation of Settlement from One – Dimensional Primary Consolidation-

Compression Index and Swell Index-Secondary Consolidation Settlement-Time Rate of Consolidation-Coefficient of Consolidation-Calculation of Consolidation Settlement under a Foundation -Method of Accelerating Consolidation Settlement.

**UNIT V SHEAR STRENGTH OF SOIL AND STABILITY OF SLOPES 9**

Mohr-Coulomb failure criterion-Inclination of the Plane of Failure caused by Shear-Laboratory Tests For Determination of shear strength Parameters-Direct Shear Test-Tri axial Shear Test-General-Consolidated drained Tri axial Test-Consolidated un drained Tri axial Test-Unconsolidated un drained Triaxial Test-Unconfined compression Test on Saturated clay-Stress Path-Vane Shear Test-Empirical Relations between undrained cohesion and effective overburden pressure-Shear strength of unsaturated Cohesive Soils-Shear Strength of Sands.-Infinite slopes and Translation slides-Definition of factor of safety-Finite slopes- Forms of Slip surface-Ø = 0 Analysis (Total stress Analysis)-C – Ø Analysis – Method of Slices-Location of the most Critical Circles-Friction Circle Method-Taylors Stability Number-Bishops method of Stability Analysis-Use of Stability Coefficients.

**COURSE OUTCOMES**

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

CO 1: Classify the soil and assess the engineering properties, based on index properties.
CO 2: Understand the stress concepts in soils
CO 3: Understand and identify the settlement in soils.
CO 4: Determine the shear strength of soil.
CO 5: Analyze both finite and infinite slopes.

**TEXT BOOKS:**


1. V.N.S. Murthy "A Text Book of Soil Mechanics and Foundation Engineering in SI units"UBS Publishers Distributors Ltd. Fourth edition 1993.
2. K. R. Arora "Soil mechanics and foundation Engineering" Standard Publisher Distribution 2017, 7th edition (Reprint).
3. Gopal Ranjan, A S R Rao, "Basic and Applied Soil Mechanics" New Age International Publication, 3rd Edition, 2016.
4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th EDITION, 2017.


**REFERENCES:**


1. Terzaghi K and Peck.R. B. John Wiley "Soil mechanics in Engineering Practice", 2nd Edition, New York, 1967
2. Braja M. Das "Principles of Geotechnical Engineering" Fifth edition. Thomson/Brookscole
3. Joseph E Bowles "Physical and Geological properties of soils", , Mc Graw Hill Co. Ltd 2nd Edition 1984.
4. S.R. Kaniraj "Design Aids in Soil Mechanics and Foundation Engineering ", Tata Mc Graw Hill Education Limited, 2018.
5. Dr. Sehgal "A text book of soil mechanics" S.B. CBS Publishers and distributors, New Delhi, 1988.


**TOTAL: 45 PERIODS**

| Course Code | **Open Channel Hydraulics & Fluid Machinery** | L | T | P | C |
|---|---|---|---|---|---|
| CE2403 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To understand the concepts of fluid mechanics in addressing problems on open channels and uniform flow
- To formulate the different types of flow profiles and its computations
- To gain knowledge on RVF, its types and surges in flow
- To enhance the knowledge of working principles of turbine and its classification
- To learn the principles behind the working of pump and its classification

**UNIT I UNIFORM FLOW 9**

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel -Velocity distribution in open channel -Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow – Wide open channel - Specific energy and specific force –Critical flow.

**UNIT II GRADUALLY VARIED FLOW 9**

Dynamic equations of gradually varied flows – Types of flow profiles - Classifications: Computation by Direct step method and Standard step method–Control section–Break in Grade–Computation.

**UNIT III RAPIDLY VARIED FLOW 9**

Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation – Celerity– Rapidly varied unsteady flows (positive and negative surges

**UNIT IV TURBINES 9**

Impact of Jet on flat, curved plates, Stationary and Moving –Classification of Turbines – Pelton wheel–Francis turbine–Kaplan turbine-Specific speed–Characteristic Curves of Turbines-Draft tube and cavitation.

**UNIT V PUMPS 9**

Classification of Pumps - Centrifugal pumps – Work done - Minimum speed to start the pump - NPSH - Multistage pumps – Characteristics curve - Reciprocating pumps - Negative slip – Indicator diagrams and its variations – Air vessels-Savings in work done.

**COURSE OUTCOMES**

On successful completion of the course, students should be able to:

CO 1: Apply their knowledge of fluid mechanics in addressing problems in open channels.
CO 2: Able to identify an effective section for flow in different cross sections.
CO 3: To solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
CO 4: Understand the principles, working and application of turbines.
CO 5: Understand the principles, working and application of pumps.

**TEXT BOOKS:**

1. Subramanya.K,"Flow in open channels", Tata Mc Graw Hill, New Delhi, 2000.
2. Modi P.N and Seth.S.M" Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2009.
3. Chandra mouli P.N.,"Applied Hydraulic Engineering", Yes Dee Publishing Pvt.Ltd., 2017.

**REFERENCES:**


1. Ven Te Chow,"Open Channel Hydraulics", Mc Graw Hill, NewYork, 2009.
2. Hanif Chaudhry.M.,"Open Channel Flow", Second Edition, Springer, 2007.
3. Rajesh Srivastava,"Flow through open channels", Oxford University Press, New Delhi, 2008.
4. Jain.A.K.,"Fluid Mechanics"(Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2016.
5. Subramanya.K.,"Fluid Mechanics and Hydraulic Machines",Tata Mc Graw Hill Education Private Limited,NewDelhi,2010.


**TOTAL: 45 PERIODS**

| Course Code | **Highway and Railway Engineering** | L | T | P | C |
|---|---|---|---|---|---|
| CE2404 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To Understand history, classification and key highway engineering terms.
- Recall the basic principles of geometric design in highways, such as sight distance requirements.
- To give an overview of Traffic engineering, traffic regulation, management and traffic safety with integrated approach in traffic planning as well.
- Summarize the principles of track design and their implications for efficient railway operation
- Investigate the effects of environmental factors on the construction, maintenance, and operation of railway tracks

**UNIT I HIGHWAY ENGINEERING 9**

Classification of highways – Institutions for Highway planning, design and construction at different levels – factors influencing highway alignment –Typical cross sections of Urban and Rural roads – Engineering surveys for alignment- Highway drainage – Evaluation and Maintenance of pavements Conventional and Modern method.

**UNIT II DESIGN OF HIGHWAY ELEMENTS 9**

Highway capacity , Cross sectional elements – Horizontal curves, super elevation, transition curves, widening of curves – Sight distances – Vertical curves, gradients– pavement components and their role - Design practice for flexible and rigid pavements (IRC methods only).

**UNIT III TRAFFIC ENGINEERING 9**

Traffic studies on PIEV theory, flow and speed, peak hour factor, accident study, parking study, statistical analysis of traffic data; Microscopic and macroscopic parameters of traffic flow, fundamental relationships; Traffic signs; Signal design by Webster's method; Types of intersections

**UNIT IV RAILWAY PLANNING AND CONSTRUCTION 9**

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

**UNIT V RAILWAY TRACK CONSTRUCTION MAINTENANCE AND OPERATION** **9**

Points and Crossings - Design of Turnouts, Working Principle-Track Circuiting - Construction & Maintenance – Conventional, Modern methods and Materials, Lay outs of Railway Stations and Yards, Rolling Stock, Tractive Power, Track Resistance - Role of Indian Railways in National Development – Railways for Urban Transportation – LRT & MRTS Feasibility study, Planning and construction

**COURSE OUTCOMES**

On completion of the course, the student is expected to

CO 1: Plan a highway according to the principles and standards adopted in various institutions in India.

CO 2: Design the geometric features of road network and components of pavement

CO 3: Analyse traffic problems, Intersections and signals.

CO 4: Understand the methods of route alignment and design elements in railway planning and constructions

CO 5: Understand the construction techniques and maintenance of track laying and railway stations

**TEXT BOOKS:**


1. Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nemchand Publishers, 2014.
2. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai,2010
3. Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications, 6th edition Delhi,2015.
4. C.Venkatramaiah., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels.,Universities Press (India) Private Limited, Hyderabad, 2015


**REFERENCES:**


1. Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements, (Third Revision), IRC:37-2012
2. Indian Road Congress (IRC), Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, ( Third Revision), IRC:58-2012
3. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi,2010
4. O'Flaherty.C.A "Highways, Butterworth – Heinemann, Oxford,2006
5. Yang H. Huang, "Pavement Analysis and Design", Pearson Education Inc, Nineth Impression, South Asia,2012
6. Ian D. Walsh, "ICE manual of highway design and management", ICE Publishers, Ist Edition, USA,2011
7. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of Highway Engineering and Traffic Analysis", Wiley India Pvt. Ltd., New Delhi,2011

8. IRC-37–2012,The Indian roads Congress, Guidelines for the Design of Flexible Pavements, NewDelhi
9. IRC 58-2012. The Indian Road Congress, Guideline for the Design of RigidPavements for Highways, NewDelhi
10. Saxena Subhash, C.and Satyapal Arora, A Course in Railway Engineering, Dhanapat Rai and Sons, Delhi, 1998.

**TOTAL:45 PERIODS**

| Course Code | Advanced Surveying (Astronomy and Drones) | L | T | P | C |
|---|---|---|---|---|---|
| CE2405 | | 3 | 0 | 0 | 2 |

**COURSE OBJECTIVES**

- To understand the use of Astronomy, Photogrammetry, Total Station and with drone surveying & applications

**UNIT I ASTRONOMICAL SURVEYING 9**

Astronomical terms and definition – Motion of sun and stars – Celestial co-ordinate System – Time system-Nautical Alamance–Apparent attitude and corrections Field observations and determinations of time, longitude, latitude and azimuth by attitude and Hour angle method.

**UNIT II AERIAL SURVEYING 9**

TerrestrialPhotogrammetry–Terrestrialstereophotogrammetry–Aerialphotogrammetry–overlaps – scale of photographs – Vertical and titled photographs distortion in aerial photographs – stereostopic vision -photo interpretation– Applications.

**UNIT III TOTAL STATION SURVEYING 9**

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

**UNIT IV INTRODUCTION ON DRONES 9**

Introduction to Drones, History of Drone/UAS/UAVs, payload, battery life, Specs for good results, Regulations of DGCA and Drone license, Pre and Post Flight planning- Flight execution and photography, data collection- Image Format, GSD, Scale and Resolution

**UNIT V SURVEYING WITH DRONE 9**

Consideration for hardware selections, comparison on surveying drone and its accuracy, Techniques of controlling errors, Consideration of GCP in vertical and horizontal accuracies, Planning and estimation of drone surveying jobs, Autonomous flight vs. manual and hybrid flight profiles. Application of drone for Surveying & Mapping-Construction, Irrigation and Agricultural, Engineering Land Survey and Transportation

**COURSE OUTCOMES**

On successful completion of the course, students should be able to:

CO 1: Know the astronomical surveying

CO 2: Do the photogrammetric surveying and interpretation

CO 3: Solve the field problems with Total station
CO 4: Know about a various type of drone technology, drone fabrication and programming
CO 5: To explain the planning process in Drone Surveying and applications

**TEXT BOOKS:**


1. James M.Anderson and Edward M.Mikhail, "Surveying, Theory and Practice", 7th Edition, Mc GrawHill, 2001.
2. Bannister and S.Raymond,"Surveying",7thEdition,Longman2004
3. Alfred Leick, GPS satellite surveying, John Wiley&SonsInc.,3rd Edition,2004.
4. Laurila, S.H. Electronic Surveying in Practice, John Wiley and SonsInc, 1993.
5. One Nation Under Drones: Legality, Morality, and Utility of Unmanned Combat Systems by John E. Jackson
6. Tal and John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", 2021 John Wiley Sons, Inc.
7. Terry Kilby and Belinda Kilby, "Make: Getting Started with Drones ",Maker Media, Inc, 2016


**REFERENCES:**


1. Roy S.K.,"Fundamentals of Surveying",2nd Edition, Prentice Hall of India,2004.
2. Arora K.R."Surveying VolI &II", Standard Book House, 10th Edition 2008.
3. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer–Verlag, Berlin, 2003.
4. Seeber G, Satellite Geodesy, Water De Gruyter, Berlin, 1998.
5. Drones and Support for the Use of Force by James Igoe Walsh
6. John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016
7. Zavrsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018


**TOTAL: 45 PERIODS**

| Course Code | தமிழரும் தொழில்நுட்பமும் /TAMILS AND TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| HS2401 | | 1 | 0 | 0 | 1 |

**COURSE OBJECTIVES:**

The main objectives of this course are to:

- To enhance Tamil.

**Course Description**

This course aims to enhance proficiency in the Tamil language, covering various aspects of Tamil grammar, vocabulary, writing, reading, and speaking.

**Prerequisites**

- Interest and enthusiasm to improve Tamil language skills
- Access to Tamil language resources (books, online materials, audio/video resources)

**UNIT I WEAVING AND CERAMIC TECHNOLOGY** **3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

**UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY** **3**

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

**UNIT III MANUFACTURING TECHNOLOGY** **3**

Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel – Copper and gold Coins as source of history – Minting of Coins – Beads making – industries Stone beads – Glass beads – Terracotta beads – Shell beads/ bone beats – Archeological evidences – Gem stone types described in Silappathikaram.

**UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY** **3**

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

**UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING** **3**

Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

**Course Format**

Lectures and discussions, Hands-on coding exercises and projects, Guest lectures by industry Experts, Group discussions and presentations, Online resources and tutorials

**Assessments & Grading**

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

**COURSE OUTCOMES:**

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

CO1: To use appropriate words in a professional context
CO2: To gain an understanding of basic grammatical structures and use them in the right context.
CO3: To communicate and write without syntax errors.
CO4: To write recommendations, instructions, and product descriptions.
CO5: To write summaries, articles, blogs, definitions, and essays.

**TEXT CUM REFERENCE BOOKS:**

1. English Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (inprint)

2. Social Life of the Tamils – The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi – 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation Tamil Nadu)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu TextBook and Educational Services Corporation, Tamil Nadu)
8. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL).

**YouTube Resources**:

1. https://youtu.be/RKK7wGAYP6k?t=2
2. https://youtu.be/Ge7c7otG2mk?t=1
3. https://youtu.be/d0yGdNEWdn0?t=2
4. https://youtu.be/Ti_gFEe1XNY?t=3
5. https://youtu.be/RKK7wGAYP6k?t=2

**15 PERIODS**

| Course Code | **Hydraulics Machinery Laboratory** | L | T | P | C |
|---|---|---|---|---|---|
| CE2406 | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

- To make an understanding on the behaviour of real fluid flows through hands on experience in calibration of flow meters
- To Provide hands on experience in measurement of major and minor losses in pipe flow
- To impart knowledge on the performance characteristics of pumps and turbines

**LIST OF EXPERIMENTS**

1. Calibration of Rotameter
2. Determination of Coefficient of discharge for Venturimeter
3. Determination of Coefficient of discharge for Orifice meter
4. Determination of Coefficient of discharge for orifice
5. Determination of Coefficient of discharge for notches
6. Study of friction losses in pipes
7. Study of minor losses in pipes

8. Study on Performance Characteristics of Pelton turbine
9. Study on Performance Characteristics of Francis turbine
10. Study on Performance Characteristics of Kaplan turbine
11. Study on Performance Characteristics of Centrifugal turbine
12. Study on Performance Characteristics of Gear Pump
13. Study on Performance Characteristics of Submersible pump
14. Study on Performance Characteristics of Reciprocating turbine

On successful completion of the course, students should be able to:
CO 1: The students will be able to measure flow in pipes and determine frictional losses.
CO 2: The students will be able to develop characteristics of pumps and turbines.

**REFERENCES:**


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


**TOTAL: 60 PERIODS**

| Course Code | **Strength Of Materials Laboratory** | L | T | P | C |
|---|---|---|---|---|---|
| CE2407 | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

- To develop skills to test various construction materials.

**LIST OF EXPERIMENTS**

I. **TESTS ON METALS**

a. Tension test on steel rod
b. Torsion test on mild steel rod
c. Deflection test on metal beam
d. Double shear test on metal
e. Impact test on metal specimen(Izod and Charpy)
f. Hardness test on metals (Rockwell and Brinell Hardness Tests)
g. Compression test on helical spring
h. Deflection test on carriage spring

II. **TESTS ON CEMENT**

a. Determination of fineness of cement
b. Determination of consistency of cement

c. Determination of specific gravity of cement
d. Determination of initial and final setting time of cement

III. **TESTS ON FINE AGGREGATE**

a. Determination of specific gravity and water absorption of fine aggregate
b. Determination of grading of fine aggregate
c. Determination of water absorption for fine aggregate

IV. **TESTS ON COARSE AGGREGATE**

a. Determination of compacted and loose bulk density of coarse aggregate
b. Determination of impact value of coarse aggregate
c. Determination of elongation index of coarse aggregate
d. Determination of flakiness index of coarse aggregate
e. Determination of aggregate crushing value of coarse aggregate
f. Determination of specific gravity and water absorption of coarse aggregate

V. **TESTS ON BRICKS**

a. Determination of compressive strength of bricks
b. Determination of water absorption of bricks
c. Determination of efflorescence of bricks

VI. **TESTS ON CONCRETE**

a. Determination of slump of concrete
b. Determination of compressive strength of concrete
c. Determination of flowability of self-compacting concrete (Demo only)

VII. **TEST ON WOOD**

a. Determination of Compression test on wood

**OUTCOMES:**

On successful completion of the course, students should be able to:

CO 1: Determine the mechanical properties of steel.
CO 2: Determine the physical properties of cement
CO 3: Determine the physical properties of fine and coarse aggregate.
CO 4: Determine the workability and compressive strength of concrete.
CO 5: Determine the strength of brick and wood.

**TOTAL: 60 PERIODS**

| Course Code | **Project Work Using Drone and GIS Laboratory** | L | T | P | C |
|---|---|---|---|---|---|
| CE2408 | | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

- At the end of the course the student will possess knowledge about the Un manned Aerial Vehicle technology and GIS for advanced topographical mapping.

**LIST OF EXPERIMENTS**

1. Study About UAV Flight Planning
2. Establish Ground Control Points.
3. Boundary setting and Data Collection by using Flight Mapping.
4. Measure UAV Data Processing Ortho mosaic Maps using 3D Point Cloud
5. Calculate Aerial Mapping using Drones
6. Calculate Topography Mapping Using Drones
7. Study About GIS Softwares In Drone Surveying
8. 3d Reality Modelling with Bentley Context capture Using Unmanned Aerial Vehicle.
9. Identify 2d &3d Reality Modelling with Google Earth Pro and Drone deploy Software using Unmanned Aerial Vehicle.
10. Analyse 2d &3d Reality Modelling With AGI SOFT Meta shape Software Using unmanned Aerial Vehicle.
11. Evaluate Contour Maps by using Unmanned Aerial Vehicle with QGIS software.

**OUTCOMES:**

On successful completion of the course, students should be able to:

CO 1: Use UAV to Calculate Flight Planning
CO 2: Advanced software's used in Boundary setting
CO 3: Measurement of Aerial and Topography Mapping
CO 4: Application of Post Processing Softwares
CO 5: Calculate 2d &3d Reality Modelling.

**REFERENCE BOOKS**


1. Garvit Pandya, Basics of Unmanned Aerial Vehicles: Time to start working on Drone Technology , Notion Press (6 March 2021)
2. PK Garg, Introduction To Unmanned Aerial Vehicles, New Age International Publishers New Age International Private Limited; First edition (1 October 2020); NEW AGE International Pvt Ltd
3. Kike Calvo, So You Want to Create Maps Using Drones?
4. George Dekoulis., "Drones Applications'', Intech open, 2018


**TOTAL: 60 PERIODS**

| Course Code | **Project- Introduction With Industry** | L | T | P | C |
|---|---|---|---|---|---|
| CE2409 | | 0 | 0 | 1 | 1 |

**COURSE OBJECTIVES**

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

**STRATEGY:**

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

**OUTCOMES:**

On successful completion of the course, students should be able to:

CO 1: The intricacies of implementation text book knowledge in to practice

CO 2: The concepts of developments and implementation of new techniques

**TOTAL: 60 PERIODS**

| Course Code | **Theory Of Structures – II** | L | T | P | C |
|---|---|---|---|---|---|
| CE2501 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To learn the method of drawing influence lines and its uses in various applications like beams, bridges and plane trusses and to analyse arches and suspension bridges.

**UNIT I INFLUENCE LINES FOR DETERMINATE STRUCTURES 9**

Introduction to moving loads, Concept of Influence Lines, Influence lines for reactions in statically determinate structures –Influence lines for shear force and bending moment in beam section – Calculation of critical stress resultants due to concentrated and distributed moving loads - Influence lines for member forces in pin jointed plane frames.

**UNIT II INFLUENCE LINES FOR INDETERMINATE BEAMS 9**

Muller Breslau's principle - Influence line for support reactions, shearing force and bending moments for indeterminate beams - propped cantilevers, fixed beams and continuous beams.

**UNIT III ARCHES 9**

Arches - Eddy's theorem - Types of arches – Analysis of three-hinged, two-hinged and fixed arches - Parabolic and circular arches - influence lines, rib shortening– Settlement and temperature effects.

**UNIT IV SUSPENSION BRIDGES AND SPACE TRUSSES 9**

Analysis of suspension bridges – Unstiffened cables and cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders - Introduction to analysis of space trusses using method of tension coefficients.

**UNIT V APPROXIMATE ANALYSIS OF FRAMES 9**

Approximate analysis for gravity loadings - substitute frame method for maximum moments in beams and columns - Approximate analysis for horizontal loads - portal method and cantilever method - assumptions - axial force, shearing force and bending moment diagrams.

**COURSE OUTCOMES**

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

CO 1: Draw influence lines for statically determinate structures and calculate critical stress resultants.

CO 2: Understand Muller Breslau principle and draw the influence lines for statically indeterminate beams.

CO 3: Analyse three hinged, two hinged and fixed arches.

CO 4: Analyse the suspension bridges with stiffening girders

CO 5: Analyse rigid frames by approximate methods for gravity and horizontal loads.

**TEXT BOOKS:**


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


**REFERENCES:**


1. Gambhir.M.L., Fundamentals of Structural Mechanics and Analysis, PHI Learning Pvt. Ltd., 2011.
2. Reddy.C.S,"Basic Structural Analysis", Tata Mc Graw Hill Publishing Company,2010.
3. NegiL.S.and Jangid R.S.,Structural Analysis, Tata Mc Graw Hill Publishing.Co.Ltd.2004
4. Vazrani.V.N And Ratwani.M.M, Analysis of Structures, Vol.II, Khanna Publishers, 2015.


**TOTAL: 45 PERIODS**

| Course Code | **Design of Reinforced Concrete Structures** | L | T | P | C |
|---|---|---|---|---|---|
| CE2502 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To introduce the different design philosophy for reinforced concrete and discuss the limit state method of design of RC rectangular beams and to learn the concept in the design of RC flanged beams and design for shear and torsion and design of RC slabs and staircase, short RC columns, RC footing for walls, pad, sloped and combined rectangular footings.

**UNIT I METHODS OF DESIGN OF CONCRETE STRUCTURES 9**

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

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

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

**UNIT III LIMIT STATE DESIGN OF SLABS AND STAIRCASE 9**

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

**UNIT IV LIMIT STATE DESIGN OF COLUMNS 9**

Types of columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending.

**UNIT V LIMIT STATE DESIGN OF FOOTING 9**

Design of wall footing – Design of axially and eccentrically loaded rectangular pad and sloped footings – Design of combined rectangular footing for two columns only.

**COURSE OUTCOMES**

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

CO 1: Know the various design concepts and design RC rectangular beams by working stress and limit state method

CO 2: Understand the design of flanged beams, design for shear and torsion, and anchorage and development length.

CO 3: Design a RC slabs and staircase and draw the reinforcement detailing.

CO 4: Design short columns for axial, uni-axial and bi-axial eccentric loadings

CO 5: Design wall footings, isolated footings and combined rectangular footing.

**TEXT BOOKS:**


1. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
2. Krishnaraju.N" Design of Reinforced Concrete Structures ", CBS Publishers & Distributors Pvt. Ltd., New Delhi.


**REFERENCES:**


1. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017
2. Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., 2021
3. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete",Laxmi Publication Pvt. Ltd., New Delhi, 2016
4. Shah V L Karve S R., "Limit State Theory and Design of Reinforced Concrete", Structures Publications, Pune, 2013


**TOTAL: 45 PERIODS**

| Course Code | **Foundation Engineering** | L | T | P | C |
|---|---|---|---|---|---|
| CE2503 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To impart knowledge to plan and execute a detail site investigation programme, to select geotechnical design parameters and type of foundations. Also to familiarize the students for the geotechnical design of different type of foundations and retaining walls.

**UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9**

Introduction and Application of Foundation Engineering-Importance and purpose-Classification of Foundation - Soil Exploration- Scope and objectives – Methods of exploration Depth and spacing of bore holes – Soil samples – Representative and undisturbed – Sampling methods– Split spoon sampler, Thin wall sampler, Stationary piston sampler – Penetrationtests (SPT and SCPT) – Data interpretation - Bore log report - Selection of foundation based on soil condition.

**UNIT II SHALLOW FOUNDATION 9**

Introduction - Bearing capacity of shallow foundation on homogeneous deposits – Location and depth of foundation – Terzaghi's formula and BIS formula – Factors affecting bearing capacity – Bearing capacity from in-situ tests (SPT, SCPT and plate load) – Allowable bearing pressure - Strength parameters and Evaluation of Liquefactionpotential - Seismic considerations in bearing capacity evaluation - Codal provisions.

**UNIT III FOOTINGS AND SETTLEMENT 9**

Proportioning of foundations for conventional rigid behaviour – Minimum depth for rigid behaviour – Applications – Floating foundation – Special foundations – Seismic force consideration - Contact pressure and settlement distribution- Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements– Codal provision

**UNIT IV DEEP FOUNDATION 9**

Types of Deep foundation-Classification of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering news and Hileys) – Capacity from insitu tests (SPT, SCPT) – Negative skin friction – Uplift capacity- Group capacity by different methods (Field's rule, Converse – Labarra formula and block failure criterion) –Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles – Capacity under compression and uplift – Types of wells or caissons- Codal provision.

**UNIT V RETAINING WALLS 9**

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls – Codal provision

**COURSE OUTCOMES**

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

CO 1: Graduates will demonstrate an ability to plan and execute a detailed site investigation to select geotechnical design parameters and type of foundation.

CO 2: Graduates will demonstrate an ability to design shallow foundations, its component or process as per the needs and specifications.

CO 3: Graduates will demonstrate an ability to design combined footings and raft foundations, its component or process as per the needs and specifications.

CO 4: Graduates will demonstrate an ability to design deep foundations, its components or processes as per the needs and specifications.

CO 5: Graduates will demonstrate an ability to design retaining walls, its component or process as per the needs and specifications.

**TEXT BOOKS:**

1. V.N.S. Murthy "A TextBook of Soil Mechanics and Foundation Engineering in SI units"UBS Publishers Distributors Ltd. Fourth edition 1993.
2. K. R. Arora "Soil mechanics and foundation Engineering" Standard Publisher Distribution 2017, 7th edition (Reprint).
3. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th EDITION, 2017.

**REFERENCES:**

1. Das, B.M. “Principles of Foundation Engineering '' (Eigth edition), Thompson Asia Pvt. Ltd., Singapore, 2017.
2. S.R. Kaniraj “Design Aids in Soil Mechanics and Foundation Engineering “, Tata McGraw Hill Education Limited, 2018.
3. Varghese, P.C.,”Foundation Engineering”, Prentice Hall of India Private Limited, New Delhi, 2012.
4. GopalRanjan, A S R Rao, “Basic and Applied Soil Mechanics” New Age International Publication, 3rd Edition, 2016.

**TOTAL: 45 PERIODS**

| Course Code | **Design of Steel Structures** | L | T | P | C |
|---|---|---|---|---|---|
| CE2504 | | 3 | 1 | 0 | 3 |

**COURSE OBJECTIVES**

- To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections and to provide the students the tools necessary for designing structural systems such as roof trusses and gantry girders as per provisions of current code (IS 800 - 2007) of practice

**UNIT I INTRODUCTION TO STRUCTURAL STEEL AND DESIGN OF CONNECTIONS 9**

General -Types of Steel -Properties of structural steel - I.S. rolled sections - Concept of Limit State Design - Design of Simple and eccentric Bolted and welded connections - Types of failure and efficiency of joint – prying action - Introduction to HSFG bolts

**UNIT II DESIGN OF TENSION AND COMPRESSION MEMBERS 9**

Behaviour and Design of simple and built-up members subjected to tension - Shear lag effect-Design of lug angles - tension splice - Behaviour of short and long columns - Euler's column theory-Design of simple and built-up compression members with lacings and battens - Design of column bases - slab base and gusseted base.

**UNIT III DESIGN OF BEAMS 9**

Design of laterally supported and unsupported beams - Design of built-up beams - Design of plate girders

**UNIT IV INDUSTRIAL STRUCTURES 9**

Design of roof trusses – loads on trusses – purlin design using angle and channel sections – truss design, Design of joints and end bearings–Design of gantry girder - Introduction to pre-engineered buildings

**UNIT V PLASTIC ANALYSIS AND DESIGN 9**

Introduction to plastic analysis - Theory of plastic Analysis - Design of continuous beams and portal frames using plastic design approach

**COURSE OUTCOMES**

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

CO 1: Recognize the design philosophy of steel structures and identify the different failure modes of bolted and welded connections, and determine their design strengths

CO 2: Select the most suitable section shape and size for tension and compression members and beams according to specific design criteria
CO 3: Apply the principles, procedures and current code requirements to the analysis and design of steel tension members, columns, column bases and beams.
CO 4: Identify and compute the design loads on Industrial structures, and gantry girder
CO 5; Find out ultimate load of steel beams and portal frames using plastic analysis

**TEXT BOOKS:**

1. Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 2010
2. Bhavikatti S.S, Design of Steel Structures, Ik International Publishing House, New Delhi, 2017.

**REFERENCES:**

1. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2013
2. Jack C. McCormac and Stephen F Csernak, Structural Steel Design, Pearson Education Limited, 2013
3. Sarwar Alam Raz, Structural Design in Steel, New Age International Publishers, 2014.
4. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016

**TOTAL: 45 PERIODS**

| Course Code | **Water Supply and Wastewater Engineering** | L | T | P | C |
|---|---|---|---|---|---|
| CE2505 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To teach students the basic principles and concepts of water supply unit operations and processes involved in water and wastewater treatment
- To develop a student's skill in the basic design of unit operations and processes involved in water and wastewater treatment
- To develop a student's skill in evaluating the performance of water and wastewater treatment plants
- To teach students the various methods of sludge management

**UNIT I WATER SUPPLY 9**

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

**UNIT II WATER TREATMENT 9**

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

**UNIT III WATER STORAGE 9**

Storage and balancing reservoirs – types, location and capacity. Distribution system: layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters,

analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations – House service connections.

**UNIT IV PLANNING AND DESIGN OF SEWERAGE SYSTEM 9**

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

**UNIT V SEWAGE TREATMENT AND DISPOSAL 9**

Objectives – Selection of Treatment Methods – Principles, Functions, – Activated Sludge Process and Extended aeration systems – Trickling filters – Sequencing Batch Reactor(SBR) – UASB –Waste Stabilization Ponds – Other treatment methods – Reclamation and Reuse of sewage – Recent Advances in Sewage Treatment – Construction, Operation and Maintenance aspects. – Discharge standards-sludge treatment -Disposal of sludge

**COURSE OUTCOMES**

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

CO 1: Quantify water required for a given population

CO 2: Examine the type and size of reactor required for various unit operations and processes involved in water and wastewater treatment

CO 3: Able to design individual unit operation or process appropriate to the situation by applying physical, chemical, biological and engineering principles. Able to identify the type of unit operations and processes involved in water and wastewater treatment plants based on the water quality

CO 4: Prepare the layout of water and wastewater treatment plants. Evaluate the water and wastewater treatment plants

CO 5: Investigate the performance of various unit operations and processes to meet the desired health and environment related goals. Understand sludge management and disposal

**TEXT BOOKS:**


1. Duggal, K.N., Elements of Public Health Engineering, S.Chand and Co., New Delhi, 1990.
2. Birdie, G.S. and Birdie, J.S., Water Supply and Sanitary Engineering, Dhanpat Rai and Sons, New Delhi, 1992.
3. *Metcalf and Eddy,* Waste Water Engineering, Collection, Treatment and Disposal, Tata McGraw Hill, Inc., New York, 1981.


**REFERENCES:**


1. Arcievala, S.J., "Wastewater Treatment for Pollution Control", Tata McGraw Hill., 2009
2. Metcalf and Eddy , Wastewater Engineering, Treatment and reuse, Tata McGraw-Hill Edition, Fourth edition., 2007
3. Hammer, M.J. and Hammer, M.J., "Water and Wastewater Technology", 7th Ed., Prentice Hall of India, 2011


**TOTAL: 45 PERIODS**

| Course Code | Irrigation Engineering and Hydrology | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3501 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- The student is exposed to different phases in irrigation practices and Planning and management of irrigation.
- Further they will be imparted required knowledge on Irrigation storage and distribution canal system and Irrigation management.
- To introduce to the students, the concepts of hydrological processes, hydrological extremes and groundwater.

**UNIT I CROP WATER REQUIREMENT 9**

Types of irrigation systems and methods - historical development and merits and demerits of irrigation-types of crops-crop season-duty, delta and base period- consumptive use of crops-evapo-transpiration;

**UNIT II DIVERSION AND IMPOUNDING STRUCTURES 9**

Tank irrigation - Well irrigation - Irrigation methods- Surface and Sub-Surface and Micro Irrigation-Gravity Dams and Spillways- Lined and unlined canals- Design of weirs on permeable foundation-cross drainage structures

**UNIT III PRECIPITATION AND ABSTRACTIONS 9**

Hydrological cycle - Meteorological measurements – Types and forms of precipitation - Rain gauges - Spatial analysis of rainfall data using Thiessen polygon and Iso-hyetal methods - Interception – Evaporation: Measurement, Evaporation suppression methods – Infiltration: Horton‟s equation - Double ring infiltrometer - Infiltration indices

**UNIT IV RUNOFF 9**

Catchment: Definition, Morphological characteristics - Factors affecting runoff - Run off estimation using Strange's table and empirical methods - SCS-CN method – Stage discharge relationship - Flow measurements - Hydrograph – Unit Hydrograph – IUH.

**UNIT V HYDROLOGICAL EXTREMES 9**

Natural Disasters - Frequency analysis - Flood estimation - Flood management - Definitions of drought: Meteorological, Hydrological, Agricultural and Integrated - IMD method - NDVI analysis - Drought Prone Area Programme (DPAP).

**COURSE OUTCOMES**

On completion of the course, the student is expected to

CO 1: Have knowledge and skills on crop water requirements

CO 2: Gain knowledge on types of Impounding structures , Understand the methods and management of irrigation

CO 3: To Discuss the hydrological processes and their integrated behaviour in catchments

CO 4: Apply the knowledge of hydrological processes to address basin characteristics, runoff and hydrograph.

CO 5: Explain the concept of hydrological extremes and its management strategies

**TEXT BOOKS:**


1. Subramanya K, "Engineering Hydrology"- Tata McGraw Hill, 2010 .
2. Jayarami Reddy P, "Hydrology", Tata McGraw Hill, 2008 .
3. Punmia B.C., et. al; Irrigation and water power Engineering, Laxmi Publications, 16th Edition, New Delhi, 2009.
4. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23rd Revised Edition, New Delhi, 2009.


**REFERENCES:**


1. David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007
2. Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
3. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers, 2005
4. Linsley R.K. and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc, 2000


**TOTAL: 45 PERIODS**

| Course Code | **Advance Concrete Technology** | L | T | P | C |
|---|---|---|---|---|---|
| CE3601 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To study the properties of concrete making materials, tests, mix design, special concretes,and various methods for making concrete.

**UNIT I CONCRETE MAKING MATERIALS 9**

Aggregates classification IS Specifications, Properties, Grading, Methods of combining aggregates, specified gradings, Testing of aggregates - Cement, Grade of cement, Chemical composition,Testing of concrete, Hydration of cement, Structure of hydrated cement, special cements - Water -Chemical admixtures, Mineral admixture.

**UNIT II MIX DESIGN 9**

Principles of concrete mix design, Methods of concrete mix design, IS Method, ACI Method, DOEMethod – Mix design for special concretes- changes in Mix design for special materials.

**UNIT III CONCRETING METHODS 9**

Process of manufacturing of concrete, methods of transportation, placing and curing, cracking,plastic shrinkage, Extreme weather concreting, special concreting methods. Vacuum dewatering –Underwater Concrete

**UNIT IV SPECIAL CONCRETES 9**

Light weight concrete Fly ash concrete, Fiber reinforced concrete, Sulphur impregnated concrete,Polymer Concrete – High performance concrete. High performance fiber reinforced concrete, SelfCompacting Concrete, Geo Polymer Concrete, Waste material-based concrete – Ready mixed concrete.

**UNIT V TESTS ON CONCRETE 9**

Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and shrinkage– Durability of concrete. Non-destructive Testing Techniques - microstructure of concrete

**COURSE OUTCOMES**

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

CO 1: Develop knowledge on various materials needed for concrete manufacture
CO 2: Apply the rules to do mix designs for concrete by various methods
CO 3: Develop the methods of manufacturing of concrete
CO 4: Explain about various special concrete
CO 5: Explain various tests on fresh and hardened concrete

**TEXT BOOKS:**

1. Gupta.B.L., Amit Gupta, "Concrete Technology, Jain Book Agency, 2017.
2. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2019.

**REFERENCES:**

1. Gambhir.M.L., Concrete Technology, McGraw Hill Education, 2006.
2. Neville, A.M., Properties of Concrete, Prentice Hall, 1995, London.
3. Thomas., Concrete Technology, Cencage learning India Private Ltd, New Delhi, 2015.

**TOTAL: 45 PERIODS**

| Course Code | **Soil Mechanics Laboratory** | L | T | P | C |
|---|---|---|---|---|---|
| CE3506 | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

To develop skills to test the soils for their index and engineering properties and to characterize the soil based on their properties.

S.NO

1. **DETERMINATION OF INDEX PROPERTIES**
   a. Grain size distribution – Sieve analysis
   b. Grain size distribution - Hydrometer analysis
   c. Liquid limit and Plastic limit tests
   d. Shrinkage limit and Differential free swell tests
   e. Specific gravity of soil solids
2. **DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS**
   a. Field density Test ( Sand replacement method)
   b. Determination of moisture – density relationship using standard proctor compaction test.
3. **DETERMINATION OF ENGINEERING PROPERTIES**
   a. Permeability determination (constant head and falling head methods)
   b. One dimensional consolidation test (Determination of co-efficient of consolidation only)
   c. Direct shear test in cohesion less soil
   d. Unconfined compression test in cohesive soil

e. Laboratory vane shear test in cohesive soil
f. Tri-axial compression test in cohesion less soil (Demonstration only)
g. California Bearing Ratio Test

4. **TEST ON GEOSYNTHETICS (Demonstration only)**
a.Determination of tensile strength and interfacial friction angle.
b. Determination of apparent opening sizes and permeability

**COURSE OUTCOMES**

On completion of the course, the student is expected to

CO1: Conduct tests to determine the index properties of soils
CO2: Determine the insitu density and compaction characteristics
CO3: Conduct tests to determine the compressibility, permeability and shear strength of soils
CO4: Understand the various tests on Geosynthetics.

**TOTAL: 45 PERIODS**

| Course Code | **Data Sciences -Application Project** | L | T | P | C |
|---|---|---|---|---|---|
| CE3507 | | 0 | 0 | 2 | 1 |

**OBJECTIVE:**

To use the knowledge acquired in data science to do an application project in Civil Engineering, which allows the students to come up with designs, fabrication or algorithms and programs expressing their ideas in a novel way.

**STRATEGY:**

- To identify a topic of interest in consultation with Faculty/Supervisor.
- Review the literature and gather information pertaining to the chosen topic
- State the objectives and develop a methodology to achieve the objectives.
- Carryout the design / fabrication or develop computer code.
- Demonstrate the novelty of the project through the results and outputs

| Course Code | **Water Quality Analysis Laboratory** | L | T | P | C |
|---|---|---|---|---|---|
| CE3508 | | 0 | 0 | 2 | 2 |

**COURSE OBJECTIVES**

- At the end of the course, the student is expected to be aware of the procedure for quantifying quality parameters for water and wastewater.

**LIST OF EXPERIMENTS**

**ANALYSIS OF WATER SAMPLE**

1. Sampling and preservation methods for water and wastewater (Demonstration only)
2. Determination of Turbidity, Electrical conductivity and pH
3. Determination of Acidity

4. Determination of Alkalinity
5. Determination of Hardness
6. Determination of Optimum Coagulant Dosage
7. Determination of Chlorides

**ANALYSIS OF WASTE WATER SAMPLE**

8. Determination of Suspended, Volatile and Fixed solids
9. Determination of DO for the Given Sample
10. Determination of COD for Given Sample
11. Determination of Sludge Volume Index of Biological Sludge
12. Determination of BOD for the Given Sample
13. Determination of Oil and Grease
14. Determination of MPN Index of given water sample(Demonstration only)

**COURSE OUTCOMES**

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

CO 1: Understand and apply appropriate methods for water and wastewater sample collection
CO 2: Quantify the pollutant concentration in water and wastewater
CO 3: Suggest the type of treatment required and amount of dosage required for the treatment
CO 4: Examine the conditions for the growth of micro-organisms
CO 5: Understand the importance of chlorine in disinfection processes

**REFERENCES:**


1. APHA, "Standard Methods for the Examination of Water and Waste water", 22nd Ed. Washington, 2012.
2. "Laboratory Manual for the Examination of water, wastewater soil Rump", H.H. and Krist,H. – Second Edition, VCH, Germany, 3rd Edition, 1999.
3. "Methods of air sampling & analysis",JamesP.Lodge Jr(Editor) 3rd Edition, Lewis publishers,Inc,USA,1989


**TOTAL: 45 PERIODS**

| Course Code | **Estimation, Costing and Valuation Engineering** | L | T | P | C |
|---|---|---|---|---|---|
| CE3602 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- The students will acquire knowledge in estimation, tender practices, contract procedures, and valuation and will be able to prepare estimates, call for tenders and execute works.

**UNIT I QUANTITY ESTIMATION** **9**

Philosophy – Purpose – Methods of estimation – Centre line method – Long and short wall method – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, bituminous and cement concrete roads, septic tank, soak pit, retaining walls – Culverts (additional practice in class room using computer softwares- qE Pro)

**UNIT II RATE ANALYSIS AND COSTING** **9**

Standard Data – Observed Data – Schedule of rates – Market rates – Materials and Labour – Standard Data for Man Hours and Machineries for common civil works – Rate Analysis for all Building works, canals, and Roads – Cost Estimates (additional practice in class room using Computer softwares) – (Analysis of rates for the item of work asked, the data regarding labour, rates of material and rates of labour to be given in the Examination Question Paper)

**UNIT III SPECIFICATIONS, REPORTS AND TENDERS** **9**

Specifications – Detailed and general specifications – Constructions – Sources – Types of specifications – Principles for report preparation – report on estimate of residential building – Culvert – Roads – TTT Act 2000 – Tender notices – types – tender procedures – Drafting model tenders , E-tendering- e NOI – e NOT -Digital signature certificates – Encrypting -Decrypting – Reverse auctions.

**UNIT IV CONTRACTS** **9**

Contract – Types of contracts – BOT – Types - Formation of contract – Contract conditions – Contract for labour, material, design, construction – Drafting of contract documents based on IBRD / MORTH Standard bidding documents – Construction contracts – Contract problems – Arbitration ,litigation and legal requirements

**UNIT V VALUATION** **9**

Definitions – Various types of valuations – Valuation methods - Necessity –Year's purchase-sinking fund-Capitalised value – Depreciation – Escalation – Valuation of land – Buildings – Calculation of Standard rent – Mortgage – Lease - Types of lease

**COURSE OUTCOMES**

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

CO 1: Gain knowledge on types of contracts.
CO 2: Understand types of specifications, principles for report preparation, tender notices types.
CO 3: Rate Analysis for all Building works, canals, and Roads and Cost Estimate.
CO 4: Estimate the quantities for buildings
CO 5: Evaluate valuation for building and land

**TEXT BOOKS:**

1. B.N Dutta 'Estimating and Costing in Civil Engineering', CBS Publishers & Distributors (P) Ltd, Twenty eighth revised edition, 2020.
2. B.S.Patil, 'Civil Engineering Contracts and Estimates', 7th edition, University Press, 2015

3. D.N. Banerjee, 'Principles and Practices of Valuation', V Edition, Eastern Law House, 2015

**REFERENCES:**

1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD
2. Tamil Nadu Transparencies in Tenders Act, 1998 and rules 2000
3. Arbitration and Conciliation Act, 1996
4. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996

**TOTAL: 45 PERIODS**

| Course Code | Building Information Modelling | L | T | P | C |
|---|---|---|---|---|---|
| CE3602 | | 3 | 0 | 2 | 4 |

**COURSE OBJECTIVES:**

The main objectives of this course are to:

- To provide students with a comprehensive understanding of BIM fundamentals, tools, benefits, challenges, and its significance in the AEC industry.
- To equip students with the knowledge and skills necessary to effectively apply BIM throughout the entire building lifecycle, from initial planning stages to construction and beyond.
- To equip students with the knowledge and skills necessary to leverage BIM across multiple dimensions to enhance the efficiency, effectiveness, and sustainability of building projects throughout their lifecycle.
- To equip students with the knowledge and skills necessary to design structurally sound, aesthetically pleasing, and environmentally responsive buildings that meet the functional and performance requirements of occupants while considering factors such as thermal comfort, lighting, acoustics, and weather resistance.
- To prepare students to effectively apply BIM methodologies and technologies in the planning, design, and management of infrastructure projects, thereby contributing to the development of sustainable, resilient, and efficient infrastructure systems to meet current and future societal needs.

**UNIT I Introduction to BIM** **6**

Definition - Guidelines - Different levels of BIM - BIM object - BIM model - Software's for BIM - Benefits - BIM challenges

**UNIT II BIM workflow in Building Lifecycle:** **6**

Planning and 3D modelling - Model based cost estimating - Construction scheduling and 4D simulation - Design co-ordination - BIM to the field.

**UNIT III Dimensional Aspects in BIM:** **6**

Visualization (3D) - Time (4D) - Cost (5D) - Operation (6D) - Sustainability (7D) - Safety (8D) - Advancements in various dimensions.

**UNIT IV Building Structural System:** **6**

Building Enclosures - Functional Aesthetic System - Thermal Infiltration - Illumination - Acoustic Control - Weather Resistance

**UNIT V Integrated Design Infrastructure using BIM:** **6**

Various Infrastructure Sectors - Highways - Railways - Ports and Aviation - Oil and Gas - Power - Telecom - Irrigation – Current Scenario and future needs.

**30 PERIODS**

**LIST OF EXPERIMENTS**

1. 3D Architectural Modelling of a residential home with floor plans using BIM Software

2. 3D Architectural Modelling of an Apartment building with floor plans using BIM Software

3. 3D Architectural Modelling of Interior Residential room with Sun light analysis using BIM Software

4. 3D Structural Modelling of a school building using BIM Software

5. 4D Simulation generation for clash detection using Navisworks

6. 5D Complete Estimate Calculation for the given building using BIM Software

7. Creating custom components using Model in Place

**45**

**PERIODS**

**COURSE OUTCOMES:**

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

CO1: To understand the definition, guidelines, different levels, and benefits of Building Information Modeling (BIM), as well as recognize challenges and software tools associated with its implementation
CO2: To effectively utilize Building Information Modeling (BIM) for planning and 3D modeling, model-based cost estimating, construction scheduling and 4D simulation, design coordination, and implementing BIM in the field
CO3: To be proficient in utilizing Building Information Modeling (BIM) for visualization (3D), time (4D), cost (5D), operation (6D), sustainability (7D), and safety (8D), as well as be aware of advancements in various dimensions within the BIM framework.
CO4: To analyze and design building enclosures, functional aesthetic systems, thermal infiltration solutions, illumination setups, acoustic control mechanisms, and weather resistance strategies within the context of structural systems, considering both functional and aesthetic requirements.
CO5: To analyze and apply Building Information Modeling (BIM) techniques to various infrastructure sectors such as highways, railways, ports and aviation, oil and gas, power, telecom, and irrigation, understanding both the current scenario and future needs in each sector.

**REFERENCES:**


1. Brad Hardin, Dave McCool , “BIM and Construction Management”, 2nd Edition, Wiley Publications, 2001.
2. Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston “BIM Handbook”, 2nd Edition, Wiley Publications, 2008.
3. Ray Crotty, “The Impact of Building Information Modelling”, 1st Edition, SPON Press, USA, 2012.
4. Dominik Holzer, The BIM Manager's Handbook: Guidance for Professionals in Architecture, Engineering, and Construction, Wiley, 2016.


**TOTAL:75 PERIODS**

| Course Code | Air & Noise Pollution Control Engineering | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3602 | | 3 | 0 | 0 | 2 |

**COURSE OBJECTIVES**

- To impart knowledge on the sources, effects and control techniques of air pollutants and noise pollution.

**UNIT I GENERAL 9**

Atmosphere as a place of disposal of pollutants – Air Pollution – Definition - Air Pollution and Global Climate - Units of measurements of pollutants - Air quality criteria - emission standards - National ambient air quality standards - Air pollution indices - Air quality management in India.

**UNIT II SOURCES, CLASSIFICATION AND EFFECTS 9**

Sources and classification of air pollutants - Man made - Natural sources - Type of air pollutants - Pollution due to automobiles - Analysis of air pollutants - Chemical, Instrumental and biological methods.Air pollution and its effects on human beings, plants and animals - Economic effects of air pollution - Effect of air pollution on meteorological conditions - Changes on the Meso scale, Micro scale and Macro scale.

**UNIT III SAMPLING, METEOROLOGY AND AIR QUALITY MODELLING 9**

Sampling and measurement of particulate and gaseous pollutants - Ambient air sampling - Stack sampling. Environmental factors - Meteorology - temperature lapse rate and stability – Adiabatic lapse rate - Wind Rose - Inversion – Wind velocity and turbulence - Plume behavior - Dispersion of air pollutants- Air Quality Modeling.

**UNIT IV AIR POLLUTION CONTROL MEASURES 9**

Control - Source correction methods - Control equipments - Particulate control methods – Bag house filter - Settling chamber - cyclone separators - inertial devices - Electrostatic precipitator – scrubbers - Control of gaseous emissions - Absorption - Absorption equipments - adsorption and combustion devices (Theory and working of equipments only).

**UNIT V NOISE POLLUTION AND ITS CONTROL 9**

Sources of noise – Units and Measurements of Noise - Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – General Control Measures – Effects of noise pollution – auditory effects, non-auditory effects. Noise Menace– Prevention and Control of Noise Pollution – Control of noise at source, control of transmission, protection of exposed person - Control of other types of Noise Sound Absorbent

**COURSE OUTCOMES**

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

CO 1: Understand various types and sources of air pollution and its effects
CO 2: Know the dispersion of air pollutants and their modeling
CO 3: Know about the principles and design of control of particulate pollutants
CO 4: Understand the principles and design of control of gaseous pollutant
CO 5: Know the sources, effects and control of vehicular, indoor air and noise pollution

**TEXT BOOKS:**

1. C. S. Rao, "Environmental Pollution Control Engineering", Wiley Eastern Limited, 2006.
2. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 2017.
3. Dr. Y. Anjaneyulu, "Air Pollution and Control Technologies", Allied publishers Pvt. Ltd., 2019.

**REFERENCES:**

1. Noel De Nevers, "Air pollution control Engineering", McGraw Hill International Edition, McGraw Hill Inc, New Delhi, 2000.
2. Air Pollution act, India, 1987
3. Peterson and E.Gross Jr., "Hand Book of Noise Measurement", 7th Edition, 1974
4. Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986
5. Antony Milne, "Noise Pollution: Impact and Counter Measures", David & Charles PLC, 1979.
6. Kenneth wark, Cecil F.Warner, "Air Pollution its Origin and Control", Harper and Row Publishers, New York, 1998

**TOTAL: 45 PERIODS**

| Course Code | **Municipal Solid Waste Management** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3603 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

**UNIT I SOURCES AND CHARACTERISTICS 9**

Sources and types of municipal solid wastes- Public health and environmental impacts of improper disposal of solid wastes- sampling and characterization of wastes - factors affecting waste generation rate and characteristics - Elements of integrated solid waste management – Requirements and salient features of Solid waste management rules (2016) –- Role of public and NGO‟s- Public Private participation – Elements of Municipal Solid Waste Management Plan.

**UNIT II SOURCE REDUCTION , WASTE STORAGE AND RECYCLING 9**

Waste Management Hierarchy - Reduction, Reuse and Recycling - source reduction of waste – On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – case studies under Indian conditions – Recycling of Plastics and Construction/Demolition wastes.

**UNIT III COLLECTION AND TRANSFER OF WASTES 9**

Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection routes – Analysis of waste collection systems; Transfer stations –location, operation and maintenance; options under Indian conditions – Field problems- solving.

**UNIT IV PROCESSING OF WASTES 9**

Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

**UNIT V WASTE DISPOSAL 9**

Land disposal of solid waste- Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor – Dumpsite Rehabilitation

**COURSE OUTCOMES**

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

CO 1: understand the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.

CO 2: Know the facts abouts Reduction, reuse and recycling of waste.

CO 3: plan and design systems for storage, collection, transport, processing and disposal of municipal solid waste.

CO 4: Have knowledge on the issues on solid waste management from an integrated and holistic perspective, as well as in the local and international context.

CO 5: Design and operation of sanitary landfill.

**TEXT BOOKS:**

1. William A. Worrell, P. Aarne Vesilind (2012) Solid Waste Engineering, Cengage Learning, 2012.
2. John Pitchel (2014), Waste Management Practices-Municipal, Hazardous and industrial – CRC Press, Taylor and Francis, New York.

**REFERENCES:**

1. CPHEEO (2014), "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi.
2. George Tchobanoglous and FrankKreith (2002).Handbook of Solid waste management, McGraw Hill, New York

**TOTAL: 45 PERIODS**

| Course Code | **Renewable Energy Sources** | L | T | P | C |
|---|---|---|---|---|---|
| CE0E3001 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To know the Indian and global energy scenario among the various solar, wind, ocean, geothermal and bio-energy technologies and its applications.

**UNIT I ENERGY SCENARIO 9**

Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status-Potential of various renewable energy sources-Global energy status-Per capita energy consumption -Future energy plans

**UNIT II SOLAR ENERGY 9**

Solar radiation – Measurements of solar radiation and sunshine – Solar spectrum - Solar thermal collectors – Flat plate and concentrating collectors – Solar thermal applications – Solar thermal energy storage – Fundamentals of solar photo voltaic conversion – Solar cells – Solar PV Systems - Solar PV applications.

**UNIT III WIND ENERGY 9**

Wind data and energy estimation – Betz limit - Site selection for windfarms – characteristics - Wind resource assessment - Horizontal axis wind turbine – components - Vertical axis wind turbine – Wind turbine generators and its performance – Hybrid systems – Environmental issues - Applications.

**UNIT IV BIO-ENERGY 9**

Bio resources – Biomass direct combustion – thermochemical conversion - biochemical conversion-mechanical conversion - Biomass gasifier - Types of biomass gasifiers - Cogeneration –- Carbonisation – Pyrolysis - Biogas plants – Digesters –Biodiesel production – Ethanol production - Applications.

**UNIT V OCEAN AND GEOTHERMAL ENERGY 9**

Small hydro - Tidal energy – Wave energy – Open and closed OTEC Cycles – Limitations – Geothermal energy – Geothermal energy sources - Types of geothermal power plants – Applications Environmental impact.

**COURSE OUTCOMES**

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

CO 1: Learn the Indian and global energy scenario.
CO 2: Understand the various solar energy technologies and its applications.
CO 3: Explore the various wind energy technologies.
CO 4: Explore the various bio-energy technologies.
CO 5: Understand the ocean and geothermal technologies.

**TEXT BOOKS:**


1. Fundamentals and Applications of Renewable Energy | Indian Edition, by Mehmet Kanoglu, Yunus A. Cengel, John M. Cimbala, cGraw Hill; First edition (10 December 2020), ISBN-10 : 9390385636
2. Renewable Energy Sources and Emerging Technologies, by Kothari, Prentice Hall India Learning Private Limited; 2nd edition (1 January 2011), ISBN-10 : 8120344707
3. Srinivasa Kumar, “Introduction to Traffic Engineering”, Universities Press, 2018
4. Partha Chakroborty and Animesh Das, PrinciplesofTransportationEngineering, PHI Learning Private Limited; 2011.
5. Papacosta.P.S and Prevedouros.P.D, “ Transportation Engineering and Planning, third edition, 2015


**REFERENCES:**


1. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 2012.
2. Rai.G.D., “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 2014.

3. Sukhatme.S.P., "Solar Energy: Principles of Thermal Collection and Storage", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.
4. Tiwari G.N., "Solar Energy – Fundamentals Design, Modelling and applications", Alpha Science Intl Ltd, 2015.
5. Twidell, J.W. & Weir A., "Renewable Energy Resources", EFNSpon Ltd., UK, 2015.

**TOTAL: 45 PERIODS**

| Course Code | Irrigation and Hydraulic Structures | L | T | P | C |
|---|---|---|---|---|---|
| CE3603 | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES**

- The student is exposed to different phases in irrigation practices and Planning and management of irrigation. Further they will be imparted required knowledge on Irrigation storage and distribution canal system and Irrigation management. At the end of the semester, the student shall conceive, irrigation structures and design and draw the irrigation and environmental engineering structures in detail showing the plan, elevation and Sections.

**UNIT I CROP WATER REQUIREMENT 9+3**

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

**UNIT II IRRIGATION METHODS AND MANAGEMENT 9+3**

Tank irrigation — Well irrigation — Irrigation methods: Surface and Sub-Surface and Micro Irrigation — design of drip and sprinkler irrigation — ridge and furrow irrigation-Irrigation scheduling — Water distribution system- Irrigation efficiencies. Modernization techniques-Rehabilitation – Optimization of water use-Minimizing water losses- On form development works-Participatory irrigation management- Water resources associations

**UNIT III STORAGE WORKS 9+3**

Reservoirs – Types of reservoirs, selection of site for reservoir, zones of storage of a reservoir, reservoir yield, estimation of capacity of reservoir using mass curve- Reservoir Sedimentation – Life of Reservoir. Types of dams, factors affecting selection of type of dam, factors governing selection of site for a dam.

**UNIT IV DIVERSION AND IMPOUNDING STRUCTURES 9+3**

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

**UNIT V CANAL IRRIGATION 9+3**

Canal regulations — direct sluice — Canal drop — Cross drainage works-Canal outlets — Design of prismatic canal, Canal alignments-Canal lining — Kennedy's and Lacey's Regime theory-

**COURSE OUTCOMES**

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

CO 1: Have knowledge and skills on crop water requirements.
CO 2: Understand the methods and management of irrigation.
CO 3: Gain knowledge on types of Impounding structures
CO 4: Understand methods of irrigation including canal irrigation.
CO 5: Get knowledge on water management on optimization of water use.

**TEXT BOOKS:**


1. Irrigation Engineering and Hydraulic structures by Santhosh kumar Garg, Khanna Publishers.
2. Irrigation engineering by K. R. Arora Standard Publishers.
3. Irrigation and water power engineering by Punmia and Lal, Laxmi publications Pvt. Ltd., New Delhi
4. Satya Narayana Murthy Challa, "Water Resources Engineering: Principles and Practice", New Age International Publishers, New Delhi, 2002.


**REFERENCES:**


1. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers, 2005
2. Linsley R.K. and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc, 2000
3. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGraw Hill Inc., New Delhi, 1997. 69
4. Sharma R.K.. "Irrigation Engineering", S.Chand& Co. 2007. 5. Michael A.M., Irrigation Theory and Practice, 2nd Edition, Vikas Publishing House Pvt. Ltd., Noida, Up, 2008
5. Asawa, G.L., "Irrigation Engineering", NewAge International Publishers, New Delhi, 2000.
6. Basak, N.N, "Irrigation Engineering", Tata McGraw Hill Publishing Co. New Delhi


**TOTAL: 60 PERIODS**

| Course Code | **Analysis and Design Software** | L | T | P | C |
|---|---|---|---|---|---|
| CE3604 | | 0 | 0 | 4 | 2 |

**COURSE OBJECTIVES**

- To develop skill and proficiency in analysis and design of various structural members using design software
- To develop skill and proficiency in analysis and design of Multistoried RCC building using design software
- To develop skill and proficiency in analysis and design of steel roof truss frame for Industrial buildings

1. Analysis and design of simply supported beam, fixed beam for different load conditions
2. Analysis and design of continuous beam and cantilever beam for different load conditions
3. Analysis and design of One way and Two-way slab
4. Analysis and design of Multi storied Building
5. Analysis and design of shear wall
6. Analysis and design of Circular Water tank

7. Analysis and design of Rectangular water tank
8. Analysis and design of doglegged stair case
9. Analysis and design of spiral stair case
10. Design of foundation for space frames
11. Analysis and design of steel roof truss frame for Industrial Buildings

**COURSE OUTCOMES**

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

CO 1: Know the analysis and design of different beams under different loading condition
CO 2: Known the analysis and design of one way and Two-way slab
CO 3: Design the multistoried RCC Building
CO 4; Design the RCC rectangular and Circular water tank
CO 5: Design the steel roof truss for Industrial buildings

**TEXT BOOKS:**


1. Krishna Raju, N., "Structural Design & Drawing (Concrete & Steel)", CBS Publishers, New Delhi, 3rd Edition, 2009.
2. Krishnamurthy, D., "Elementary Structural Design & Drawing, Volume 2 (Concrete Structures)", CBS Publishers & Distributors, New Delhi, 2008.
3. Krishnamurthy, D., "Elementary Structural Design & Drawing, Volume 3 (Concrete Structures)", CBS Publishers & Distributors, New Delhi, 2008.
4. Autodesk Robot Structural Analysis Professional 2015: Essentials Paperback – Import, 24 October 2014


**REFERENCES:**


1. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017
2. Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., 2021
3. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete",Laxmi Publication Pvt. Ltd., New Delhi, 2016
4. Shah V L Karve S R., "Limit State Theory and Design of Reinforced Concrete", Structures Publilcations, Pune, 2013
5. Punmia, B.C., Ashok Kumar Jain and Arun Kumar Jain, "Design of Steel structures", Lakshmi Publication Pvt. Ltd., Chennai, 2008
6. Duggal, S.K., "Design of Steel structures", Tata Mcgraw – Hill Publishers, New Delhi, 2009.


**TOTAL: 45 PERIODS**

| Course Code | **Environment, Irrigation Engineering Design and Drawing Project** | L | T | P | C |
|---|---|---|---|---|---|
| CE3605 | | 0 | 0 | 4 | 4 |

**COURSE OBJECTIVES**

- At the end of the semester, the student shall conceive irrigation structures and design and draw the irrigation and environmental engineering structures in detail showing the plan, elevation and Sections.

**PART A: IRRIGATION ENGINEERING**

**I TANK COMPONENTS** **9**

Fundamentals of design – Tank surplus weir – Tank sluice with tower head – Drawings showing foundation details, plan and elevation

**II IMPOUNDING STRUCTURES** **6**

Design principles – Earth dam – Profile of Gravity Dam

**III CROSS DRAINAGE WORKS** **6**

General design principles – Aqueducts – Syphon aqueduct (Type III) – Canal drop (Notch Type) – Drawing showing plan, elevation and foundation details.

**IV CANAL REGULATION STRUCTURES** **9**

General Principles – Direct Sluice – Canal regulator – Drawing showing detailed plan, elevation and foundation details

**PART B: ENVIRONMENTAL ENGINEERING**

**V WATER SUPPLY AND TREATMENT** **15**

Design and Drawing of flash mixer, flocculator, clarifier – Rapid sand filter – Service reservoirs Pumping station – House service connection for water supply and drainage.

**VI SEWAGE TREATMENT & DISPOSAL** **15**

Design and Drawing of screen chamber – Grit channel – Primary clarifier – Activated sludge process – Aeration tank – Trickling filter – Sludge digester – Sludge drying beds – Septic tanks and disposal arrangements.

**COURSE OUTCOMES**

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

CO 1: design and draw various units of Municipal water treatment plants and sewage treatment plants.

**TEXT BOOKS:**


1. Irrigation Engineering and Hydraulic structures by Santhosh kumar Garg, Khanna Publishers.
2. Irrigation and water power engineering by Punmia and Lal, Laxmi publications Pvt. Ltd., New Delhi
3. Satya Narayana Murthy Challa, “Water Resources Engineering: Principles and Practice”, New Age International Publishers, New Delhi, 2002


**REFERENCES:**


1. Duggal, K.N. and Soni, J.P., “Elements of Water Resources Engineering”, New Age International Publishers, 2005
2. Linsley R.K. and Franzini J.B, “Water Resources Engineering”, McGraw-Hill Inc, 2000


**TOTAL: 45 PERIODS**

| Course Code | Survey Camp (2 weeks) | L | T | P | C |
|---|---|---|---|---|---|
| CE3606 | | 0 | 0 | 0 | 1 |

**COURSE OBJECTIVES**

The objective of the survey camp is to enable the students to get practical training in the field work. Groups of not more than six members in a group will carry out each exercise in survey camp. At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

S.NO Two weeks Survey Camp will be conducted during summer vacation in the following activities:

1. Traverse – using Theodolite / Total station
2. Contouring:
   (i). Radial tachometric contouring - Radial Line at Every 45 Degree and Length not less than 60 Meter on each Radial Line
   (ii). Block Level/ By squares of size at least 100 Meter x 100 Meter atleast 20 Meter interval
   (iii).L.S & C.S - Road and canal alignment for a Length of not less than 1 Kilo Meter atleast L.S at Every 30M and C.S at every 90 M
3. Offset of Buildings and Plotting the Location
4. Sun observation to determine azimuth (guidelines to be given to the students)
5. Use of GPS to determine latitude and longitude and locate the survey camp location
6. Traversing using GPS
7. Curve setting by deflection angle

Apart from above students may be given survey exercises in other area also based on site condition to give good exposure on survey.

**COURSE OUTCOMES**

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

CO 1: Handle the modern surveying instruments like Total station and GPS
CO 2: Apply modern surveying techniques in field to establish horizontal control.
CO 3: Understand the surveying techniques in field to establish vertical control
CO 4: Apply different survey adjustment techniques.
CO 5: Carry out different setting out works in the field

**TOTAL: (2 weeks)**

| Course Code | Prestressed Concrete Structures | L | T | P | C |
|---|---|---|---|---|---|
| CE3701 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To understand the methods and types of prestressing and to enable the students to design prestressed concrete structural elements and systems

**UNIT I INTRODUCTION – THEORY AND BEHAVIOUR 9**

Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept – Losses of prestress in post -tensioned and pre-tensioned members.

**UNIT II DESIGN FOR FLEXURE AND SHEAR 9**

Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343 Code – Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for flexural capacity based on I.S. 1343 Code – Influence of Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code.

**UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE 9**

Factors influencing deflections – Short-term deflections of uncracked members – Prediction of longterm deflections due to creep and shrinkage – Check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and I.S. 1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pretensioned beams.

**UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS 9**

Analysis and design of composite beams – Shrinkage strain and its importance – Differential shrinkage - Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design

**UNIT V MISCELANEOUS STRUCTURES 9**

Role of prestressing in members subjected to Tensile forces and compressive forces – Design of Tension members and Compression members - Design of Tanks, Pipes, Sleepers and Poles – Partial prestressing – methods of achieving partial prestressing, merits and demerits of partial prestressing.

**COURSE OUTCOMES**

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

CO 1: Design a prestressed concrete beam accounting for losses.
CO 2; Design for flexure and shear.
CO 3: Design the anchorage zone for post-tensioned members and estimate the deflection in beams
CO 4: Design composite members and continuous beams.
CO 5: Design water tanks, pipes, poles and sleepers.

**TEXT BOOKS:**

1. Krishna Raju N., "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, New Delhi, 2012

2. Pandit.G.S. and Gupta. S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2014

**REFERENCES:**

1. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
2. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2017.
3. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH,2017
4. Sinha.N.C. And Roy.S.K. Fundamentals of Prestressed Concrete, S.Chand and Co. Ltd., 2011

**TOTAL: 45 PERIODS**

| Course Code | **Project Work Phase -I** | L | T | P | C |
|---|---|---|---|---|---|
| CE3702 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To use the knowledge acquired in Civil Engineering to do a mini project, which allows the students to come up with designs, fabrication or algorithms and programs expressing their ideas in a novel way.

**STRATEGY**

To identify a topic of interest in consultation with the Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design / fabrication or develop computer code. Demonstrate the novelty of the project through the results and outputs.

**TOTAL: 60 PERIODS**

| Course Code | **Project Work Phase -II** | L | T | P | C |
|---|---|---|---|---|---|
| CE3801 | | 0 | 0 | 0 | 10 |

**COURSE OBJECTIVES**

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

**STRATEGY**

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner

**OUTCOME**

On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

**TOTAL: 300 PERIODS**

**APPENDIX A: PROFESSIONAL ELECTIVES**

**PROFESSIONAL ELECTIVE COURSE**

| STRUCTURES | CONSTRUCTION TECHNIQUES AND PRACTICES | GEOTECHNICAL |
|---|---|---|
| Concrete Structures | Formwork Engineering | Geo Environmental Engineering |
| Steel Structures | Construction Equipment and Machinery | Ground Improvement Techniques |
| Prefabricated Structures | Sustainable Construction and Lean Construction | Soil Dynamics and Machine Foundations |
| Prestressed Concrete Structures | Digitalized Construction Lab | Rock Mechanics |
| Rehabilitation/ Heritage Restoration | Construction Management and Safety | Earth and Earth Retaining Structures |
| Dynamics and Earthquake Resistant Structures | Advanced Construction Techniques | Pile Foundation |
| Introduction to Finite Element Method | Energy Efficient Buildings | Tunnelling Engineering |

| GEO-INFORMATICS | TRANSPORTATION INFRASTRUCTURE | ENVIRONMENT |
|---|---|---|
| Total Station and GPS Surveying | Airports and Harbours | Climate Change Adaptation and Mitigation |
| Remote Sensing Concepts | Traffic Engineering and Management | Air and Noise Pollution Control Engineering |
| Satellite Image Processing | Urban Planning and Development | Environmental Impact Assessment |
| Cartography and GIS | Smart cities | Industrial Wastewater Management |

| | | |
|---|---|---|
| Photogrammetry | Intelligent Transport Systems | Solid and Hazardous Waste Management |
| Airborne and Terrestrial laser mapping | Pavement Engineering | Environmental Policy and Legislations |
| Hydrographic Surveying | Transportation planning Process | Environment, Health and Safety |

| **WATER RESOURCES** |
|---|
| Participatory Water Resources Management |
| Groundwater Engineering |
| Water Resources Systems Engineering |
| Watershed Conservation and Management |
| Integrated Water Resources Management |
| Urban Water Infrastructure |
| Water Quality and Management Coastal Zone Management |

**VERTICAL I- STRUCTURES**

| Course Code | **CONCRETE STRUCTURES** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3001 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE**:

- To acquire hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice using Computer Software Staad Pro, E-Tabs and any Structural design and analysis Software.

**UNIT I INTRODUCTION AND CODES** **9**

Geometric Parameters, Grade of concrete and steel for different elements, Exposure and cover requirements, Fire rating, Load Combinations, Serviceability Requirements, Analysis tools. Indian & International Codes for Reinforced concrete Design, Design loads, National Building Code 2016, Practical building example, drawing sizes and scale.

**UNIT II LOADS ACTING ON STRUCTURES** **9**

Introduction, Dead, Live loads, Wind loading and Calculations of - force coefficients, Wind pressure, storey forces and base shears. Earthquake loading and Calculations of - acceleration coefficient, Time period, Base shear. Scheme Design, Concrete floor systems, Sizing and design of various slab systems, Beams, Reinforced Concrete Columns - Location

and Shape, Design Axial Load, sizing, Lateral Load Systems, IS 1893- Requirements.

**UNIT III MODELLING OF BASIC STRUCTURAL ELEMENTS 9**

Introduction to Analysis & Modelling, Modelling of Cantilever, Portal Frame, three bay Portal Frame, 3D structural models - Geometry, gravity loads, defining earthquake loads, defining wind loads, Modelling Shear walls, Practical Structural Model of building, Structural models of Floor System, Estimation of deflections

**UNIT IV DESIGN OF STRUCTURAL ELEMENTS 9**

Design of Beams- flexural reinforcement, shear reinforcement, Design of flat slabs- Flexural Reinforcement, shear reinforcement, Design of 2-way continuous slabs.Design of Reinforcements in Columns, Post processing, Design and arrangement of vertical reinforcement, horizontal reinforcement in the design of buildings. Design of shear walls - Sizing of elements based on Constructability aspects like formwork, concrete placement and compaction, rebar arrangement to satisfy economy and optimum utilization.

**UNIT V DETAILING OF STRUCTURAL ELEMENTS 9**

Development of Reinforcement, Typical details of- flat slabs, two-way continuous slabs, beams, columns and shear wall, detailing and documentation.

Case Studies : Structural analysis and design of a multi-storey building with load calculation (dead, live, wind and seismic) as per Indian standard codes using any Structural design and analysis Software.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the student will able to

**CO1** Plan a layout of a structure

**CO2** Calculate loads using IS codes and various computational tools

**CO3** Analyse the structure for various loads and load combination according to the relevant IS codes

**CO4** Design and Analysis of structures using computer software/tools

**CO5** Prepare the complete structural drawings using computer software

**REFERENCES:**


1. Unnikrishna Pillai, S., Devdas Menon, “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., 2009.
2. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.

3. Krishnaraju.N " Design of Reinforced Concrete Structurres ", CBS Publishers & Distributors Pvt. Ltd., New Delhi.
4. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002.
5. Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete",Laxmi Publication Pvt. Ltd., New Delhi, 2007.

| Course Code | STEEL STRUCTURES | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3002 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To acquire hands on experience in design and preparation of structural drawings for steel structures like industrial buildings, steel framed buildings using structural design software and detailed drawing softwares
- To introduce the students to design of light gauge steel structures

**UNIT I DESIGN ASPECTS AND LOADS ON A STEEL BUILDING 9**

Inputs for the design of a steel building - Design basis report, covering Site Data, geometrical, functional and structural requirements for its end usage - material specifications - Methods of designing a steel building. Calculating the various loads acting on a steel building - Vertical & Lateral loads - Effects of each loads separately and in combination – Dead, superimposed dead, live, temperature, MEP service loads - Lateral loads due to Wind and Seismic effects.

**UNIT II SELECTION OF LOAD RESISTING SYSTEM AND MODELLING OF STRUCTURE 9**

Studying the layout plans of the structure - Selection of load resisting systems - Load flow in each system - Satisfying Stability and strength of the structure - Vertical and Lateral load resisting systems -Analysis and design of Sway and non-sway frames - Manual and Computer aided modelling,analysis and design - Geometric and structural parameters of the structure - Loading the structure - Interpretation of the results of the software – Analysis and Design of a multi-storeyed building.

**UNIT III DESIGN OF VARIOUS ELEMENTS OF A STEEL BUILDING 9**

Manual and Software aided design – Beams, columns, floors, bracings, purlins/girts and facades, base plates and anchor bolts – Various loads, different conditions of supports, exposure, and purpose of use - Design of Connections between the members – bolted and welded, moment and shear connections

**UNIT III DESIGN OF AN INDUSTRIAL BUILDING 9**

Functional requirements - Serviceability Requirements - Structural Configurations - Selection of sections as per requirements - Configuration of the elements, connectivity - Analysis and design of different types of trusses –– Design of Gantry Girders – Design of gable frames – Design of steel columns for combined loading - Analysis and design of industrial buildings - Study of General assembly drawings - Fabrication processes - Fabrication, logistics & erection – Sequence of erection -Inspection of a completed structure.

**UNIT V DESIGN OF LIGHT GAUGE STEEL STRUCTURES** **9**

Philosophy of design of light gauge steel members, Direct Strength Method (DSM) ,Effective width method (EWM) – Concept of buckling, local buckling and post-buckling strength - Analysis and design of Compression members– Analysis and design of flexural members, Lateral buckling of beams, Shear Lag, Flange Curling – Design of wall panels

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES:**

Students will be able to

**CO1** Plan the layout of the structure and calculate the loads of the steel structure.

**CO2** Select a load resisting system, model the structure and interpret the results.

**CO3** Design the various elements of a steel buildings

**CO4** Design a typical industrial building

**CO5** Design the various elements of a cold –formed steel buildings

**TEXT BOOKS**


1. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016
2. Negi L.S. “Design of steel structures” McGraw Hill Co., New Delhi, 2014
3. Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi,2010


**REFERENCES**


1. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2013
2. Jack C. McCormac and Stephen F Csernak, Structural Steel Design, Pearson Education Limited, 2013.
3. Sarwar Alam Raz, Structural Design in Steel, New Age International Publishers, 2014
4. Gaylord E H, Gaylord N C and Stallmeyer J E, “Design of Steel Structures”, 3rd edition, McGraw Hill Publications, 1992.
5. Salmon, Johnson & Malhas,” Steel Structures: Design and Behavior, 4th Edition, Harper Collins College Publisher, 1996

6. Bhavikatti S.S, Design of Steel Structures, Ik International Publishing House, New Delhi,2017.
7. Wie Wen Yu, Design of Cold Formed Steel Structures, McGraw Hill Book Company, 1996
8. www.nptel.ac.in
9. http://www.steel-insdag.org/TM_Contents.asp

**INDIAN STANDARD CODES**

1. IS: 800 – 2007, Code of Practice for general construction in steel, BIS, New Delhi
2. SP 6 (1) – Structural steel sections
3. IS 875 (1-5) - 1987 Code of practice for Design Loads (Other than Earthquake) for Buildings and Structures, BIS
4. IS 816 :1969 - Code of practice for Metal Arc Welding for general Construction in Mild Steel, BIS IS: 808 – 1989 Dimensions For Hot Rolled Steel Beam, Column, Channel and Angle Sections

| Course Code | **PREFABRICATED STRUCTURES** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3003 | | 3 | 0 | 0 | 3 |

| **COURSE OBJECTIVE:** | | | | | |
|---|---|---|---|---|---|

- To introduce the basic concepts of prefabrication
- To acquire the knowledge of prefabrication components and systems
- To understand the design principles in prefabrication
- To perceive the types of joints and connections in structural members
- To impart knowledge about structural stability.

**UNIT I INTRODUCTION** **9**

Need for prefabrication -Advantages and limitations – Principles of prefabrication – Modular coordination – Standarization– Loads and load combinations– Materials – Production – Transportation – Erection.

**UNIT II PREFABRICATED COMPONENTS AND SYSTEMS** **9**

Behaviour and types of structural components– roof and floor slabs – Walls panels - Shear walls - Beams - Columns – skeletal system- portal frame system-Large panel systems- block system

**UNIT III DESIGN PRINCIPLES** **9**

Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast

concrete systems- Design for stripping , stacking ,transportation and erection of elements

**UNIT IV JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS 9**

Types of Joints – based on action of forces - compression joints - shear joints - tension joints - based on function - construction joints , contraction joints, expansion joints. Design of expansion joints -Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.

**UNIT V DESIGN FOR ABNORMAL LOADS 9**

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse -case study.

**TOTAL: 45 PERIODS**

**OUTCOMES**:

Students will be able to

**CO1** Understand concepts about principles of prefabrication, production, transportation, erection.

**CO2** Acquire knowledge about panel systems, slabs, beams, shear walls and columns used in precast construction.

**CO3** Acquire knowledge about design of cross section, joint flexibility.

**CO4** Acquire knowledge about joints and connection in precast construction.

**CO5** Acquire knowledge about structural stability.

**TEXTBOOKS:**


1. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers, USA,1991.
2. Lewitt,M. " Precast Concrete- Materials, Manufacture, Properties And Usage ,CRC Press, 2019
3. Alfred Steinle, Hubert Bachmann, Mathias Tillmann, Philip Thrift . "Precast Concrete Structures", Ernst & Sohn, Berlin, 2019.


**REFERENCES**:


1. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.
3. " Precast concrete connection details", Structural Design manual, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.


| Course Code | **PRESTRESSED CONCRETE STRUCTURES** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3004 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE**

- To understand the methods and types of prestressing and to enable the students to design prestressed concrete structural elements and systems

**UNIT I INTRODUCTION – THEORY AND BEHAVIOUR 9**

Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept – Losses of prestress in post -tensioned and pre-tensioned members.

**UNIT II DESIGN FOR FLEXURE AND SHEAR 9**

Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343 Code – Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for flexural capacity based on I.S. 1343 Code – Influence of Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code.

**UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE 9**

Factors influencing deflections – Short-term deflections of uncracked members – Prediction of long- term deflections due to creep and shrinkage – Check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and I.S. 1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pre- tensioned beams– design of anchorage zone reinforcement – Check for transfer bond length in pre- tensioned beams.

**UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS 9**

Analysis and design of composite beams – Shrinkage strain and its importance – Differential shrinkage - Methods of achieving continuity in continuous beams – Analysis for secondary moments

– Concordant cable and linear transformation – Calculation of stresses – Principles of design.

**UNIT V MISCELANEOUS STRUCTURES 9**

Role of prestressing in members subjected to Tensile forces and compressive forces – Design of Tension members and Compression members - Design of Tanks, Pipes, Sleepers and Poles – Partial prestressing – methods of achieving partial prestressing, merits and demerits of partial prestressing.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

Students will be able to

**CO1** Design a prestressed concrete beam accounting for losses.

**CO2** Design for flexure and shear.

**CO3** Design the anchorage zone for post-tensioned members and estimate the deflection in beams.

**CO4** Design composite members and continuous beams.

**CO5** Design water tanks, pipes, poles and sleepers.

**TEXTBOOKS:**

1. Krishna Raju N., "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, New Delhi, 2012
2. Pandit.G.S. and Gupta. S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2014

**REFERENCES:**

1. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
2. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2017.
3. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2017
4. Sinha.N.C. And Roy.S.K. Fundamentals of Prestressed Concrete, S.Chand and Co. Ltd., 2011

| Course Code | **REHABILITATION/HERITAGE RESTORATION** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3005 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To acquire the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures, Restoration of Heritage structures and demolition procedures.

**UNIT I MAINTENANCE AND REPAIR STRATIGES 9**

Maintenance, Repair and Rehabilitation - Facets of Maintenance - Importance of Maintenance - Various aspects of Inspection - Assessment procedure for evaluating a damaged structure - causes of deterioration.

**UNIT II STRENGTH AND DURABILITY OF CONCRETE 9**

Quality assurance for concrete – Strength and Durability of concrete - Cracks, different types, causes-Effects due to climate, temperature, Sustained elevated Temperature, Corrosion –

**UNIT III SPECIAL CONCRETES 9**

Polymer concrete - Sulphur infiltrated concrete - Fibre reinforced concrete - High strength concrete- High performance concrete - Self compacting concrete - Geopolymer concrete - Concrete made with industrial wastes.

**UNIT IV TESTING TECHNIQUES AND PROTECTION METHODS 9**

Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.

**UNIT V STRENGTHENING, REPAIR, REHABILITATION AND RESTORATION OF STRUCTURES 9**

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage and earthquake - Restoration of Heritage structures- Case studies.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

Students will be able to

**CO1** Know the importance of inspection and maintenance.

**CO2** Study the Impacts of cracks, corrosion and climate on structures.

**CO3** Know about various special concretes

**CO4** Understand the testing techniques and various protection measures

**CO5** Know the Repair of structures and Restoration of Heritage structures

**TEXT BOOKS:**


1. Shetty.M.S. Jain A K., Concrete Technology - Theory and Practice, S.Chand and Company, Eighth Edition, 2019.
2. B.Vidivelli, Rehabilitation of Concrete Structures Standard Publishes Distribution.1st edition 2009.


**REFERENCES:**


1. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.
2. Hand Book on "Repair and Rehabilitation of RCC Buildings" – Director General works CPWD ,Govt of India , New Delhi – 2002
3. P.C.Varghese, Maintenance Repair and Rehabilitation & Minor works of building, Prentice Hall India Pvt Ltd 2014.
4. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann, Elsevier, New Delhi 2012

| Course Code | DYNAMICS AND EARTHQUAKE RESISTANT STRUCTURES | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3006 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE**

- To understand the behaviour of structures under dynamic, earthquake loading and design the structures as earthquake resistant as per codal provisions.

**UNIT I INTRODUCTION TO DYNAMICS 9**

Dynamics - Degree of freedom – Free and forced vibration - Idealization of structure as Single Degree of Freedom (SDOF) and Multi degree of freedom (MDOF) system – D'Alemberts Principles Formulation of equation of motion for SDOF system and MDOF system –- Evaluation of natural frequencies and modes - Effect of damping.

**UNIT II SEISMOLOGY 9**

Elements of Engineering Seismology – Seismic hazard - Earthquake phenomenon – Seismotectonics – Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters – Soil Structure Interaction – Liquefaction of soil - Seismic zone map – Response spectra

**UNIT III EARTHQUAKE EFFECTS ON STRUCTURES 9**

Inertia force on structures – load transfer path – Effect of architectural features on behavior of structures – Hysteretic Behaviour of RCC, steel and prestressed concrete - Pinching Effect – Bouchinger Effects - Energy dissipation - P-delta effect - storey drift - Behavior of brick masonry, stone masonry and reinforced concrete structures under past earthquakes – typical failures - Causes of damage –- Lessons learnt from past earthquakes.

**UNIT IV EARTHQUAKE LOAD ANALYSIS 9**

Design spectra – Codal provision – Different methods of earthquake analysis –- Analysis of structure by Equivalent static method – Analysis of structure by Response spectrum method – Introduction to time-history method of analysis

**UNIT V EARTHQUAKE RESISTANT DESIGN 9**

Philosophy of earthquake resistant design - Planning considerations and Architectural concepts - Design and detailing as per codal provisions - Design and detailing of typical flexural member and column member, Ductile detailing of beam-column joints and footing – Concept and principle of shear wall - Introduction to performance based seismic design - Seismic isolation principles and methods.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

**CO1** Develop the equations of motion for SDOF and MDOF system and to evaluate the natural frequencies and mode shapes.

**CO2** Explain the elements of engineering seismology, characteristics of earthquake and seismic instrumentation.

**CO3** Explain the behavior of various types of structures under earthquake

**CO4** Determine the forces in a structure due to earthquake

**CO5** Design earthquake resistant building structures

**TEXTBOOKS:**


1. Mario Paz, Structural Dynamics – Theory and Computations, Fifth Edition 2nd printing, CBS publishers, 2006.
2. Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2011.


**REFERENCES:**


1. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.
2. Minoru Wakabayashi, Design of Earthquake Resistant Buildings, Mc Graw – Hill Book Company, 1986.
3. Anil K Chopra, Dynamics of structures – Theory and applications to Earthquake Engineering, Prentice Hall Inc., 2007.
4. Moorthy.C.V.R., Earthquake Tips, NICEE, IIT Kanpur,2002.


**Publication of Bureau of Indian Standards:**

a. IS 4326: 2013 Earthquake Resistant Design And Construction Of Buildings – Code of Practice

b. IS 1893: 2016 Criteria For Earthquake Resistant Design Of Structures – Part 1 General Provisions and Buildings.

IS 13920:2016 Ductile Design And Detailing Of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice.

| | | | | | |
|---|---|---|---|---|---|
| CEPE3007 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE**

- To develop a thorough understanding of the finite element analysis techniques with an ability to effectively use the tools of the analysis for solving practical problems arising in Civil Engineering.

**UNIT I INTRODUCTION** **9**

Historical Background – Mathematical Modeling of field problems in Engineering –Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

**UNIT II STIFFNESS MATRIX FORMULATION** **9**

Introduction to Discrete and Continua elements – Discrete Elements - Direct stiffness method - Special characteristics of stiffness matrix - Assemblage of elements – Boundary condition & reaction

- 2D – truss element - 2D - beam element - Analysis of framed Structures - Basic steps in finite element analysis - Differential equilibrium equations - strain displacement relation - linear constitutive relation - Numerical methods in finite element analysis- Gauss elimination method.

**UNIT III ONE DIMENSIONAL PROBLEMS** **9**

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Continua Elements - Displacement models - convergence requirements. Natural coordinate systems - Shape function. Interpolation function. Linear and quadratic elements - Lagrange & Serendipity elements. Strain displacement matrix - element stiffness matrix and nodal load vector. Natural frequencies of longitudinal vibration and mode shapes.

**UNIT IV TWO DIMENSIONAL PROBLEMS** **9**

Two dimensional isoparametric elements - Four noded quadrilateral elements - triangular elements. Computation of stiffness matrix for isoparametric elements - numerical integration (Gauss quadrature) Convergence criteria for isoparametric elements.

**UNIT V ANALYSIS OF PLATES** **9**

Introduction to Plate Bending Problems - displacement functions – Analysis of Thin Plate - Analysis of Thick Plate - Analysis of Skew Plate, Finite Element Analysis of Shell, plane stress and plane strain analysis, Example problem using any general-purpose finite element

software

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

**CO1** to understand the basics of finite element formulation.

**CO2** to formulate the stiffness matrix for beam, truss and framed structures. **CO3** :to apply finite element formulations to solve one-dimensional problems. **CO4**: to apply finite element method to solve two dimensional problems.

**CO5** to apply finite element method to analyze plate bending problems.

**TEXT BOOKS:**


1. Rao, S.S., "The Finite Element Method in Engineering", 6th Edition, ButterworthHeinemann,2018.
2. Reddy,J.N. "Introduction to the Finite Element Method", 4thEdition, Tata McGrawHill,2018.


**REFERENCES**


1. Krishnamoorthy, C. S, Finite Element Analysis - Theory and Programming, McGraw - Hill, 1995.
2. David Hutton, Fundamentals of Finite Element Analysis, Tata McGraw Hill Publishing Company Limited, New Delhi, 2005.
3. G.R. Liu and S.S.Quek, Finite Element Method: A Practical Course, Butterworth-Heinemann; 1st edition (21 February 2003)
4. Chennakesava R. Alavala Finite Element Methods: Basic Concepts and Applications, Prentice Hall Inc., 2010.
5. R. T. Chandrupatla and A. D. Belegundu, Introduction to Finite Elements in Engineering, PHI Learning Pvt Ltd, New Delhi, 1997 .S. S. Bhavikatti, Finite Element Analysis, New Age Publishers, 2007.

**VERTICAL II: CONSTRUCTION TECHNIQUES AND PRACTICES**

| Course Code | FORM WORK ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3008 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- On completion of this course the students will be able to know the detailed planning of formwork, design of forms and erection of form work.

**UNIT I INTRODUCTION TO FORM WORK 9**

Introduction to Formwork and false work, Temporary work systems, Requirements, Construction planning and site constraints, Selection, and Classification (Types) of Formwork, General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples - Overall Planning - Detailed planning - Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork.

**UNIT II FORMWORK MATERIALS ASSESORIES & PRESSURES 9**

Formwork Materials, Accessories and consumables – Application of tools, Reconstituted wood – Steel Aluminum Plywood - Types and grades Standard units - Corner units – Pass units, Calculation of labour constants - Formwork hours - Labour Requirement. Hardware and fasteners - Nails in Plywood - Allowable withdrawal load and lateral load. Pressures on formwork - Examples - Finish - Sheathing boards working stresses - Repetitive member stress Vertical loads for design of slab forms - Uplift on shores - Laterals loads on slabs and walls.

**UNIT III FORMWORK**

**DESIGN 9**

Concepts, Formwork Systems – components, assembly, De-shuttering, safety of work and Design for Tall Structures, Foundation Wall, Column, Slab and Beam formworks. Design of Decks and False works. Effects of various loads. Loading and moment of formwork, IS Code provisions.

**UNIT IV FORMWORK FOR SPECIAL**

**STRUCTURES 9**

Formwork for Bridge Structures, Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Nuclear Reactor, Tunnel, Lift Shaft, stairs and Formwork for Precast Concrete. Various climbing system, Table lifting system.

**UNIT V CASE**

**STUDIES 9**

Formwork failures: Causes of failures – Inadequate shoring inadequate bracing of members – improper vibration – Premature stripping Errors in design – Case studies – Finish of exposed concrete design deficiencies – Safety factors – Prevention of rotation – Stripping sequence – failure formwork issues in multi - story building construction – vertical and horizontal elements used in the industry.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

**CO1** To understand the overall and detailed planning of formwork.

**CO2** To impart knowledge on formwork materials, accessories, pressures and labour requirement.

**CO3** To develop the conceptual understanding of design, construction and erection of formwork.

**CO4** To impart the knowledge about different types of formwork used for special structures.

**CO5** To understand the errors in design and judge the formwork failures through case studies.

**TEXT BOOKS**


1. Peurify R.L and Oberlender G.D , Formwork for Concrete Structures, , McGraw Hill Education India ,2015
2. Jha K N, Formwork for Concrete Structures, Tata McGraw Hill Education, 2012.


**REFERENCES:**


1. Austin, C.K., Formwork for Concrete, Cleaver -Hume Press Ltd., London, 1996.
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996
3. Michael P. Hurst, Construction Press, London and New York, 2003.
4. Christopher Souder , (2014), Temporary Structure Design, Wiley Publications, London.
5. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS.

| Course Code | CONSTRUCTION EQUIPMENT AND MACHINERY | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3009 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE**

- To train the students in field of construction equipment and machineries so as to have a first hand knowledge of practical problems in carrying out engineering tasks. To develop skills in facing and solving the field problems using construction equipment like bull dozer, concrete mixer, cranes and scraper etc.,

**STRATEGY:**

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

**COURSE OUTCOMES:**

At the end of the course the student will be able to understand the output of construction equipment and machineries:

**CO1** To implement the textbook knowledge into practice.

**CO2** To analyse the concepts of developments and implementation of new construction equipment

**CO3** To analyse the concepts of developments and implementation of new construction equipment

**CO4** To develope a user friendly construction equipment and machinery model.

**CO5** To analyse the cost effectiveness of using construction equipment and machinery

| Course Code | SUSTAINABLE CONSTRUCTION AND LEAN CONSTRUCTION | L | T | P | C |
|---|---|---|---|---|---|
| CEPE30010 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To impart knowledge about sustainable construction and to understand the concepts of sustainable materials, energy calculations, green buildings and environmental effects.

**UNIT I INTRODUCTION & MATERIALS USED IN SUSTAINABLE CONSTRUCTION 9**

Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - CO2 contribution from cement and other construction materials - Recycled and manufactured aggregate - Role of QC and durability - Life cycle and sustainability.

**UNIT II ENERGY CALCULATIONS 9**

Components of embodied energy - calculation of embodied energy for construction materials - Energy concept and primary energy - Embodied energy via-a-vis operational energy in conditioned building - Life Cycle energy use.

**UNIT III GREEN BUILDINGS 9**

Control of energy use in building – National Building Code (NBC), ECBC code, codes in neighboring tropical countries - OTTV concepts and calculations – Features of LEED and TERI – Griha ratings - Role of insulation and thermal properties of construction materials - influence of moisture content and modeling -Performance ratings of green buildings - Zero energy building'

**UNIT IV CORE CONCEPTS IN LEAN 9**

Introduction to the Course; Lean Overview; Need for Productivity Measurement and improvement; Productivity Measurement System (PMS).

**UNIT V LEAN CONSTRUCTION TOOLS AND TECHNIQUES 9**

Sampling/ Work Sampling; Survey/ Foreman delay survey; Value Stream/ Process Mapping– 5S , Collaborative Planning System (CPS)/ Last Planner™ System (LPS) – Big Room Approach, IT/BIM and Lean, How to Start Practicing Lean Tools in Project Site.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

**CO1** Describe the various sustainable materials used in construction.

**CO2** Explain the method of estimating the amount of energy required for building.

**CO3** Describe the features of LEED, TERI and GRIHA ratings of buildings.

**CO4** Explain the core concepts of lean construction tools and techniques and their importance in achieving better productivity.

**CO5** Apply lean tools & techniques to achieve sustainability in construction projects.

**REFERENCES:**

1. Charles J Kibert, Sustainable Construction : Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.

2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.
3. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
4. Ballard, G., Tommelein, I., Koskela, L. and Howell, G., Lean construction tools and techniques, 2002.
5. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005.

| Course Code | **DIGITALIZED CONSTRUCTION LAB** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE30011 | | 0 | 0 | 6 | 3 |

**COURSE OBJECTIVE:**

- To train the students in field of digitalization of construction. Students can be trained in the latest softwares relevant to construction industry

**List of experiments:**

To implement the digital knowledge in construction (use relevant softwares)

1. Introduction and understanding of Primavera project planner for construction
2. Using Primavera project planner, update the schedule of the project of a construction project.
3. Introduction and understanding of MS Project for a construction project
4. Using MS project, schedule the construction project planning
5. Introduction to BIM in construction projects
6. Development of BIM for small construction project
7. Progress the work flows in construction project using BIM
8. Development of bid management for a small firm construction industry using software.

**TOTAL: 90 PERIODS**

**COURSE OUTCOMES:**

At the end of the course the student will be able to understand the output ofdigitalization of construction

**CO1** To understand the importance of latest softwares in the construction industry.

**CO2** To plan a construction project using Primervera

**CO3** To plan a construction project using MS project

**CO4** To develope a BIM information model

**CO5** To analyse the bid management and its effectiveness using bid management software

| Course Code | CONSTRUCTION MANAGEMENT AND SAFETY | L | T | P | C |
|---|---|---|---|---|---|
| CEPE30012 | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVE**

- To study and understand the formulation, costing of construction projects, scheduling and various safety concepts and its requirements applied to construction projects.

**UNIT I GENERAL OVERVIEW AND PROJECT ORGANIZATION 6**

Introduction - Interdisciplinary nature of modern construction projects – execution of project – evaluation of bits – resource management.

**UNIT II ESTIMATION OF PROJECT COST & ECONOMICS 6**

Estimating quantities – description of items – estimation of project cost – running account bills – decision making in construction projects – depreciation of construction equipment – case study.

**UNIT III PLANNING AND SCHEDULING 6**

Introduction – project scheduling – uncertainties in duration of activities using PERT – Project monitoring and control system – resource levelling and allocation – crashing of network.

**UNIT IV SAFETY DURING CONSTRUCTION 6**

Basic terminology in safety - types of injuries - safety pyramid - Accident patterns - Planning for safety budget, safety culture - Introduction to OSHA regulations - Site safety programs - Job hazard analysis, accident investigation & accident indices-violation, penalty.

**UNIT V SAFE OPERATING PROCEDURES 6**

Safety during alteration, demolition works – Earthwork, steel construction, temporary structures, masonry & concrete construction, cutting & welding - Construction equipment, materials handling- disposal & hand tools - Other hazards – fire, confined spaces, electrical safety.

**TOTAL: 30 PERIODS**

**LAB**

**Ex 1** Introduction to various construction management software

**Ex 2** Planning and creating new project

**Ex 3** Scheduling and constraints using PRIMAVERA

**Ex 4** Project cost management using PRIMAVERA

**Ex 5** Construction project safety management using BIM

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

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

**CO1** Perform formulations of projects.

**CO2** Analyze project costing.

**CO3** Identify and estimate the activity in the construction.

**CO4** Develop the knowledge on accidents and their causes.

**CO5** Plan, assess, analyze and manage the construction project sites.

**REFERENCES :**


1. Barcus, S.W. and Wilkinson.J.W., Hand Book of Management Consulting Services, McGraw Hill, New York, 1986.
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd., 1992
3. Albert Lester, Project Management, Planning and Control, 7th Edition, Butterworth-Heinemann, USA , 2017 Patrick X.W. Zou ,Riza YosiaSunindijo, Strategic Safety Management in Construction and Engineering John Wiley & Sons, Ltd 2015


| Course Code | **ADVANCED CONSTRUCTION TECHNIQUES** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE30013 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To study and understand the latest construction techniques applied to engineering construction for sub structure, super structure, special structures, rehabilitation and strengthening techniques and demolition techniques.

**UNIT I SUB STRUCTURE CONSTRUCTION** **9**

Construction Methodology - Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet

piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - well points - Dewatering for underground open excavation.

**UNIT II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS 9**

Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ prestressing in high rise structures, Post tensioning of slab- aerial transporting – Handling and erecting lightweight components on tall structures.

**UNIT III CONSTRUCTION OF SPECIAL STRUCTURES 9**

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

– Erection of articulated structures and space decks.

**UNIT IV REHABILITATION AND STRENGTHENING TECHNIQUES 9**

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

**UNIT V DEMOLITION 9**

Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

- On completion of the course, the student is expected to be able to

**CO1** Understand the modern construction techniques used in the sub structure construction.

**CO2** Demonstrate knowledge and understanding of the principles and concepts relevant to super structure construction for buildings

**CO3** Understand the concepts used in the construction of special structures

**CO4** Knowledge on Various strengthening and repair methods for different cases.

**CO5** Identify the suitable demolition technique for demolishing a building.

**REFERENCES:**

1. Jerry Irvine, Advanced Construction Techniques, CA Rocket, 1984
2. Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 1992.
3. Peter H.Emmons, "Concrete repair and maintenance illustrated", Galgotia Publications Pvt. Ltd., 2001.Press, 2008.
4. Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 1995.Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University, New Delhi, 2008

| Course Code | ENERGY EFFICIENT BUILDINGS | L | T | P | C |
|---|---|---|---|---|---|
| CEPE30014 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE**

- To provide an understanding of the concept of energy consumption in buildings and design an energy efficient building

**UNIT I INTRODUCTION** **9**

Climate adapted and climate rejecting buildings – Heat Transfer – Measuring Conduction – Thermal Storage – Measurement of Radiation – The Greenhouse Effect – Convection – Measuring latent and sensible heat – Psychrometry Chart – Thermal Comfort – Microclimate, Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Path Diagrams – Sun Protection – Types of Shading Devices – Design responses to energy conservation strategies.

**UNIT II PASSIVE SOLAR HEATING AND COOLING** **9**

General Principles of passive Solar Heating – Key Design Elements – Sunspace – Direct gain – Trombe Walls, Water Walls – Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Principles – Case studies – Courtyards – Roof Ponds– Cool Pools -Predicting ventilation in buildings – Window Ventilation Calculations – Room Organization Strategies for Cross and Stack Ventilation – Radiation – Evaporation and dehumidification – Wind Catchers – Mass Effect – Zoning – Load Control – Air Filtration and odor removal.

**UNIT III DAYLIGHTING AND ELECTRICAL LIGHTING** **9**

Materials, components and details – Insulation – Optical materials – Radiant Barriers – Glazing materials – Glazing Spectral Response – Day lighting – Sources and concepts –Building Design Strategies – Case Studies – Daylight apertures – Light Shelves – Codal requirements – Day lighting design – Electric Lighting – Light Distribution – Electric Lighting control for day lighted

buildings – Switching controls – Coefficient of utilization – Electric Task Lighting – Electric Light Zones – Power Adjustment Factors.

**UNIT IV HEAT CONTROL AND VENTILATION 9**

Hourly Solar radiation – Heat insulation – Terminology – Requirements – Heat transmission through building sections – Thermal performance of Building sections – Orientation of buildings – Building characteristics for various climates – Thermal Design of buildings – Influence of Design Parameters – Mechanical controls – Examples. Ventilation – Requirements – Minimum standards for ventilation – Ventilation Design – Energy Conservation in Ventilating systems – Design for Natural Ventilation – Calculation of probable indoor wind speed.

**UNIT V DESIGN FOR CLIMATIC ZONES 9**

Energy efficiency – An Overview of Design Concepts and Architectural Interventions – Embodied Energy – Low Embodied Energy Materials – Passive Downdraft Evaporative Cooling – Design of Energy Efficient Buildings for Various Zones – Cold and cloudy – Cold and sunny – Composite – Hot and dry – Moderate – Warm and humid – Case studies of residences, office buildings and other buildings in each zones – Commonly used software packages in energy efficient building analysis and design - Energy Audit – Certification.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

On completion of this course, the student is expected to be able to

**CO1** Explain environmental energy supplies on buildings

**CO2** Explain the passives ol arheating,cooling system

**CO3** Discuss the various aspects of day-lighting and electrical lighting in a building

**CO4** Predict and design building ventilation and heat control for indoor comfort

**CO5** Design a building for climatic zone and apply simulation programs of buildings to perform energy alculations

**REFERENCES**


1. Energy Conservation Building Code, cau of Energy Efficiency, New Delhi, 2018.
2. Handbook on Functional Requirements of Buildings Part 1 to 4 SP : 41 ( S and T) 1995
3. Residential Energy: Cost Savings and Comfort for Existing Buildings by John Krigger and Chris Dorsi, Published by Saturn Resource Management, 2013.
4. Brown, G.Z. and DeKay, M., Sun, Wind and Light - Architectural Design Strategies, John Wiley and Sons Inc,3rd Edition, 2014 Majumdar, M (Ed), Energy - Efficient Buildings in India, Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources, 2009

**VERTICAL III: GEOTECHNICAL**

| Course Code | GEOENVIRONMENTAL ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| CEPE30015 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- The student acquires the knowledge on the Geotechnical engineering problems associated with soil contamination, safe disposal of waste and remediate the contaminated soils by different techniques here by protecting environment.

**UNIT I SOIL – WASTE INTERACTION 9**

Role of Geo-environmental Engineering – sources, generation and classification of wastes – causes and consequences of soil pollution – case studies in soil failure -factors influencing soilpollutant interaction – modification of index, chemical and engineering properties – physical and physio- chemical mechanisms.

**UNIT II CONTAMINANT TRANSPORT AND SITE CHARACTERISATION 9**

Transport of contaminant in subsurface – advection, diffusion, dispersion – chemical process – biological process, sorption, desorption, precipitation, dissolution, oxidation, complexation, ion exchange, Volatization, biodegradation – characterization of contaminated sites – soil and rock data

– hydrological and chemical data – analysis and evaluation.

**UNIT III WASTE CONTAINMENT AND REMEDIATION OF CONTAMINATED SITES 9**

In-situ containment – vertical and horizontal barrier – surface cover – ground water pumping system on subsurface drain – soil remediation – Soil Vapour extraction, soil waste stabilization, solidification of soils, electrokinetic remediation, soil heating, vitrification, bio remediation, Phyto-remediation – groundwater remediation – pump and treat , In-situ flushing, permeable reacting barrier, In-situ air sparging.

**UNIT IV LANDFILLS AND SURFACE IMPOUNDMENTS 9**

system – Source and characteristics of waste - site selection for landfills – components of landfills – liner soil, geomembrane, geosynthetic clay, geo-composite liner system – leachate collection – final cover design – monitoring landfill - Environmental laws and regulations**.**

**UNIT V STABILISATION OF WASTE 9**

Evaluation of waste materials – flyash, municipal sludge, plastics, scrap tire, blast furnace slag, construction waste, wood waste and their physical, chemical and biological characteristics – potential reuse – utilization of waste and soil stabilization.

**TOTAL:45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to;

**CO1** Understand the various causes and consequences of waste interaction with soil and their modification.

**CO2** Understand the various mechanism of transport of contaminants into the subsurface and characterization of contaminated sites and their risk analysis.

**CO3** Understand on how to decontaminate the site so as to reuse the site for human settlement

**CO4** Understand how to safely dispose the waste through different containment processes.

**CO5** Expose on how to convert the waste into a resource material through soil waste stabilization techniques with or without chemical stabilization.

**REFERENCES:**


1. Daniel B.E, Geotechnical Practice for waste disposal, Chapman & Hall, London, 1993.
2. Hari D. Sharma and Krishna R.Reddy, Geo-Environmental Engineering – John Wiley and Sons, INC, USA, 2004.
3. Westlake, K., Landfill Waste pollution and Control, Albion Publishing Ltd., England, 1995.
4. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore, 1989.
5. Proceedings of the International symposium of Environmental Geotechnology (Vol.I and II), Environmental Publishing Company, 1986 and 1989.
6. Ott, W.R., Environmental Indices, Theory and Practice, Ann Arbor, 1978.
7. Fried, J.J., GroundWater Pollution, Elsevier, 1975.
8. ASTM Special Tech. Publication 874, Hydraulic Barrier in Soil and Rock, 1985.Lagrega, M.d., Buckingham, P.L., and Evans, J.C., Hazardous Waste Management, McGraw Hill, Inc. Singapore, 1994.


| Course Code | **GROUND IMPROVEMENT TECHNIQUES** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE30016 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- Students will be exposed to various problems associated with soil deposits and methods to evaluate them. The different techniques will be taught to them to improve the characteristics of difficult soils as well as design techniques required to implement various ground improvement methods.

**UNIT I HYDRAULIC MODIFICATIONS 9**

Scope and necessity of ground improvement in Geotechnical engineering basic concepts. Drainage – Ground Water lowering by well points, deep wells, vacuum and electro-osmotic methods. Stabilization by thermal and freezing techniques - Applications.

**UNIT II MECHANICAL MODIFICATIONS 9**

Insitu compaction of granular and cohesive soils, Shallow and Deep compaction methods – Sand piles – Concept, design, factors influencing compaction. Blasting and dynamic consolidation design and relative merits of various methods – Soil liquefaction mitigation methods.

**UNIT III PHYSICAL MODIFICATION 9**

Preloading with sand drains, fabric drains, wick drains – theories of sand drain - Stone column with and without encased, lime stone – functions – methods of installation – design, estimation of load carrying capacity and settlement. Root piles and soil nailing – methods of installation – Design and Applications.

**UNIT IV MODIFICATION BY INCLUSIONS 9**

Reinforcement – Principles and basic mechanism of reinforced earth, simple design: Synthetic and natural fiber based Geotextiles and their applications. Filtration, drainage, separation, erosion control.

**UNIT V CHEMICAL MODIFICATION 9**

Grouting – Types of grout – Suspension and solution grouts – Basic requirements of grout. Grouting equipment – injection methods – jet grouting – grout monitoring – Electro – Chemical stabilization – Stabilization with cement, lime - Stabilization of expansive clays.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

**CO1** identify and evaluate the deficiencies in the deposits of the given project area and improve its characteristics by hydraulic modifications

**CO2** improve the ground characteristics by mechanical modifications using various method and design the system

**CO3** improve the ground characteristics by physical modifications using various method and design the system

**CO4** improve the characteristics of soils by various reinforcement techniques and design

**CO5** Analyse the ground and decide the suitable chemical method for improving its characteristics

**REFERENCES:**

1. Pappala, A.J.,Huang,J., Han, J., and Hoyos, L.R., Ground Improvement and

Geosynthetics; Geotechnical special publication No.207, Geo Institute, ASCE, 2010
2. Cox, B.R., and Grifiths S.C., Practical Recommendation for Evaluation and mitigation of Soil Liquefaction in Arkansas, (Project Report), 2010.
3. Day, R.W., Foundation Engineering Handbook, McGraw – Hill Companies, Inc. 2006.
4. Rowe, R.K., Geotechnical and Geo-environmental Engineering Handbook, Kluwer Academic Publishers, 2001.
5. Das, B.M., Principles of Foundation Engineering, Fourth Edition, PWS Publishing, 1999.
6. Moseley, M.P., Ground Treatment, Blackie Academic and Professionals, 1998.
7. Koerner, R.M., Designing with Geosynthetics, Third Edition, Prentice Hall 1997.
8. Hehn, R.W., Practical Guide to Grouting of Underground Structures, ASCE, 1996.
9. Jewell, R.A., Soil Reinforcement with Geotextiles, CIRIA, London, 1996.
10. Koerner, R.M. and Welsh, J.P., Construction and Geotechnical Engineering using Synthetic Fabrics, John Wiley, 1990.
11. Han,J., Principles and Practice of Ground Improvement, John Wiley and Sons, New Jersey, Canada 2015.
12. Jones, J.E.P., Earth Reinforcement and Soil Structure, Butterworths, 1985.
13. Manfred R. Hausmann, Engineering Principles of Ground Modifications, McGraw-Hill Publishing Company, New York

| Course Code | SOIL DYNAMICS AND MACHINE FOUNDATIONS | L | T | P | C |
|---|---|---|---|---|---|
| CEPE30017 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To design different types of machine foundations based on the dynamic properties of soils and to get an exposure on vibration isolation techniques.

**UNIT I THEORY OF VIBRATION 9**

Introduction – Nature of dynamic loads – Basic definitions – Simple harmonic motion – Fundamentals of vibration – Single degree and multi degree of freedom systems – Free vibrations of spring – Mass systems – Forced vibrations – Resonance – Viscous damping – Principles of vibrations measuring systems – Effect of transient and pulsating loads.

**UNIT II DYNAMIC SOIL PROPERTIES 9**

Dynamic stress-strain characteristics – Principles of measuring dynamic properties – Laboratory techniques – Field tests – Block vibration test – Factors affecting dynamic properties – Typical values. Mechanism of liquefaction – Influencing factors – Evaluation of liquefaction potential – Analysis from SPT test – Dynamic bearing capacity – Dynamic earth

pressure.

**UNIT III MACHINE FOUNDATIONS 9**

Introduction – Types of machine foundations – General requirements for design of machine foundations – Design approach for machine foundation – Vibration analysis – Elastic Half-Space theory – Mass-spring-dashpot model – Permissible amplitudes – Permissible bearing pressures.

**UNIT IV DESIGN OF MACHINE FOUNDATION 9**

Evaluation of design parameters – Types of Machines and foundations – General requirements – their importance – Analysis and design of block type and framed type machine foundations – Modes of vibration of a rigid foundation – Foundations for reciprocating machines, impact machines, Two – Cylinder vertical compressor, Double-acting steam hammer –Codal recommendations - Emprical approach – Barken's method – Bulb of pressure concept – Pauw's analogy – Vibration table studies.

**UNIT V VIBRATION ISOLATION 9**

Vibration isolation – Types of isolation – Transmissibility – Passive and active isolation – Methods of isolation – Use of springs and damping materials – Properties of isolating materials – Vibration control of existing machine foundation.

**TOTAL:45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to;

**CO1** Acquire knowledge to apply theories of vibration to solve dynamic soil problems.

**CO2** Evaluate the dynamic properties of soil using laboratory and field tests.

**CO3** Acquire basic knowledge about machine foundations and design various types of machine foundation.

**CO4** To know and capable of selecting the types of vibration isolation materials.

**CO5** To apply vibration isolation techniques for various field problems.

**REFERENCES*:***


1. KameswaraRao, N.S.V., Dynamics soil tests and applications, Wheeler Publishing, New Delhi, 2000.
2. Prakash, S and Puri, V.K., Foundations for machines, McGraw Hill, 1987.
3. Moore, P.J.,Analysis and Design of Foundations for Vibrations, Oxford and IBH, 1985.
4. Vaidyanathan, C.V., and Srinivasalu, P., Handbook of Machine Foundations, McGraw Hill, 1995.

5. Arya, S., O'Nelt; S., Design of Structures and Foundations for Vibrating Machines, Prentice Hall, 1981.
6. Major, A., Vibration Analysis and Design of Foundations for Machines and Turbines, Vol. I. II and III Budapest, 1964.
7. Barkan, D.D., Dynamics of Basis of Foundation, McGraw Hill, 1974.
8. Swami Saran, Soil Dynamics and Machine Foundation, Galgotia publications Pvt. Ltd. New Delhi 2010.
9. Das B.M., Principles of Soil Dynamics, McGraw Hill, 1992.
10. Krammer S.L., Geotechnical Earthquake Engineering, Prentice Hall, International series, Pearson Education (Singapore) Pvt Ltd, 2004.
11. KameswaraRao, Vibration Analysis and Foundation Dynamics, Wheeler Publishing, New Delhi, 1998

| Course Code | **ROCK MECHANICS** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE30018 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- Students are expected to classify, understand stress-strain characteristics, failure criteria, and influence of in-situ stress in the stability of various structures and various technique to improve the in-situ strength of rocks.

**UNIT I CLASSIFICATION OF ROCKS** **9**

Types of Rocks - Index properties and classification of rock masses, competent and incompetent rock - value of RMR and ratings in field estimations.

**UNIT II STRENGTH CRITERIA OF ROCKS** **9**

Behaviour of rock under hydrostatic compression and deviatric loading - Modes of rock failure planes of weakness and joint characteristics - joint testing, Mohr - Coulomb failure criterion and tension cut- off. Hoek and Brown Strength criteria for rocks with discontinuity sets.

**UNIT III INSITU STRESSES IN ROCKS** **9**

In-situ stresses and their measurements, Hydraulic fracturing, flat jack, over coring and under coring methods - stress around underground excavations – Design aspects of openings in rocks.

**UNIT IV SLOPE STABILITY AND BEARING CAPACITY OF ROCKS** **9**

Rock slopes - role of discontinuities in slop failure, slope analysis and factor of safety - remedial measures for critical slopes – Bearing capacity of foundations on rocks.

**UNIT V ROCK STABILIZATION** **9**

Stabilization of rocks-rock support and rock reinforcement-active and passive supports-ground response curve-support reaction curve-reinforcement of fractured and joined rocks-Shotcreting- bolting-anchoring-installation methods.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

**CO1** Classify the Rock mass and rate the quality of rock for tunnelling and foundations works and suggest the safer length of tunnelling and stand-up time.

**CO2** Apply the knowledge of engineering and understand the stress – strain characteristics and failure criteria of rock and apply them to arrive at the shear strength parameters of rocks to be used for the design of structures resting on rock and also for the design of underground excavation in rocks.

**CO3** Apply the knowledge of engineering and assess the influence of in-situ stress in the stability of various underground excavations and also acquire the knowledge of design of opening in rocks.

**CO4** Apply the knowledge on rock mechanics and analyze the stability of rock slopes and arrive at the bearing capacity of shallow and deep foundations resting on rocks considering the presence of joints. design the foundations resting on rocks. Able to carry-out suitable foundation for the structure resting on rock.

**CO5** Improve the in-situ strength of rocks by various methods such as rock reinforcement and rock support. Able to select suitable support system considering the interaction between rock and support. Also capable of executing the same in the field.

**REFERENCES:**


1. Goodman, R.E., Introduction to rock mechanics, John Willey and Sons, 1989.
2. Hudson, A. and Harrison, P., Engineering Rock mechanics – An introduction to the principles, Pergamon publications, 1997.
3. Hoek, E and Bray, J., Rock slope Engineering, Institute of Mining and Metallurgy, U.K. 1981.
4. Hoek, E and Brown, E.T., Underground Excavations in Rock, Institute of Mining and Metallurgy,
   U.K. 1981.
5. Obvert, L. and Duvall, W., Rock Mechanics and the Design of structures in Rock, John Wiley, 1967.

6. Bazant, Z.P., Mechanics of Geomaterials Rocks, Concrete and Soil, John Wiley and Sons, Chichester, 1985.Wittke, W., Rock Mechanics. Theory and Applications with case Histories, Springerverlag, Berlin, 1990.
7. Waltham, T, Foundations of Engineering Geology, Second Edition, Spon Press, Taylor & Francis Group, London and New York, 2002.
8. Ramamurthy T., "Engineering in Rocks for Slopes Foundations and Tunnels", PHI Learning Pvt.Ltd., 2007

| Course Code | EARTH AND EARTH RETAINING STRUCTURES | L | T | P | C |
|---|---|---|---|---|---|
| CEPE30019 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**:

- At the end of this course, students are expected to analyse and design rigid, flexible earth retaining structures, slurry supported trenches and deep cuts.

**UNIT I EARTH PRESSURE THEORIES 9**

Introduction – State of stress in retained soil mass – Earth pressure theories – Classical and graphical techniques (Culmann's method) – Active and passive cases – Earth pressure due to external loads.

**UNIT II COMPACTION, DRAINAGE AND STABILITY OF RETAINING STRUCTURES 9**

Retaining structure – Selection of soil parameters - Lateral pressure due to compaction, strain softening, wall flexibility, drainage arrangements and its influence. – Stability analysis of retaining structure both for regular and earthquake forces.

**UNIT III SHEET PILE WALLS 9**

Types of sheet piles - Analysis and design of cantilever and anchored sheet pile walls – free earth support method – fixed earth support method. Design of anchor systems - isolated and continuous.

**UNIT IV SUPPORTED EXCAVATIONS 9**

Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos – Soil anchors – Soil pinning –Basic design concepts.

**UNIT V SLURRY SUPPORTED EXACAVATION 9**

Slurry supported trenches-basic principles-slurry characteristics-specifications-diaphragm walls- bored pile walls-contiguous pile wall-secant piles-stability analysis.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

**CO1** Analyse the earth pressure acting on retaining structures by applying classical theories considering all influencing parameters and suggest the earth pressure to be considered for the design of retaining structures.

**CO2** Apply the knowledge of engineering and earth pressure to analyse and design rigid retaining structures considering effect of compaction, wall flexibility, pore water pressure and earth quake forces.

**CO3** Apply the knowledge of engineering and earth pressure to analyse and design flexible earth retaining walls and also acquire the knowledge of design of anchors

**CO4** Apply the knowledge on lateral earth pressure behind and around excavation to analyse and design braced excavations, slurry supported excavations and underground utilities.

**CO5** To understand the role of slurry in supporting excavations and to perform stability analysis by considering the actual shape of slurry support

**REFERENCES:**


1. Clayton, C.R.I., Militisky, J. and Woods, R.I., Earth pressure and Earth-Retaining structures, Second Edition, Survey University Press, 1993.
2. Das, B.M., Principles of Geotechnical Engineering, Fourth Edition, The PWS series in Civil Engineering, 1998.
3. Militisky, J. and Woods, R., Earth and Earth retaining structures, Routledge,1992.
4. Winterkorn, H.F. and Fang, H.Y., Foundation Engineering Handbook, GalgotiaBooksource, 2000.
5. Rowe, R.K., Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001.
6. Koerner, R.M. Designing with Geosynthetics, Third Edition, Prentice Hall, 1997.
7. Day, R.W., Geotechnical and Foundation Engineering: Design and Construction, McGraw Hill, 1999.
8. Mandal, J.N., Reinforced Soil and Geotextiles, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1993.
9. McCarthy, D.F., Essentials of Soil Mechanics and Foundations: Basic Geotechnics, Sixth Edition, Prentice Hall, 2002.
10. Hajnal, I., Marton, J. and Regele, Z., Construction of diaphragm walls, A Wiley – Interscience Publication, 1984.
11. Petros P. Xanthakos., Slurry walls as structural systems, McGraw-Hill, Inc., New York, 1994.
12. Bramhead, E.N., The Stability of Slopes, Blacky Academic and Professionals Publications, Glasgow, 1986.

| Course Code | PILE FOUNDATION | L | T | P | C |
|---|---|---|---|---|---|
| CEPE30020 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- The student will be exposed to the design of piles, pile groups and caissons with respect to vertical and lateral loads for various field conditions.

**UNIT I PILE CLASSIFICATIONS AND LOAD TRANSFER PRINCIPLE 9**

Necessity of pile foundation – classification of piles – Factors governing choice of type of pile – Load transfer mechanism – piling equipments and methods – effect of pile installation on soil condition – pile raft system – basic interactive analysis - criteria for pile socketing.

**UNIT II AXIAL LOAD CAPACITY OF PILES AND PILE GROUPS 9**

Allowable load of piles and pile groups – Static and dynamic methods – for cohesive and cohesionless soil – negative skin friction – group efficiency – pile driving formulae - limitation – Wave equation application – evaluation of axial load capacity from field test results - Settlement of piles and pile group.

**UNIT III LATERAL AND UPLIFT LOAD CAPACITIES OF PILES 9**

Piles under Lateral loads – Broms method, elastic, p-y curve analyses – Batter piles – response to moment – piles under uplift loads – under reamed piles – Drilled shaft – Lateral and pull out capacity from load test.

**UNIT IV STRUCTURAL DESIGN OF PILE AND PILE GROUPS 9**

Structural design of pile – structural capacity – pile and pile cap connection – pile cap design – shape, depth, assessment and amount of steel – truss and bending theory- Reinforcement details of pile and pile caps –– pile subjected to vibration.

**UNIT V CAISSONS 9**

Necessity of caisson – type and shape - Stability of caissons – principles of analysis and design – tilting of caisson – construction - seismic influences.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

**CO1** Explain the importance of pile foundation and various functions and responsibilities of geotechnical engineer and contractor, in addition to the piling equipment..

**CO2** Determine the vertical load carrying capacity of pile and pile group- keeping the

settlement of pile as an important criteria based on field practices and codal provisions.

**CO3** Apart from vertically loaded piles, the structures are exposed to the peculiar pile subjected to lateral and uplift load with reference to codal provision and case studies.

**CO4** Understand the design of pile and pile caps, considering the wind and seismic loads.

**CO5** Explain the importance of caisson foundation and checking the stability of caissons based on codal provisions.

**REFERENCES:**


1. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
2. Poulos, H.G., Davis, E.H., Pile foundation analysis and design, John Wiley and Sons, New York, 1980.
3. Tomlinson, M.J. Foundation engineering, ELBS, Longman Group, U.K. Ltd., England 1995.
4. Michael Tomlinson and John Woodward, Pile design and construction practice, Taylor & Francis Group, London & New York, 2008.
5. Cernica, J.N. Geotechnical Engineering Foundation Design, John Wiley and Sons, Inc. 1995.
6. Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1996.
7. Donald, P., Coduto, Foundation Design Principles and Practices, Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1996.
8. Varghese P.C.," Foundation Engineering", PHI Learning Private Limited, New Delhi, 2005.
9. Reese,L.C., Isenhower,W.M. and Wang,S.T. Analysis and Design of Shallow and Deep Foundations, John Wiley and Sons, New York, 2005.
10. Varghese P.C.," Design of Reinforced Concrete Foundations", PHI Learning Private Limited,

New Delhi, 2009.

11. Reese, L. C. and Van Impe, W. F., Single Piles and Pile Groups Under Lateral Loading, Taylor and Francis, London, 2011.


| Course Code | **TUNNELING ENGINEERING** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE30021 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- Students mainly focused in visualizing and critically analyzing the behavior of underground structures with reference to various supporting systems under different loading conditions due to induced earth pressure on the underground

structures.

- To give idea about the equipment used in underground excavations

**UNIT I TUNNELS AND UNDERGROUND SPACE APPLICATION 9**

History-caves-tunnels for transport-water,power supply-storage of LPG –nuclear waste disposal-defence facilities-submerged tunnels-underground library,museums.

**UNIT II EXCAVATION TECHNIQUES 9**

Types and purpose of tunnels-choice of excavation methods-soft ground tunneling-hardrock tunneling-tunnel drilling-blasting-impact hammers-problems encountered and remedial measures.

**UNIT III PLANNING AND GEOMETRIC DESIGN OF TUNNELS 9**

Topographical –geological survey-rock sampling-testing-determination of location size shape and alignment-subsidence problem on soft ground –tunneling design in hard rock.

**UNIT IV CONSTRUCTION OF TUNNEL 9**

Advanced drilling techniques –TBM-cuttability assessment-shield tunneling-advantages-types of shield tunneling-factors affecting selection of shield-twin tunnel-NATM.

**UNIT V DESIGN OF TUNNEL SUPPORTING SYSTEMS AND VENTILATION 9**

Classification of supports-active –passive-permanent-temporary-excavation support-steel supports- lining-grouting-ground freezing-environment in underground-various methods of ventilation.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME:**

On completion of the course, the student is expected to be able to

**CO1** To Understand need of utilization of underground space for various applications.

**CO2** To study various methods of excavations and tunneling methods.

**CO3** Planning and design process of tunnels.

**CO4** To identify the suitable method of tunneling.

**CO5** To study various types of support system and its merit and demerits.

**REFERENCES:**


1. Underground infrastructure planning design construction-R.K.Goel, Bhavani singh, Jian Zhao, Butterworth heinemunn publishers.
2. Practical tunnel construction, Hemphill G.B 2012 Johnwileyand Son.

Introduction to tunnel construction, David chapran, Nicole metse and Alfred stark,Spor press

**VERTICAL IV: GEO-INFORMATICS**

| Course Code | TOTAL STATION AND GPS SURVEYING | L | T | P | C |
|---|---|---|---|---|---|
| GI3492 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To understand the working of Total Station and GPS and solve the surveying problems.

**UNIT I FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES 9**

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying - Applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies – Refractive index (RI) – factors affecting RI -Computation of group for light and near infrared waves at standard and ambient conditions – Computation of RI for microwaves at ambient condition – Reference refractive index -Real-time application of first velocity correction. Measurement of atmospheric parameters - Mean refractive index – Second velocity correction -Total atmospheric correction - Use of temperature -pressure, transducers.

**UNIT II ELECTRO-OPTICAL AND MICROWAVE 9**

Electro - optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments.Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments.COGO functions: Area, Inverse / MLM, REM, Resection, offsets and stakeout - Land survey applications.

**UNIT III SATELLITE SYSTEM 9**

Basic concepts of GPS – Historical perspective and development – applications -Geoid and Ellipsoid – satellite orbital motion – Keplerian motion – Kepler's Law – Perturbing forces -Geodetic satellite – Doppler effect – Positioning concept – GNSS and IRNSS – SBAS: GAGAN and WAAS Different segments - space, control and user segments – satellite configuration – GPS signal structure – Orbit determination and representation – Anti Spoofing and Selective Availability -Task of control segment

– GPS receivers.

**UNIT IV GPS DATA PROCESSING 9**

GPS observables – code and carrier phase observation – linear combination and derived observables

– concept of parameter estimation – downloading the data – RINEX Format–Differential data processing – software modules - solutions of cycle slips, ambiguities - Multi path and other observational errors – satellite geometry and accuracy measures – Continuously Operating Reference System (CORS)– long base line processing - use of different processing software's: Open Source, Scientific and Commercial.

**UNIT V SURVEYING METHODS AND APPLICATIONS** **9**

Total Station: Traversing and Trilateration measurement and adjustment –Planimetric map and Contour map and Topography Mapping.

GNSS: Concepts of rapid, static, semi-Kinematic, pure Kinematic and RTK methods. Observation by Radiation, Lee frog and Trilateration measurement and processing - Topography mapping using PPK and RTK methods

Total Station and GNSS applications

**TOTAL:45 PERIODS**

**COURSE OUTCOMES:**

- On completion of the course, the student is expected to

**CO1** Learn about the fundamental concept of Total station.

**CO2** Provide knowledge about electromagnetic waves and its usage in Total station and GNSS.

**CO3** Gain Knowledge on basic concepts of GNSS

**CO4** Understand the measuring and working principle of electro optical and Microwave Total station and GPS

**CO5** Gain knowledge about Total station and GNSS data processing and Mapping.

**TEXTBOOKS:**


1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th Edition,1996.
2. SatheeshGopi, rasathishkumar, N.madhu, — Advanced Surveying , Total Station GPS and Remote Sensing — Pearson education , 2nd Edition,2017. isbn: 978-81317 00679.
3. Gunter Seeber , Satellite Geodesy, Walter De Gruyter, Berlin, 2nd Edition, 2003


**REFERENCES:**


1. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983
3. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin,

3rdEdition, 2016. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 4th Edition, 2015

| Course Code | REMOTE SENSING CONCEPTS | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3022 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To introduce the concepts of remote sensing processes and its components.
- To expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation

**UNIT I REMOTE SENSING AND ELECTROMAGNETIC RADIATION 9**

Definition – components of RS – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic Spectrum – Radiation principles - Wave theory, Planck's law, Wien's Displacement Law, Stefan's Boltzmann law, Kirchoff's law – Radiation sources: active & passive - Radiation Quantities

**UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL 9**

Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows - Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance – Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.

**UNIT III ORBITS AND PLATFORMS 9**

Motions of planets and satellites – Newton's law of gravitation - Gravitational field and potential - Escape velocity - Kepler's law of planetary motion - Orbit elements and types – Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Airborne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Legrange Orbit.

**UNIT IV SENSING TECHNIQUES 9**

Classification of remote sensors – Resolution concept : spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors – microwave sensors – Calibration of sensors - High Resolution Sensors - LIDAR , UAV

– Orbital and sensor characteristics of live Indian earth observation satellites

**UNIT V DATA PRODUCTS AND INTERPRETATION 9**

Photographic and digital products – Types, levels and open source satellite data products –- selection and procurement of data– Visual interpretation: basic elements and interpretation keys

-Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

**CO1** understand the concepts and laws related to remote sensing

**CO2** understand the interaction of electromagnetic radiation with atmoshphere and earth material

**CO3** acquire knowledge about satellite orbits and different types of satellites

**CO4** understand the different types of remote sensors

**CO5** gain knowledge about the concepts of interpretation of satellite imagery

**TEXTBOOKS:**


1. Thomas M.Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York,2015.
2. George Joseph and C Jeganathan, Fundamentals of Remote Sensing,Third Edition Universities Press (India) Private limited, Hyderabad, 2018


**REFERENCES:**


1. Janza, F.Z., Blue H.M. and Johnson,J.E. Manual of Remote Sensing. Vol.I, AmericanSociety of Photogrametry, Virginia, USA, 2002.
2. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 1995
3. Paul Curran P.J. Principles of Remote Sensing. Longman, RLBS, 1988.
4. Introduction to Physics and Techniques of Remote Sensing , Charles Elachi and JacobVan Zyl, 2006 Edition II, Wiley Publication.Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, 2011


| Course Code | **SATELLITE IMAGE PROCESSING** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3023 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE**

- To make the undergraduate Engineering Students understand the concepts, principles, processing of Satellite data in order to extract useful information from them.

**UNIT I FUNDAMENTALS OF IMAGE PROCESSING** **9**

Information Systems - Encoding and decoding - acquisition, storage and retrieval –data products - satellite data formats - Digital Image Processing Systems - Hardware and software design consideration Scanner, digitizer - photo write systems.

**UNIT II SENSORS MODEL AND PRE PROCESSING** **9**

Image Fundamentals – Sensor models – spectral response – Spatial response – IFOV,GIFOV& GSI – Simplified Sensor Models – Sampling & quantization concepts – Image Representation& geometry and Radiometry – Colour concepts – Sources of Image degradation and Correction procedures- Atmospheric, Radiometric, Geometric Corrections- Image Geometry Restoration- Interpolation methods and resampling techniques.

**UNIT III IMAGE ENHANCEMENT** **9**

Image Characteristics - Histograms - Scattergrams – Univariate and multi variate statistics- enhancement in spatial domain – global, local & colour Transformations – PC analysis, edge detections, merging - filters - convolution – LPF, HPF , HBF, directional box, cascade – Morphological and adaptive filters – Zero crossing filters – scale space transforms – power spectrum – texture analysis – frequency transformations - Fourier, wavelet and curvelet transformations.

**UNIT IV IMAGE CLASSIFICATION** **9**

Spectral discrimination - pattern recognition concepts - Baye‘s approach - Signature and training sets – Separability test –Supervised Classification – Minimum distance to mean, Parallelepiped, MLC – Unsupervised classifiers – ISODATA,K-means-Support Vector Machine – Segmentation (Spatial, Spectral) – Tree classifiers - Accuracy assessment – Error matrix – Kappa statistics – ERGAS, RMS.

**UNIT V ADVANCED CLASSIFIERS** **9**

Fuzzy set classification – sub- pixel classifier – hybrid classifiers, Texture based classification –Object based classifiers – Artificial Neural nets – Hebbian leaning – Expert system, types and examples – Knowledge systems.

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

**CO1** Understand about Remote sensing and Image processing systems

**CO2** Acquire knowledge about the source of error in satellite image and also toremove the error from satellite image.

**CO3** Select appropriate image Enhancement techniques based on image characteristics

**CO4** Classify the satellite image using various method and also evaluate the accuracy of classification.

**CO5** Apply the advanced image classification methods and conduct lifelong researchin the field of image processing.

**TEXTBOOKS :**


1. John, R. Jensen, Introductory Digital Image Processing, Prentice Hall, New Jersey, 4th Edition, 2015.
2. Robert, A. Schowengergt, Techniques for Image Processing and classification in Remote Sensing, Academic Press, 2012.


| Course Code | CARTOGRAPHY AND GIS | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3024 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To introduce concepts of Cartography and GIS
- To expose the process of map making and production
- To introduce GIS data structures, data input and data presentation

**UNIT I ELEMENTS OF CARTOGRAPHY 9**

Definition of Cartography – Maps – Functions – Uses and Types of Maps – Map Scales and Contents

– Map Projections – Shape, Distance, Area and Direction Properties – Perspective and mathematical Projections – Indian Maps and Projections – Map Co-ordinate System – UTM and UPS References.

**UNIT II MAP DESIGN AND PRODUCTION 9**

Elements of a Map – Map Layout Principles – Map Design Fundamentals – Symbols and Conventional Signs – Graded and Ungraded Symbols – Color Theory – Colours and Patterns in Symbolization – Map Lettering – Map Production – Map Printing – Colours and Visualization – Map Reproduction – Map Generalization – Geometric Transformations – Bilinear and Affine Transformations.

**UNIT III FUNDAMENTALS OF GIS** **9**

Introduction to GIS – Definitions – History of GIS – Components of a GIS – Hardware, Software, Data, People, Methods – Introduction to data quality – Types of data – Spatial, Attribute data – types of attributes – scales/levels of measurements – spatial data models – Raster Data Structures – Raster Data Compression – Vector Data Structures – Raster Vs Vector Models – TIN and GRID data models.

**UNIT IV DATA INPUT AND TOPOLOGY** **9**

Scanner – Raster Data Input – Raster Data File Formats – Georeferencing– Vector Data Input – Digitizer– Datum Projection and Reprojection – Coordinate Transformation – Topology - Adjacency, Connectivity and containment – Topological Consistency – Non topological file formats – Attribute Data Linking – Linking External Databases – GPS Data Integration – Raster to Vector and Vector to Raster Conversion.

**UNIT V DATA QUALITY AND OUTPUT** **9**

Assessment of Data Quality - Basic Aspects - Completeness, Logical Consistency, Positional Accuracy, Temporal Accuracy, Thematic Accuracy and Lineage – Metadata – GIS Standards – Interoperability – OGC - Spatial Data Infrastructure – Data Output – Map Compilation – Chart / Graphs.

**TOTAL:45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to

**CO1** Be familiar with appropriate map projection and co-ordinate system for production of Maps and shall able to compile and design maps for their required purpose.

**CO2** Be familiar with co-ordinate and Datum transformations

**CO3** Understand the basic concepts and components of GIS, the techniques used for storage of spatial data and data compression

**CO4** Understand the concepts of spatial data quality and data standard

**CO5** Understand the concept of spatial data inputs

**TEXTBOOKS:**


1. Arthur H. Robinson et al, “Elements of Cartography”, 7th Edition, Wiley, 2002.
2. Kang – Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, Fourth Edition, 2017.
3. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, “An Introduction to Geographical

Information Systems, Pearson Education, Fourth Edition, 2011.

**REFERENCES:**


1. John Campbell, "Introductory Cartography", Wm. C.BrownPublishers,3rd Edition,2004
2. Chor Pang LO, Albert K. W. Yeung, “Concepts and Techniques of Geographic Information Systems”,

Pearson Education, 2nd Edition, November 2016. ISBN: 9789332581883


| Course Code | PHOTOGRAMMETRY | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3025 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To introduce basics and concepts of optics, aerial photography acquisition and mapping from aerial photographs.

**UNIT I PRINCIPLES AND PROPERTIES OF PHOTOGRAPHY 9**

History - Definition, Applications – Types of Photographs, Classification – Photographic overlaps – Camera: metric vs. non-metric, Digital Aerial cameras – Multiple frame and Line cameras – Linear array scanner – Flight Planning – Crab & Drift– Computation of flight plan - Photogrammetry project Planning.

**UNIT II GEOMETRIC PROPERTIES OF AERIAL PHOTOGRAPHS 9**

Photo coordinate measurement – Vertical photographs -geometry, scale, Coordinate system, Relief displacement – Stereoscopes – Stereoscopic parallax – parallax equations - Geometry, Scale, Coordinate system – Relief displacement –- Photo Interpretation.

**UNIT III STEREOPLOTTERS & ORIENTATION 9**

Projection system, Viewing, Measuring and Tracing system Stereo plotters–Classification: Analog, semi analytical, Analytical and Digital systems – Interior orientation - Relative orientation – Absolute orientation - Collinearity condition and Coplanarity condition - Orientation: Two-dimensional coordinate transformations –Three-dimensional conformal coordinate transformation

**UNIT IV AEROTRIANGULATION, TERRAIN MODELING, ORTHOPHOTO 9**

model – Strip and blocks of photographs – Aerotriangulation: strip adjustment, independent model triangulation, Bundle block Adjustment and GPS Aerotriangulation (INS and GNSS integration) - feature collection – DTM generation and Contour mapping – ortho rectification - mono plotting – stereo plotting

**UNIT V DIGITAL PHOTOGRAMMETRY 9**

Photogrammetric Scanner – Digital Photogrammetry WorkStation – Work Station Basic system function – Storage System – Stereoscopic Viewing and Measuring System – Image properties - Image matching: template matching, feature based matching - DEM and DSM - Satellite photogrammetry principles

**TOTAL:45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to

**CO1** Understand and appreciate the importance of photography as means of mapping, functional and physical elements of photography.

**CO2** Understand the need of the photogrammetric mapping and the relevance of accuracy standards and means to achieve them for precise large-scale maps with scientific methods.

**CO3** Evaluate the standards of map based on the state-of-the-art tool and techniques and assess the production standards for photogrammetric map making.

**CO4** Acquire knowledge on the current development, issues methods and solutions in map making and evaluate methods of production.

**CO5** Analyze critically and evaluate methods by applying the knowledge gained and to be a part of innovation and integration of mapping technology.

**TEXTBOOKS:**


1. Paul. R Wolf., Bon A. De Witt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4thEdition, 2014.
2. E. M. Mikhail, J. S. Bethel, J. C. McGlone, Introduction to Modern Photogrammetry, Wiley Publisher, 2001.


**REFERENCES:**


1. Gollfried Konecny, Geoinformation: Remote Sensing, Photogrammetry and Geographical Information Systems, CRC Press, 2nd Edition, 2014.
2. Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, Walter de Gruyter GmbH & Co.2nd Edition, 2007.
3. Manual of Photogrammetry – American society of Photogrammetry & amp; R. S by Albert. D, 1980.
4. Digital Photogrammetry – A practical course by Wilfried Linder, 3rd edition, Springer, 2009.
5. Digital Photogrammetry by – Y. Egels& amp; Michel Kasser, Taylor & amp; Francis group, 2003.


| Course Code | AIRBORNE AND TERRESTRIAL LASER MAPPING | L | T | P | C |
|---|---|---|---|---|---|
| CEPE30226 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To introduce the concepts of Space Borne, Air Borne, Terrestrial and Bathymetric LASER Scanners for Topographic and Bathymetric Mapping

**UNIT I SPACE BORNE RADAR AND LIDAR ALTIMETER 9**

Principle and Properties of LASER- Production of Laser – Components of LASER – LiDAR – Types of LiDAR:Range Finder, DIAL and Doppler LiDAR - Platforms: Terrestrial, Airborne and Space borne LiDAR – Space Borne LiDAR Missions – Space Borne Radar Altimeter for mapping Sea Surface Topography , Moon Topography - Merits of ALS in comparison to Levelling, echo sounding, GPS leveling, Photogrammetry and Interferometry

**UNIT II AIRBORNE LASER SCANNERS 9**

Airborne Topographic Laser Scanner – Ranging Principle – Pulse Laser and Continuous Wave Laser –First Return and Last Return – Ellipsoidal and Geoidal Height - Typical parameters of Airborne Laser Scanner (ALS) – Specifications of Commercial ALS –- Components of ALS - GPS, IMU, LASER Scanner, Imaging Device, Hardware and Software - Various Scanning Mechanisms: Oscillating Mirror, Rotating Polygon, Nutating Mirror, Fibre Optic

**UNIT III DATA ACQUISITION AND PRE-PROCESSING 9**

Laser Classification – Class I to Class IV Laser – Eye Safety - Synchronization of GPS, IMU and ALS Data -Reflectivity of terrain objects –- Flight Planning – Determination of various data acquisition parameters – Swath Width, Point Density, No. of Strips, Area Covered, Point Spacing - Data Processing – Determination of optimal flight trajectory- Quality Assurance

**UNIT IV POST PROCESSING of LiDAR Data 9**

Post Processing – Geo location of Laser Foot Prints – Various Co-ordinate Transformations involved Filtering - Ground Point filtering – Digital Surface Model and Digital Elevation Model - LIDAR data file formats – LAS File format and other proprietary file formats – Post Processing Software: Open Source and COTS Software – Quality Control Measures – Error Budget - Overview of LIDAR Applications in various domains - 3D city models – Corridor Mapping Applications – Forestry Applications.

**UNIT V TERRESTRIAL LASER SCANNERS 9**

Terrestrial Laser Scanners (TLS) – Working Principle – Static TLS – Dynamic TLS –- Commercial TLS Specifications – Mobile Mapping Lasers :Vehicle Mounted TLS, Back Pack Wearable Laser Scanners – Asset Management Studies – Highways and Railway Asset Management – Indoor Mapping : Laser Scanning of interior of buildings/monuments – Immersive Applications - BIM Model

– Applications in Tunnel Surveying, Forest Inventory, Open Cast Mine Surveying

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to

**CO1** Understand the components of laser and various platforms of laser scanning

**CO2** Summarize the components of Airborne Laser Scanner and concept of ranging principles

**CO3** Analyse the flight planning parameters and pre-processing of acquired data

**CO4** Post process the data to derive DSM and DEM and its applications

**CO5** Understand the components of TLS and its applications

**TEXTBOOKS:**

1. Jie Shan, Charles K. Toth, "Topographic Laser Ranging and Scanning – Principles and Processing", 2nd Edition, CRC Press Publication, March 2018. ISBN: 9781498772273.

**REFERENCES:**

1. George Vosselman and Hans-Gerd Maas, Airborne and Terrestrial Laser Scanning, WhittlesPublishing, 2010
2. Matti Maltamo, Erik Næsset, JariVauhkonen, Forestry Applications of Airborne Laser Scanning-Concepts and Case Studies, Springer, Dordrecht , 2016,Reprint Edition. ISBN 978-94- 017-8662-1
3. Michael Renslow, Manual of Airborne Topographic LiDAR, The American Society for Photogrammetry and Remote Sensing, 2013

| Course Code | **HYDROGRAPHIC SURVEYING** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3027 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES**

- To provide the necessary knowledge and practical instrument operational and data processing skills needed for them to confidently accomplish a bathymetric survey in the real world
- To develop students' critical and creative thinking, as well as cooperative attitudes & behaviour

of working with others.

**UNIT I INTRODUCTION, TIDES AND DATUMS 9**

Overview of hydrographic surveying concepts- bathymetric and nautical charts- Basic tidal theory- tidal observations and predictions - common types of recording tide gauges -

different vertical datums Indian tides.

**UNIT II SOUNDINGS** **9**

Overview of depth data types- Working principle of echo sounders - characteristics and nature of underwater acoustic signals – transducers - error sources and calibrations- Advanced instrumentation.

**UNIT III NAVIGATION AND POSITION FIXING** **9**

Horizontal positioning methods and requirements - concept of line and surface of position - positioning and navigation using satellite positioning systems - differential GPS and Real-time kinematic (RTK)

**UNIT IV PLANNING AND DATA PROCESSING** **9**

General considerations for planning of an inshore hydrographic survey - ground and track control - practical soundings in inshore and coastal surveys - data processing and chart compilation - hydrographic software packages for data collection - processing and plotting.

**UNIT V MARINE ENVIRONMENTAL MEASUREMENTS** **9**

Methods of measuring and recording of currents - composition of the sea bed - and solids in suspension - Case Studies (The role of the hydrographic surveyor on different marine projects)

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

**CO1** Learn the fundamentals of hydrographic surveying

**CO2** Identify the appropriate techniques for different types of survey

**CO3** Understand the various options available during the Navigation

**CO4** Analyze the data collected from a survey and assess its quality against the project requirements

**CO5** Discuss the different roles for a hydrographic surveyor on marine projects

**TEXTBOOK:**

1. U.S. Army Corps of Engineers, (2002), Hydrographic Surveying, Document No. EM 1110-2-1003.

**REFERENCES**

1. de Jong, C. D., Lachapelle, G., Skone, S. & Elema, I. A. (2002), Hydrography, Delft University Press, The Netherlands.
2. Ingham, A. E. (1992), Hydrography for the Surveyor and Engineer, 3rd Edition revised by Abbott

V. J., Blackwell Science.

3. International Hydrographic Organisation (1998), IHO Standards for Hydrographic Surveying (S- 44), IHB Monaco.
4. Loweth, R. P. (1997), Manual of Offshore Surveying for Geoscientists and Engineers Chapman & Hall.
5. Pugh, D. (2004), Changing Sea Levels – Effects of Tides, Weather and Climate, Cambridge University Press.
6. Sonnen berg, G. J. (1988), Radar and Electronic Navigation, Butter worths.

## VERTICAL V: TRANSPORTATION INFRASTRUCTURE

| Course Code | AIRPORTS AND HARBOURS | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3028 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To introduce the students about airport planning, design, construction and planning design principles of seaport

**UNIT I AIRPORT PLANNING** **7**

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

**UNIT II AIRPORT COMPONENTS** **9**

Airport Classification, Planning of Airfield Components – Runway, Taxiway, Apron, Hangar-Passenger Terminals- Geometric design of runway and taxiways-Runway pavement Design-Difference between Highway and airport pavements- Introduction to various design methods- Airport drainage.

**UNIT III AIRPORT DESIGN** **10**

Runway Design: Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design – Elements of Runway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings- Air Traffic Control Tower- Instrumental Landing.

**UNIT IV SEAPORTS COMPONENTS AND CONSTRUCTION** **10**

Definition of Basic Terms: Harbor, Port, Satellite Port, Docks- Dry and Floating Dock, Waves and Tides – Planning and Design of Harbors: Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins Floating Landing Stage – Navigational Aids-Inland Water Transport.

**UNIT V SEAPORT REGULATIONS AND EIA**

**9**

Wave action on Coastal Structures and Shore Protection and Reclamation – Coastal Regulation Zone, 2011-EIA – methods of impact analysis and its process

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**CO1** Gain an insight on the planning and site selection of Airport Planning and design.

**CO2** Knowledge on Design of various Airport components

**CO3** Analyze and design the elements for orientation of runways and passenger facility systems.

**CO4** Understand the various features in Harbours and Ports, their construction, coastal protection works

**CO5** Knowledge on various Environmental Regulations and Acts

**TEXTBOOKS:**


1. Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand and Bros, Roorkee,1994
2. Robert Honjeff and Francis X.Mckelvey, "Planning and Design of Airports", McGraw Hill, New York,1996 2. Richard De Neufille and Amedeo Odoni, "Airport Systems Planning and Design", McGraw Hill, New York,2003
3. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering,Scitech Publications (India), Chennai, 2010


**REFERENCES:**


1. Venkatramaiah. C., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels.,Universities Press (India) Private Limited, Hyderabad, 2015.
2. Mundrey J S, Railway Track Engineering, McGraw Hill Education ( India) Private Ltd, New Delhi, 2013.


| Course Code | **TRAFFIC ENGINEERING AND MANAGEMENT** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3029 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE**

- To give an overview of Traffic engineering, various surveys to be conducted,

traffic Regulation, management and traffic safety

**UNIT I TRAFFIC SURVEYS AND ANALYSES 8**

Traffic characteristics: Human, vehicular, and Pavement Characteristics, Problems-presentation of traffic volume data, Annual Average Daily Traffic, Average Daily Traffic, Design hourly traffic volume; Speed- spot speed, presentation of spot speed data, speed and delay studies, methods of conducting spot-speed studies and Speed and Delay studies; Problems Origin and Destination – methods of conducting the survey and presentation of data; parking surveys, presentation of data and analyses, determination of parking demand; Accident studies and analyses; Different problems.

**UNIT II TRAFFIC FLOW AND ROADWAY CAPACITY 8**

Traffic Flow Characteristics – Basic traffic manoeuvres, Traffic stream flow characteristics, Speed- Flow- Density Relations; Passenger Car Units – Mixed traffic flow and related issues – Concept of PCU value- Factors affecting PCU values- Recommended PCU values for different conditions; Capacity and Level of Service – Factors affecting practical capacity – Design Service Volumes

**UNIT III COST – EFFECTIVE TRAFFIC MANAGEMENT TECHNIQUES 10**

Traffic System Management: Regulatory Techniques- one way street, Reversible Street, Reversible lane, Turning moment restrictions, closing streets; Traffic Control Devices – Traffic Signs – Road Markings, Traffic Signals, Miscellaneous traffic control devices; Traffic Segregation – Vehicle segregation, Pedestrian segregation, Traffic signals design; Bus Priority Techniques – Priority manoeuvres – With-flow bus lane and contra-flow bus lane; Self-Enforcing Techniques- Demand Management Techniques (TDM) Road pricing, parking control, Tolls, Staggering of office/educational institution hours.

**UNIT IV DESIGN OF ROAD INTERSECTIONS**

**10**

Importance and Classification; Intersections at-grade – uncontrolled, channelised; Rotary intersections (problems)- Signalised intersections (problems)- Grade Separated Intersections – merits and demerits, types, pattern of intersections with different types of interchanges- Capacity, Concept diagrams.

**UNIT V DESIGN OF PARKING AND PEDESTRIAN FACILITIES AND CYCLE TRACKS 9**

**Parking:** Need for parking studies and its ill effects- Parking Standards for different land uses, different types of parking - Conceptual plans for different types of parking;

**Pedestrians:** Importance, Barriers, Behaviour, Pedestrian facilities – Principles of planning, Level of Service (LoS), Design standards.; **Cycle Tracks:** Principles of design, Design criteria, Design standards for Rural Expressways.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**CO1** Apply the knowledge of science and engineering fundamentals in conducting traffic surveys, analyze the problems and relating it with standards

**CO2** Understand the principles of traffic flow characteristics and their relationships

**CO3** Understand various traffic management measures in addressing the demand Pricing and ITS applications.

**CO4** Designing various types of control and regulatory measures to meet an efficient traffic network.

**CO5** Understand various type of facilities and plan for Non Motorised Transport

**TEXT BOOKS:**


1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2019.
2. Khanna .K and Justo C.E.G. and Veeraragavan, A Highway Engineering, Nem Chand Bros., Roorkee, Revised 10th Edition, 2014.
3. Srinivasa Kumar, "Introduction to Traffic Engineering", Universities Press, 2018
4. Partha Chakroborty and Animesh Das Principles of Transportation Engineering, PHI Learning Pvt. Ltd., 2011.
5. Papacosta.P.S and Prevedouros.P.D, " Transportation Engineering and Planning, third edition, 2015


**REFERENCES**


1. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
2. Khanna S. K, and others, Highway Engineering, Nam Chand & Bros, Roorkee, 2014, Pages 177 – 308.
3. C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
4. Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions, Hargreen Publishing Company , 1998.
5. Salter. R.I and Hounsell N.B, Highway Traffic Analysis and design, Macmillan Press Ltd.1996.

6. Roger P.Roess, William R.Mcshane and Elena S.Prassas, Traffic Engineering-Second Edition, Prentice Hall Publishers,, Upper Saddle River, New Jersey 1998

| Course Code | URBAN PLANNING AND DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3030 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To enable students to have the knowledge on planning process and to introduce to the students about the regulations and laws related to Urban Planning.

**UNIT I INTRODUCTION 7**

Definition of Human settlement, Urban area, Town, City, Metropolitan City, Megalopolis, Urbanisation, Urbanism, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Urban Agglomeration, Census definition of urban settlements, Classification of urban areas

–Positive and negative impacts of urbanisation, **-** Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

**UNIT II PLANNING PROCESS AND THEORIES 10**

Principles of Planning –Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Draft Plans, Evaluation, Final Plan. Planning Theories - Garden City Concept, Geddesian Triad by Patrick Geddes, Modernism Concept by Le-Corbusier, Radbun Concept, Neighbourhoods, Theories of Ekistics, Bid-rent Theory by William Alonso, Green Belt Concept

**UNIT III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION 10**

Types of plans – Regional Plan, Master Plan, Structure Plan, Detailed Development Plan, New Town/ Satellite town- Development Plan, urban nodes, Smart City Plan -Scope and Content of Regional Plan (RP), Master Plan (MP), and the Detailed Development Plan (DDP), Methodologies for the preparation of the RP, MP, and the DDP – Case Studies.

**UNIT IV PLAN IMPLEMENTATION 10**

Planning Standards, Project Formulation and evaluation; Project Report preparation and presentation; Legal, Financial and Institutional constraints – Problems due to multiple laws, rules and institutions; Financing of Urban Development Projects; Urban planning agencies and their functions in the plan formulation and implementation. –

**UNIT V URBAN AND REGIONAL PLANNING LEGISLATIONS, REGULATIONS**

**AND DESIGNS 8**

Town and Country Planning, Local Bodies and Land Acquisition Acts, Development and Building Rules, Site analyses, Layouts and Buildings Design.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**CO1** Understand the basic issues and meaning of terminologies in urban planning

**CO2** Understand the different types of theories of urban planning and city development.

**CO3** Understand the different types of plan, their strategies and their preparation process.

**CO4** Comprehend the planning standards, evaluate the constraints and the financial mechanism

**CO5** Knowledge on various town and country planning acts and their functions.

**TEXTBOOKS:**


1. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002
2. George Chadwick, A Systems view of planning, Pergamon press, Oxford 1978
3. Singh V.B, Revitalised Urban Administration in India, Kalpaz publication, Delhi, 2001
4. Edwin S.Mills and Charles M.Becker, Studies in Urban development, A World Bank publication, 1986


**REFERENCES**


1. Tamil Nadu Town and Country Planning Act 1971, and Rules made thereunder, Government of Tamil Nadu, Chennai
2. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005
3. Chennai City Municipal Corporation Act, 1919 and Tamil Nadu District Municipalities Act, 1920
4. The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013
5. The Tamil Nadu Combined Development and Building Rules, 2019
6. Urban & Regional Development Plans Formulation & Implementation (URDPFI) Guidelines, Vol I & II, Jan 2015, Govt of India, Ministry of Urban Development http:/.moud.gov.in


| Course Code | **SMART CITIES** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3031 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To help the leaners to understand the concepts of smart city and to introduce the students about application of technologies in smart cities

**UNIT I INTRODUCTION** **6**

Urbanisation, need of focused development, role of Authorities, Smart city, Opportunity and Challenges- Smart infrastructures for city- Smart Cities Mission

**UNIT II SMART PHYSICAL INFRASTRUCTURE** **12**

Infrastructure development in Smart Cities - Physical Infrastructure, Land Use - Compact/mixed-use development, Transit oriented development (TOD); Smart City Management-Transportation Unified governance structure (UMTA). Smart public transportation, Smart parking, Intelligent traffic management, Detour management; Low emission vehicles, Electric Mobility - Environmental projects etc

**UNIT III SUSTAINABILITY AND SMART PLANNING** **10**

Relationship Between Sustainability and Smart planning - Place making project guidelines- Surveillance, Smart Street Lighting, Intelligent Emergency Services, Intelligent Disaster Forecasting and Management, GIS-based Spatial Decision Support Systems, Smart Communication Services;

**UNIT IV APPLICATION OF TECHNOLOGIES IN SMART CITIES** **8**

Role of Technologies in Smart Cities - Integrated Command and Control Center (ICCC), Data Analytics, Data driven strategies implementation in smart cities

**UNIT V SMART CITIES PROJECT MANAGEMENT** **9**

Need for project management, Philosophy and concepts; Project phasing and stages; Project organizational structuring: Planning and Scheduling: Project cost analysis; Procurement and Contracting: PPP: Project Monitoring and Evaluation: Risk Management; Case studies.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**CO1** Understand the basics of Urbanisation and the role of smart cities.

**CO2** Gain knowledge on implementation of smart physical infrastructure.

**CO3** Understand the role of smart planning for sustainable development.

**CO4** Comprehend the knowledge of Technologies in Smart City planning

**CO5** Reviewing the case studies of smart city projects.

**REFERENCES**


1. P Sharma , "Sustainable Smart cities in India, Challenges and Future Perspectives", Springer Link, 2017
2. Sameer Sharma,"Smart Cities Unbounded- Ideas and Practice of Smart Cities in India", Bloomsbury India, 2018.
3. Binti Singh, ManojParmar, "Smart City in India Urban Laboratory, Paradigm or Trajectory? Routledge India,2019
4. https://smartcities.gov.in/guidelines#block-habikon-content
5. https://smartnet.niua.org/learn/library


| Course Code | INTELLIGENT TRANSPORTATION SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3032 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To learn the fundamentals of ITS.
- To study the ITS functional areas
- To have an overview of ITS implementation in developing countries

**UNIT I INTRODUCTION TO ITS** **7**

Fundamentals of ITS: Definition of ITS, Challenges in ITS Development-Purpose of ITS Deployment- Benefits of ITS- Overview of application of ITS in Transportation Planning

**UNIT II DATA COLLECTION THROUGH ITS** **9**

Sensors & its application in traffic data collection - Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – vehicle Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, RFID, video data collection, Internet of Things (IOT)

**UNIT III ITS IN TRAFFIC MANAGEMENT** **10**

ITS User Needs and Services and Functional areas –Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS)- Autonomous Vehicles- Autonomous Intersections

**UNIT IV ITS IN TRANSPORTATION PLANNING** **10**

ITS and safety, ITS and security- Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations – public transportation applications- Weight – in Motion

**UNIT V ITS APPLICATION IN LOGISTICS**

**9**

Commercial vehicle operations and intermodal freight-Fleet Management- IT application in freight logistics-E commerce

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**CO1** Understand the fundamentals of ITS and its benefits.

**CO2** Gain knowledge on data collection using sensors and its applications.

**CO3** Acquainted with the knowledge of ITS in Traffic Management

**CO4** Application of ITS in Transportation Planning

**CO5** Able to gain knowledge on application of ITS in Logistics

**TEXT BOOKS:**

1. R. Srinivasa Kumar,"Intelligent Transportation Systems", Universities Press P Ltd, Telangana, 2022.

**REFERENCES:**

1. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US,2001.
2. Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill,1992.
3. TurbanE.,"Decision Support and Export Systems Management Support Systems", Maxwell Macmillan,1998.
4. Sitausu S. Mittra, "Decision Support Systems–Tools and Techniques", John Wiley, New York,1986.
5. Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems–Theory and Application‟, Springer Verlog, New York, 1987
6. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

| Course Code | **PAVEMENT ENGINEERING** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3033 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- Student gains knowledge on various IRC guidelines for designing rigid and flexible pavements. Further, the student will be in a position to assess quality and serviceability conditions of roads.

**UNIT I PAVEMENT MATERIALS AND SUBGRADE ANALYSIS 8**

Introduction – Pavement as layered structure – Pavement types -rigid and flexible-Subgrade analysis- Stress and deflections in pavements- Pavement Materials and Testing- Modified Binders.

**UNIT II DESIGN OF FLEXIBLE PAVEMENTS 10**

Flexible pavement design – Advantages and disadvantages -Factors influencing design of flexible pavement, Empirical – Mechanistic empirical and theoretical methods – Design procedure as per IRC guidelines – Design and specification of rural roads.

**UNIT III DESIGN OF RIGID PAVEMENTS 9**

Cement concrete pavements Factors influencing CC pavements – Modified Westergaard approach Design procedure as per IRC guidelines – Concrete roads and their scope in India.

**UNIT IV PAVEMENT CONSTRUCTION, EVALUATION AND MAINTENANCE 10**

Construction Techniques practice of flexible and concrete pavement Pavement Evaluation - Causes of distress in rigid and flexible pavements – Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance. Structural Evaluation by Deflection Measurements - Pavement Serviceability index, - Pavement maintenance (IRC Recommendations only).

**UNIT V STABILIZATION OF PAVEMENTS 8**

Stabilization with special reference to highway pavements – Choice of stabilizers – Testing and field control - Stabilization for rural roads in India – Use of Geosynthetics in roads.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**CO1** Get knowledge about types of rigid and flexible pavements.

**CO2** Able to design of rigid pavements

**CO3** Able to design flexible pavements.

**CO4** Determine the causes of distress in rigid and flexible pavements.

**CO5** Understand stabilization of pavements, testing and field control.

**TEXTBOOKS:**

1. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, "Highway Engineering", New Chand and Brothers, Revised 10th Edition,2014.
2. Kadiyali, L.R., "Principles and Practice of Highway Engineering", Khannatech. Publications, New Delhi,2015.

**REFERENCES:**

1. Yoder, R.J. and Witchak M.W. "Principles of Pavement Design", John Wiley2000.
2. Guidelines for the Design of Flexible Pavements, IRC-37–2012, The Indian roads Congress, NewDelhi.
3. Guideline for the Design of Rigid Pavements for Highways, IRC 58-2018, The Indian Road Congress, NewDelhi.

| Course Code | TRANSPORTATION PLANNING PROCESS | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3034 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE**

- To impart knowledge in the rudiments and stages in Transportation Planning Process

**UNIT I TRANSPORTATION PLANNING PROCESS 8**

Importance of transportation planning, Integration of Land Use and Transport; Systems Approach to Transport Planning; Four Steps in the Transport Planning Process; Travel Demand Modelling Approach; Traffic Analyses Zones – internal and external; Various Transportation Surveys for the collection of data – methodology, analyses of data and presentation of results.

**UNIT II TRIP GENERATION STAGE 9**

Definition and importance; Trip Production and Attraction, Types of trips; Factors governing trip generation: population related data, land and building use, socio-economic, Trip generation models: Types, Assumptions made, Multiple Linear Regression, category analysis-merits and de-merits of the model, verification, calibration and validation of the model.

**UNIT III TRIP DISTRIBUTION STAGE 10**

Definition and objective; Data collection, analyses and presentation of trip matrix table, Desire Line Diagram, Development of Gravity, growth factor methods for Trip Distribution, Calibration of gravity model and its validation.

**UNIT IV MODAL SPLIT STAGE 9**

Factors influencing mode choice - Household characteristics; Zonal Characteristics; Network

characteristics - Modal split: pre distribution or post distribution - Mode wise trip matrix and modal split analyses- Overview of Probit and Logit model

**UNIT V TRAFFIC ASSIGNMENT STAGE 9**

Meaning and objective; General principles; Assignment Techniques- all-or-nothing assignments, multiple route assignment, capacity restraint, diversion curves, Trip assignment route selection; Mode-wise trip matrices; element of transportation network, nodes and links, speed flow curves, minimum path trees

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

**CO1** Understand the principles of the transportation planning process and methods of data collection.

**CO2** Acquainted with the trip production, trip attraction models and calibration.

**CO3** Acquainted with the trip production, trip attraction models and calibration.

**CO4** Able to understand trip distribution models and its application.

**CO5** Gain knowledge on the mode choice behaviour and mode split models.

**TEXTBOOKS:**


1. Kadiyali. L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2019.
2. C.S. Papacostas and P.D. Prevedouros, Transportation Engineering and Planning, Prentice Hall of India Pvt. Ltd., 2009.
3. Michael J.Bruton, Introduction to Transportation Planning, Hutchinson, London, 1995.


**REFERENCES**


1. J D Ortuzar and L G Willumnsen. Modeling Transport. John Wiley and Sons, New York, 2011.
2. John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1990.
3. C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
4. Juan de Dios Ort zar and Luis G. Willumsen, Modelling Transport, John Wiley & Sons 2001
5. Chennai Comprehensive Traffic Study, Chennai Metropolitan Development Authority, 2007.
6. James H.Banks, Introduction to Transportation Engineering, Tata McGraw Hill

Education Pvt Ltd, 2010

**VERTICAL VI: ENVIRONMENT**

| Course Code | CLIMATE CHANGE ADAPTATION AND MITIGATION | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3035 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To impart knowledge on the global warming, the impact of climate change on society and the adaptation and mitigation measures to the students

**UNIT I INTRODUCTION 9**

Atmosphere – weather and Climate - climate parameters – Temperature, Rainfall, Humidity, Wind – Global ocean circulation – El Nino and its effect - Carbon cycle

**UNIT II ELEMENTS RELATED TO CLIMATE CHANGE 7**

Greenh ouse gases - Total carbon dioxide emissions by energy sector – industrial, commercial, transportation, residential – Impacts – air quality, hydrology, green space - Causes of global and regional climate change – Changes in patterns of temperature, precipitation and sea level rise – Greenhouse effect

**UNIT III IMPACTS OF CLIMATE CHANGE 10**

Effects of Climate Changes on living things – health effects, malnutrition, human migration, socioeconomic impacts- tourism, industry and business, vulnerability assessment- infrastructure, population and sector – Agriculture, forestry, human health, coastal areas

**UNIT IV MITIGATING CLIMATE CHANGE 9**

IPCC Technical Guidelines for Assessing Climate Change Impact and Adaptation -Identifying adaption options – designing and implementing adaption measures – surface albedo environment- reflective roofing and reflective paving – enhancement of evapotranspiration - tree planting programme – green roofing strategies – energy conservation in buildings – energy efficiencies – carbon sequestration.

**UNIT V ALTERNATE FUELS AND RENEWABLE ENERGY 10**

Energy source – coal, natural gas – wind energy, hydropower, solar energy, nuclear energy, geothermal energy – biofuels – Energy policies for a cool future - Energy Audit.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

The students completing the course will have

**CO1** an insight into carbon cycle, physical basis of the natural greenhouse effect, including the meaning of the term radiative forcing, climate change, global warming and measures to adapt and to mitigate the impacts of climate change

**CO2** understanding on the growing scientific consensus established through the IPCC as well as the complexities and uncertainties

**CO3** ability to plan climate change mitigation and adaptation projects including the use of alternate fuels and renewable energy

**CO4** Gain in-depth knowledge on climate models

**CO5** Post process the modeloutputs for climate impact assessment, know about adaptation strategies

**TEXTBOOKS:**


1. Ruddiman W.F, freeman W.H. and Company, "Earth‟s Climate Past and Future", 2001
2. Velma. I. Grover "Global Warming and Climate" Change. Vol I an II. Science Publishers, 2005.
3. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007


**EFERENCES:**


1. IPCC Fourth Assessment Report, Cambridge University Press, Cambridge, UK, 2007
2. Thomas E, Lovejoy and Lee Hannah "Climate Change and Biodiversity", TERI Publishers, 2005
3. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.


| Course Code | **AIR AND NOISE POLLUTION CONTROL ENGINEERING** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3036 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To impart knowledge on the sources, effects and control techniques of air pollutants and noise pollution.

**UNIT I GENERAL 9**

Atmosphere as a place of disposal of pollutants – Air Pollution – Definition - Air Pollution and Global Climate - Units of measurements of pollutants - Air quality criteria - emission standards - National ambient air quality standards - Air pollution indices - Air quality

management in India.

**UNIT II SOURCES, CLASSIFICATION AND EFFECTS 9**

Sources and classification of air pollutants - Man made - Natural sources - Type of air pollutants - Pollution due to automobiles - Analysis of air pollutants - Chemical, Instrumental and biological methods.Air pollution and its effects on human beings, plants and animals - Economic effects of air pollution - Effect of air pollution on meteorological conditions - Changes on the Meso scale, Micro scale and Macro scale.

**UNIT III SAMPLING, METEOROLOGY AND AIR QUALITY MODELLING 9**

Sampling and measurement of particulate and gaseous pollutants - Ambient air sampling - Stack sampling. Environmental factors - Meteorology - temperature lapse rate and stability – Adiabatic lapse rate - Wind Rose - Inversion – Wind velocity and turbulence - Plume behavior - Dispersion of air pollutants- Air Quality Modeling.

**UNIT IV AIR POLLUTION CONTROL MEASURES 9**

Control - Source correction methods - Control equipments - Particulate control methods – Bag house filter - Settling chamber - cyclone separators - inertial devices - Electrostatic precipitator - scrubbers

- Control of gaseous emissions - Absorption - Absorption equipments - adsorption and combustion devices (Theory and working of equipments only).

**UNIT V NOISE POLLUTION AND ITS CONTROL 9**

Sources of noise – Units and Measurements of Noise - Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – General Control Measures – Effects of noise pollution – auditory effects, non-auditory effects. Noise Menace– Prevention and Control of Noise Pollution – Control of noise at source, control of transmission, protection of exposed person - Control of other types of Noise Sound Absorbent

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to

**CO1** Understand various types and sources of air pollution and its effects

**CO2** Know the dispersion of air pollutants and their modeling

**CO3** Know about the principles and design of control of particulate pollutants

**CO4** Understand the principles and design of control of gaseous pollutant

**CO5** Know the sources, effects and control of vehicular, indoor air and noise pollution

**TEXTBOOKS:**

1. C. S. Rao, “Environmental Pollution Control Engineering”, Wiley Eastern Limited, 2006.

2. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 2017
3. Dr. Y. Anjaneyulu, “Air Pollution and Control Technologies”, Allied publishers Pvt. Ltd., 2019.

**REFERENCES:**

1. Noel De Nevers, "Air pollution control Engineering", McGraw Hill International Edition, McGraw Hill Inc, New Delhi, 2000.
2. Air Pollution act, India, 1987
3. Peterson and E.Gross Jr., “Hand Book of Noise Measurement”, 7th Edition, 1974
4. Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986
5. Antony Milne, “Noise Pollution: Impact and Counter Measures”, David & Charles PLC, 1979.
6. Kenneth wark, Cecil F.Warner, “Air Pollution its Origin and Control”, Harper and Row Publishers, New York, 1998.

| Course Code | **ENVIRONMENTAL IMPACT ASSESSMENT** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3037 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To expose the students to the need, methodology, documentation and usefulness of environmental impact assessment and to develop the skill to prepare environmental management plan.
- To provide knowledge related to the broad field of environmental risk assessment, important processes that control contaminant transport and tools that can be used in predicting and managing human health risks.

**UNIT I INTRODUCTION 9**

Historical development of Environmental Impact Assessment (EIA). Environmental Clearance- EIA in project cycle. legal and regulatory aspects in India – types and limitations of EIA –EIA process screening – scoping - terms of reference in EIA- setting – analysis – mitigation. Cross sectoral issues –public hearing in EIA- EIA consultant accreditation.

**UNIT II IMPACT INDENTIFICATION AND PREDICTION 10**

Matrices – networks – checklists – cost benefit analysis – analysis of alternatives – expert systems in EIA. prediction tools for EIA – mathematical modelling for impact prediction – assessment of impacts – air – water – soil – noise – biological –– cumulative impact assessment

**UNIT III SOCIO-ECONOMIC IMPACT ASSESSMENT 8**

Socio-economic impact assessment - relationship between social impacts and change in community and institutional arrangements. factors and methodologies- individual and family level impacts. communities in transition-rehabilitation

**UNIT IV EIA DOCUMENTATION AND ENVIRONMENTAL MANAGEMENT PLAN 9**

Environmental management plan - preparation, implementation and review – mitigation and rehabilitation plans – policy and guidelines for planning and monitoring programmes – post project audit – documentation of EIA findings – ethical and quality aspects of environmental impact assessment

**UNIT V CASE STUDIES 9**

Mining, power plants, cement plants, highways, petroleum refining industry, storage & handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

**CO1** Apply the principle of limit state design for concrete pipe design

**CO2** Do structural design of Water tanks

**CO3** Design the water treatment plant Structures.

**CO4** Design the components of wastewater treatment plant structures.

**CO5** Apply the knowledge of structural design to various environmental engineering structures.

**REFERENCES:**


1. Canter, L.W., "Environmental Impact Assessment", McGraw Hill, New York. 1996
2. Lawrence, D.P., "Environmental Impact Assessment – Practical solutions to recurrent problems", Wiley-Interscience, New Jersey. 2003
3. World Bank –Source book on EIA
4. Cutter, S.L., "Environmental Risk and Hazards", Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
5. Kolluru Rao, Bartell Steven, Pitblado R and Stricoff “Risk Assessment and Management Handbook”, McGraw Hill Inc., New York,1996.
6. K. V. Raghavan and A A. Khan, "Methodologies in Hazard Identification and Risk Assessment", Manual by CLRI, 1990.
7. Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification, Assessment and Control, 4th Edition, Butterworth Heineman, 2012.

| Course Code | INDUSTRIAL WASTEWATER MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3038 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To impart knowledge on the concept and application of Industrial pollution prevention, cleaner technologies, industrial wastewater treatment and residue management.
- Understand principles of various processes applicable to industrial wastewater treatment
- Identify the best applicable technologies for wastewater treatment from the perspective of yield production.

**UNIT I INTRODUCTION 8**

Industrial scenario in India– Industrial activity and Environment - Uses of Water by industry – Sources and types of industrial wastewater – Nature and Origin of Pollutants - Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater monitoring and sampling – generation rates, characterization and variables –Toxicity of industrial effluents and Bioassay tests – Major issues on water quality management.

**UNIT II INDUSTRIAL POLLUTION PREVENTION & WASTE MINIMISATION 8**

Prevention vis a vis Control of Industrial Pollution – Benefits and Barriers – Waste management Hierarchy - Source reduction techniques – Periodic Waste Minimisation Assessments – Evaluation of Pollution Prevention Options – Cost benefit analysis – Pay-back period – Implementing & Promoting Pollution Prevention Programs in Industries.

**UNIT III INDUSTRIAL WASTEWATER TREATMENT 10**

Flow and Load Equalisation – Solids Separation – Removal of Fats, Oil & Grease- Neutralisation- Removal of Inorganic Constituents – Precipitation, Heavy metal removal, Nitrogen & Phosphorous removal, Ion exchange, Adsorption, Membrane Filtration, Electro dialysis & Evaporation –Removal of Organic Constituents – Biological treatment Processes, Chemical OxidationProcesses, Advanced Oxidation processes – Treatability Studies.

**UNIT IV WASTEWATER REUSE AND RESIDUAL MANAGEMENT 9**

Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse Industrial reuse , Present status and issues - Disposal on water and land – Residuals of industrialwastewater treatment – Quantification and characteristics of Sludge –

Thickening, digestion,conditioning, dewatering and disposal of sludge – Management of ROrejects.

**UNIT V CASE STUDIES** **10**

Industrial manufacturing process description, wastewater characteristics, source reduction optionsand waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Sugar and Distilleries

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

After completion of this course, the students is expected to be able to,

**CO1** Explain the source and types of industrial wastewater and their environmental impacts and choose the regulatory laws pertaining to environmental protection

**CO2** Identify industrial wastewater pollution and implement pollution prevention, waste minimization in industries

**CO3** Apply knowledge and skills to design industrial wastewater treatment schemes

**CO4** Audit and analyze environmental performance of industries to internal, external client, regulatory bodies and design water reuse management techniques

**CO5** Conduct research to develop effective management systems for industrial wastewater that are technically sound, economically feasible and socially acceptable

**REFERENCES:**


1. "Industrial wastewater management, T reatment & disposal, Water Environment" Federation Alexandria Virginia, Third Edition, 2008.
2. Lawrance K. Wang, Yung Tse Hung, Howard H.Lo and Constantine Yapijakis "handlook of Industrial and Hazardous waste Treatment", Second Edition, 2004.
3. Metcalf & Eddy, Inc., George Tchobanoglous, Franklin L. Burton and H. David Stensel, Wastewater engineering, treatment and reuse, Fourth Edition, McGraw-Hill, 2017
4. Nelson Leonard Nemerow, " industrial waste Treatment", Elsevier, 2007.
5. Wesley Eckenfelder W., " Industrial Water Pollution Control", Second Edition, Mc Graw Hill, 2000.
6. Paul L. Bishop, Pollution Prevention: - Fundamentals and Practice", Mc-Graw Hill International, Boston, 2000.
7. Waste water Treatment for pollution control and reuse by Soli. J. Arceivala, Shyam.

R. Asolekar, Tata McGraw Hill, 2007

| Course Code | SOLID AND HAZARDOUS WASTE MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3039 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE**

- To impart knowledge and skills relevant to minimization, storage, collection, transport, recycling, processing and disposal of solid and hazardous wastes including the related regulations, engineering principles, design criteria, methods and equipment.

**UNIT I WASTE CLASSIFICATION AND REGULATORY REQUIREMENTS 9**

Sources and types of solid and hazardous wastes - need for solid and hazardous waste management- salient features of latest Indian legislations on management and handling of solid wastes, hazardous wastes, biomedical wastes, electronic wastes, construction and demolition wastes, plastics and discarded lead acid batteries – elements of integrated waste management and roles of stakeholders - seven elements and seven step approach to integrated solid waste management planning.

**UNIT II WASTE CHARACTERIZATION SOURCE REDUCTION AND RECYCLING 9**

Waste sampling and characterization plan - waste generation rates and variation – physical composition, chemical and biological properties – hazardous characteristics – ignitability, corrosivity and TCLP tests –source reduction, segregation and onsite storage of wastes – waste exchange - extended producer responsibility - recycling of plastics, C&D wastes and E wastes.

**UNIT III WASTE COLLECTION TRANSPORT AND MATERIAL RECOVERY 9**

Door to door collection of segregated solid wastes - analysis of hauled container and stationery container collection systems - compatibility, storage, labeling and handling of hazardous wastes – principles and design of transfer and transport facilities - hazardous waste transport and manifests - mechanical processing and material separation technologies – Size reduction – size separation - density separation - magenetic separation – compaction – principles and design of material recovery facilities – physico chemical treatment of hazardous wastes - solidification and stabilization – case studies on waste collection and material recovery

**UNIT IV BIOLOGICAL AND THERMAL PROCESSING OF WASTES 9**

Biological and thermos-chemical conversion technologies – composting – biomethanation – incineration – pyrolysis- plasma arc gasification –principles and design of biological and thermal treatment facilities - MSW processes to energy with high-value products and specialty By-products

- operation of facilities and environmental controls - treatment of biomedical wastes – case studies and emerging waste processing technologies.

**UNIT V WASTE DISPOSAL** **9**

Sanitary and secure landfills - components and configuration– site selection - liner and cover systems - geo synthetic clay liners and geo membranes - design of sanitary landfills and secure landfills- leachate collection, treatment and landfill gas management – landfill construction and operational controls - landfill closure and environmental monitoring – landfill bioreactors – rehabilitation of open dumps and biomining of dumpsites-remediation of contaminated sites- Case studies

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

**CO1** Explain the various functional elements of solid and hazardous waste management including the associated legal, health, safety, and cultural issues as well as responsibilities of different stakeholders

**CO2** Apply the knowledge of science and engineering fundamentals to characterize different types of solid and hazardous wastes, assess the factors affecting variation and assess performance of waste treatment and disposal systems

**CO3** Design of systems and processes to meet specified needs of waste minimization, storage, collection, transport, recycling, processing and disposal.

**CO4** Select appropriate methods for processing and disposal of solid and hazardous wastes, taking into account the impact of the solutions in a sustainability context

**CO5** Conduct research pertinent to solid and hazardous waste management and communicate effectively to different stakeholders as well as engage in independent lifelong learning

**REFERENCES:**


1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, “Integrated Solid Waste Management, Mc-Graw Hill India, First edition, 2015.
2. CPHEEO, “Manual on Municipal Solid waste management,Vol I, II and III, Central Public Health

   and Environmental Engineering Organisation , Government of India, New Delhi, 2016.
3. William A. Worrell, P. Aarne Vesilind, Christian Ludwig, Solid Waste Engineering –

A Global erspective, 3rd Edition, Cengage Learning, 2017.

4. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and "Environmental Resources Management, Hazardous waste Management", Mc-Graw Hill International edition, New York,2010.
5. John Pitchtel,Waste Management Practices, CRC Press,Taylor and Francis Group,2014.
6. Gary C. Young, Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, Wiley, 2010
7. Cherry P M, Solid and Hazardous Waste Management, CBS publishers and distributors Pvt Ltd, 2018.
8. Rao M.N, Razia Sultana, Sri Harsha Kota, solid and hazardous waste management – Science and Engineering , Butterworth-Heinemann, 2016

| Course Code | ENVIRONMENTAL POLICY AND LEGISLATIONS | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3040 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- The course will analyze the legislative and judicial responses to environmental problems and the administrative system of environment related laws such as air, water, land, and hazardous substances etc. Environment advocacy and approaches for using litigation in environment protection will receive special attention

**UNIT I INTRODUCTION TO ENVIRONMENTAL LEGISLATIONS AND INTERNATIONAL SCENARIO 9**

Significance of Environmental Law -International Environmental Law -Development of International Environmental Law -Source and General principals of International Environmental Law –General rights and obligations of States -General Issues of the international law related to environmental protection -Stockholm Declaration-Rio Declaration on Environment and Development-Basel Convention on the Control of Trans boundary Movement of Hazardous Wastes and their disposal- Convention of Biological Diversity-U.N Frame Work Convention on Climate Change-Montreal Protocol on Substances that deplete Ozone Layer-Kyoto Protocol

**UNIT II INDIAN CONSTITUTIONS AND ENVIRONMENTAL PROTECTION 9**

Indian Constitution and Environmental Protection -Constitutional provisions concerning Environment Articles 14,15,(2) (b) 19 (e),21,31,32,38,39,42,47, 48-A,49,51,51-A: Indian Environmental Policy 2006 Administrative machinery for pollution control Common Law &

Criminal Law Nuisance, Negligence, Strict liability and Absolute liability, Provisions of IPC relating to environmental problems (public nuisance u/s 268 and others (Sections 269,270,277,284,285,286,425 to 440) Section 133 of Cr.P.C.

**UNIT III REMEDIES FOR ENVIRONMENTAL POLLUTION** **9**

Common Law Remedies/Remedies under Law of Tort – Penal Remedies – Indian Penal Code and Code of Criminal Procedure – Remedies under Constitutional Law – Writs – Public Interest Litigation

- Public Liability Insurance Act, 1991 – The National Green Tribunal Act 2010

**UNIT IV MAJOR INDIAN LEGISLATIONS** **9**

Water Act (1974) Air Act (1981) Environmental Protection Act (1986) Major Notifications, The Municipal solid Wastes (Management and Handling) Rules 2000-Bio Medical Wastes (Management and Handling) Rules 1998- Hazardous Wastes (Management and Handling Rules 1989-

Environment Impact Assessment Notifications- Coastal Regulation Zone Notification- Public Hearing Notifications

**UNIT V ENVIRONMENT AND DEVELOPMENT CASE LAWS** **9**

Meaning and concept of development - Its impact on environment; conflict between environment and development, Concept of Sustainable Development., Polluter Pay Principle, Precautionary Principle, Public Trust Doctrine. Landmark Judgments **-** Olium gas leakage case, Rural Litigation and Entitlement Kendra, Dehradun, (1985) Supp SCC 487) Vellore Citizen Welfare Forum v. Union of India, (1996) 5SCC 647) Ganga Pollution case (1988) I SCC) S. Jagannath v. UOI (1997) SCC867) Vellore Citizens welfare forum case M.C. Mehta V. Kamalnath (1997) I SCC 388)

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

**CO1** Understand origins and sources of environmental laws, and understand how and by whom environmental laws are made and interpreted

**CO2** Understand the key principles of, and actors within, environmental laws

**CO3** Understand the National Environmental Policy and Various Legislations enacted in line with Policy

**CO4** Critically analyze environmental laws within various contexts and to evaluate laws against procedural and substantive criteria.

**CO5** Understand and the Legal system operating in India and will be in a position to prepare compliance reports for getting environmental clearance.

**REFERENCES**


1. Leelakrishnan P., Environmental Law in India, Butterworths,1998
2. Leelakrishnan P., Environmental Case Book, Lexis Nexis, 2000
3. Shanthakumar S. , Environmental Law – An Introduction, Butterworths,2004
4. Shyam Diwan and Armin Rosencranz, Environmental Law and Policy in India, Oxford, 2001


| Course Code | ENVIRONMENTAL HEALTH AND SAFETY | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3041 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To educate overview of EHS in industries and related Indian regulations, types of Health hazards, effect, assessment and control methods and EHS Management System

**UNIT I INTRODUCTION 9**

Need for developing Environment, Health and Safety systems in work places- International initiatives, National Policy and Legislations on EHS in India - Regulations and Codes of Practice - Role of trade union safety representatives - Ergonomics.

**UNIT II OCCUPATIONAL HEALTH AND HYGIENE 10**

Definition of occupational health and hygiene - Categories of health hazards – Exposure pathways and human responses–Exposure Assessment-occupational exposure limits - Hierarchy of control measures - Role of personal protective equipment and the selection criteria

**UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS 11**

Features of Satisfactory and Safe design of work premises – good housekeeping - lighting and color, Ventilation and Heat Control, Noise, Chemical and Radiation Safety – Electrical Safety – Fire Safety

– Safety at Construction sites, ETP – Machine guarding – Process Safety, Working at different levels

**UNIT IV HAZARDS AND RISK MANAGEMENT 8**

Safety appraisal – Job Safety Analysis-Control techniques – plant safety inspection – Accident investigation - Analysis and Reporting – Hazard and Risk Management Techniques –Onsite and Offsite emergency Plans. Employee Participation- Education and Training- Case Studies

**UNIT V ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT 7**

Concept of Environmental Health and Safety Management – Elements of Environmental Health and Safety Management Policy and implementation and review – ISO 45001-Strucure and Clauses-Case Studies

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

After completion of this course, the students are expected to be able to understand:

**CO1** Need for EHS in industries and related Indian regulations

**CO2** Various types of Health hazards, effect, assessment and control methods

**CO3** Various safety systems in working environments

**CO4** The methodology for preparation of Emergency Plans and Accident investigation

**CO5** EHS Management System and its elements

**REFERENCES**


1. Industrial Health and Safety Acts and Amendments, by Ministry of Labour and Employment, Government of India
2. Fundamentals of Industrial Safety and Health by Dr.K.U.Mistry, Siddharth Prakashan, 2012
3. The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ., 2007.
4. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services, 2005.
5. Environmental and Health and Safety Management by Nicholas P.Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995


## VERTICAL VII: WATER RESOURCES

| Course Code | PARTICIPATORY WATER RESOURCES MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3042 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To enable the students to understand the regional and global experiences of participatory ideology in irrigation water management
- To help students acquire knowledge on paradigms shifts and reorientations

with regard to stakeholder participation in water management in general and in irrigation management in particular.

**UNIT I FUNDAMENTALS OF SOCIOLOGY AND PARTICIPATORY APPROACH 6**

Basic Sociological concepts and Definitions - Objectives – Perspectives- Social stratification – Sociological understanding - Irrigation as a Sociotechnical Process - paradigm shift and Participatory approach

**UNIT II UNDERSTANDING FARMERS PARTICIPATION 12**

Need of farmers participation –Benefits of farmers participation – Comparisons of cost and benefit Water User Association –- Membership - Kinds of participation – National and International Experiences -Activities on Water towards Organization and Structure - Context of participation- factors in the environment.

**UNIT III ROLE OF STAKEHOLDERS AND THE UNDERLYING ISSUES 12**

Multiple use of water – Issues in sectoral Water Allocation - Domestic, Irrigation, Industrial sectors

- Woman as a water user –Constraints and Opportunities. Role of Community Organisers – Constraints in Organising farmers Organisation.

**UNIT IV IMPROVING AGENCY RELATIONS AND INSTITUTIONAL REFORMS 10**

Supporting farmer organization and participation -Decision Making- Leadership and responsibilities

– Development strategy – Channels for implementation –- Equity and Equality- AgencyIncentives- Technical co-operation – Special roles – Agency Roles- Institutional Reforms

**UNIT V POLICY CONSIDERATIONS AND EMERGING CHALLENGES 5**

Water Policy-Irrigation Governance-Building from Below-Non-political Associations-Bureaucratic Reorientation- Policy options and Alternatives and Sustainability.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

**CO1** Capture to fundamental concepts and terms which are to be applied and understood all through the study.

**CO2** Acquire a clear insight into the subject matter of participatory ideology with its rudiments under the light of both national and international illustrative cases.

**CO3** Comprehend the roles of different players as stakeholders with the ground reality of the

underlying issues in farm community.

**CO4** Articulate as how reforms can help build up institutional and irrigation agencies with the support obtained from the existing farm network in irrigation Management

**CO5** Gain an overarching understanding of recommendation for improved irrigation management with a vision to transform the existing governance and policies with the novel approach of sustainability.

**TEXT BOOKS**


1. Desai A.R., Rural sociology in India, Popular Prakashan, Bombay, 1969.
2. Michael C.M., Putting people first, Sociology variables in Rural Development, Oxford University press, London 1985.
3. Uphoff. N., Improving International Irrigation management with Farmer Participation – Getting the process Right – Studies in water Policy and management, New West - View press, Boulder and London, 1986.
4. Chambers R., Managing canal irrigation, Oxford IBM publishing Co. Pvt. Ltd., New Delhi, 1998.
5. Korten F.F and Robert Y. Siy, Jr. Transforming a Bureaucracy – The experience of the Philippines National Irrigation Administration, Ateneo De Manila University Press, Manila, 1989.


**REFERENCES:**


1. Sivasubramanium K., Water Management SIMRES Publication, Chennai 2009.
2. http://irapindia.org/IMTInIndia-Pa
3. http://mowr.gov.in/writereaddata/mainlinkFile/File421.pdf


| Course Code | GROUNDWATER ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3043 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- The objective of this course is to enable the student to understand the principles of Groundwater governing Equations, Characteristics of different aquifers and techniques of groundwater model development and management.

**UNIT I HYDROGEOLOGICAL PARAMETERS 9**

Introduction – Water bearing Properties of Rock – Type of aquifers - Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation – GEC norms - Steady state flow - Darcy's Law - Groundwater Velocity –- Dupuit Forchheimer

assumption

– Steady Radial Flow into a Well

**UNIT II WELL HYDRAULICS 9**

Unsteady state flow - Theis method - Jacob method – Chow's method – Law of Times – Theis Recovery – Bailer method – Slug method - tests - Image well theory – Partial penetrations of wells - Well losses – Specific Capacity and Safe yield - Collector well and Infiltration gallery

**UNIT III GROUNDWATER MANAGEMENT 9**

Need for Management Model – Database for Groundwater Management – Groundwater balance study – Introduction to Mathematical model – Model Conceptualization – Initial and Boundary Condition – Calibration – Validation – Future Prediction – Sensitivity Analysis – Uncertainty – Development of a model

**UNIT IV GROUNDWATER QUALITY 9**

Ground water chemistry - Origin, movement and quality - Water quality standards – Drinking water Industrial water – Irrigation water - Groundwater Pollution and legislation - Environmental Regulatory requirements

**UNIT V GROUNDWATER CONSERVATION 9**

Artificial recharge techniques – Reclaimed wastewater recharge – Soil aquifer treatment (SAT) – Aquifer Storage and Recovery (ASR) Seawater Intrusion and Remediation – Ground water Basin management and Conjunctive use – Protection zone delineation, Contamination source inventory and remediation schemes

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to:

**CO1** Define the groundwater system basic, types of aquifers, aquifer parameters, movement and its potential for confined and unconfined aquifers

**CO2** Apply the knowledge of groundwater flow in steady and unsteady flow characteristics of well hydraulics

**CO3** Explain the concept of groundwater model development and database management for groundwater management

**CO4** Describe the importance of artificial recharge and groundwater quality concepts

**CO5** Apply the creative and innovative technique on conservation of groundwater

| Course Code | WATER RESOURCES SYSTEMS ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3044 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To introduce the student to the concept of Mathematical approaches for managing the water resources system and apply to operate a water resource system optimally.

**UNITI SYSTEM APPROACH 9**

Definition, classification, and characteristics of systems - Philosophy of modelling – Goals and Objectives – Basics of system analysis concept – steps in systems engineering.

**UNITII LINEAR PROGRAMMING 9**

Introduction to Operation research - Linear programming Problem Formulation-graphical solution Simplex method –Sensitivity analysis - application to operation of single purpose reservoir

**UNITIII DYNAMIC PROGRAMMING 9**

Bellman's optimality criteria, problem formulation and solutions – Water Allocation for three state (user), Forward and Backward Recursion techniques in Dynamic Programming - Shortest pipeline route problem - Application to reservoirs capacity expansion

**UNITIV SIMULATION 9**

Basic principles and concepts – Monte Carlo techniques – Model development – Inputs and outputs – Single and multipurpose reservoir simulation models – Deterministic simulation – Rule Curve development for reservoir

**UNITV ADVANCED OPTIMIZATION TECHNIQUES 9**

Integer and parametric linear programming – Goal programming types – Applications to reservoir release optimization – application of evolutionary algorithms like Genetic algorithm, Particle swarm, Simulated Annealing to reservoir release optimization

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to:

**CO1** Define the economic aspects and analysis of water resources systems for comprehensive and integrated planning of a water resources project.

**CO2** Apply the concept of linear programming for optimisation of water resources problems.

**CO3** Explain the concept of dynamic programming and apply in water resource system.

**CO4** Develop the simulation model based on deterministic and stochastic simulation for reservoir operating

policy

**CO5** Apply advance optimisation techniques like goal programming, heuristic algorithm in the field of

water resources planning and management.

**TEXT BOOKS**

1. Vedula, S., and Majumdar, P.P. Water Resources Systems – Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint,2010.
2. Bhave PR, Water Resources Systems, Narosa Publishers,2011

**REFERENCES:**

1. Gupta, P.K., and Man Mohan, "Problems in Operations Research", (Methods and Solutions), Sultan Chand and Sons, New Delhi,1995.
2. Chaturvedi, M.C., "Water Resources Systems Planning and Management", Tata McGraw Hill, New Delhi,1997.
3. Taha, H.A., "Operations Research", McMillan Publication Co., New York,1995.
4. Hiller, F.S., and Liebermann, G.J., "Operations Research", CBS Publications and Distributions,

New Delhi,1992.

| Course Code | **WATERSHED CONSERVATION AND MANAGEMENT** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3045 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To provide the technical and sociological understanding of a watershed.
- To provide a comprehensive discourse on the engineering practices of watershed management for realizing the higher benefits.

**UNIT I WATERSHED CONCEPTS 9**

Watershed – Definition, Need and Elements – Principles - Influencing Factors: Geology – Soil – Morphological Characteristics - Toposheet - Delineation – Codification – Prioritization – Watershed Atlas.

**UNIT II SOIL CONSERVATION MEASURES 9**

Types of Erosion – Water and Wind Erosion: Causes, Factors, Effects and Management – Soil Conservation Measures: Agronomical and Mechanical – Design of Terraces and Bunds - Estimation of Soil Loss – USLE Equation - Sedimentation.

**UNIT III WATER HARVESTING AND CONSERVATION 9**

Yield from a Catchment - Traditional Water Harvesting Techniques – Micro-Catchments - Design of Small Water Harvesting Structures: Farm Ponds, Percolation Tanks, Check dams, Grassed Waterways.

**UNIT IV GIS FOR WATERSHED MANAGEMENT 9**

Applications of Remote Sensing and Geographical Information System - Role of Decision Support System – Conceptual Models and Case Studies.

**UNIT V WATERSHED MANAGEMENT 9**

Project Proposal Formulation - Watershed Development Plan – Entry Point Activities – Watershed Economics - Agroforestry – Grassland Management – Wasteland Management – Watershed Approach in Government Programmes – People's Participation – Evaluation of Watershed Management Programmes – Integrated Watershed Management – Case studies.

**TOTAL: 45 PERIODS**

**COURSE OUTCOME :**

- On Completion of the course the student is expected to

**CO1** Recognize and Interpret the morphological features of a watershed.

**CO2** State, design and sketch the soil conservation structures.

**CO3** Describe the micro catchment and apply the concepts to design the small water harvesting structures.

**CO4** Illustrate the application of modern tools and technology in the management of watershed.

**CO5** Classify the management activities and to develop an integrated watershed development plan.

| Course Code | **INTEGRATED WATER RESOURCES MANAGEMENT** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3046 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE**

- Students will be introduced to the concepts and principles of IWRM, which is inclusive of the economics, public-private partnership, water & health, water & food security and legal & regulatory settings.

**UNIT I CONTEXT FOR IWRM 9**

Water as a global issue: Key challenges – Definition of IWRM within the broader context of development – Key elements of IWRM - Principles – Paradigm shift in water management - Complexity of the IWRM process – UN World Water Assessment - SDGs.

**UNIT II WATER ECONOMICS 9**

Economic view of water issues: Economic characteristics of water good and services – Non-market monetary valuation – Water economic instruments – Private sector involvement in water resources management: PPP objectives, PPP models, PPP processes, PPP experiences through case studies.

**UNIT III LEGAL AND REGULATORY SETTINGS 9**

Basic notion of law and governance: Principles of International and National law in the area of water management - Understanding UN law on non-navigable uses of International water courses- International law for groundwater management – World Water Forums – Global Water Partnerships Development of IWRM in line with legal and regulatory framework: Case Studies.

**UNIT IV WATER AND HEALTH WITHIN THE IWRM CONTEXT 9**

Links between water and health: Options to include water management interventions for health – Health protection and promotion in the context of IWRM – Global burden of Diseases - Health impact assessment of water resources development projects – Case studies.

**UNIT V AGRICULTURE IN THE CONCEPT OF IWRM 9**

Water for food production: 'blue' versus 'green' water debate – Water foot print - Virtual water trade for achieving global water and food security - Climate Smart Agriculture - Current water pricing policy– Scope to relook pricing.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

On completion of the course, the student is expected to

**CO1** Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.

**CO2** Select the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.

**CO3** Apply law and governance in the context of IWRM.

**CO4** Discuss the linkages between water-health; develop a HIA framework.

**CO5** Analyse how the virtual water concept pave way to alternate policy options.

**TEXTBOOKS:**


1. Cech Thomas V., Principles of water resources: history, development, management and policy. John Wiley and Sons Inc., New York. Fourth Edition 2018.
2. Mollinga.P. etal "Integrated Water Resources Management", Water in South Asia Volume I,

Sage Publications, 2006.

**REFERENCES:**


1. Technical Advisory Committee, Dublin principles for water as reflected in comparative assessment of institutional and legal arrangements for Integrated Water Resources Management, Technical Advisory Committee Background Paper No: 3. Global water partnership, Stockholm, Sweden. 1999.
2. Technical Advisory Committee, Integrated Water Resources management, Technical Advisory Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002.
3. Technical Advisory Committee, Effective Water Governance". Technical Advisory Committee

   Background Paper No: 7. Global water partnership, Stockholm, Sweden, 2003.
4. Tony Allan, Virtual Water: Tackling the Threat to Our Planet's Most Precious Resource, I. B.

   Taurus, 2011.
5. Convention on the Law of the Non-navigational Uses of International Watercourses. https://legal.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf


| Course Code | URBAN WATER INFRASTRUCTURE | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3047 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVE:**

- To impart knowledge and skills relevant to water management in the context of urbanization and relate engineering principles to water supply, storm water and wastewater management, along with related regulations and best management practices from around the world.

**UNIT I URBAN ECOSYSTEM 9**

Cities as Ecological system – hybrid ecosystem – Resilience in urban ecosystem. Human components of Ecosystem – Urban pattern and Ecosystem function. Population and Community dynamics, functions of Urban Ecosystem.

**UNIT II URBANHYDROLOGY 9**

The urban hydrological cycle – Function – Human induced changes in urban watershed – Hydrological calculation – Runoff – Infiltration – hydrograph.

**UNIT III URBAN STORM WATER MANAGEMENT 9**

Design of Drainage System – Roadway Drainage Analysis – Types of inlet – inlet design –

Design of storm drain - Storm water management regulations - structural storm management systems – Newer trends in storm water management (Green infrastructure) – installation – operation and maintenance.

**UNIT IV WATER CONSERVATION AND REUSE 9**

Trends in supply and demand – indoor conservation – outdoor conservation – water reuse – Rainwater harvesting – public education.

**UNIT V WATER GOVERNANCE 9**

Challenges in water sector - Institutional setting, Supply Management, Demand Management, Waste water management – Private sector participation, urban service delivery, customer satisfaction, financial resource management – case studies of best practices in cities across the world.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the student is expected to be able to

**CO1** Explain various functional elements of urban ecosystem.

**CO2** Calculate urban runoff, compute supply and demand of water, draw hydrograph

**CO3** Compare advantages of Newer techniques of green infrastructure and illustrate benefits

**CO4** Assess the Operation and Maintenance needs of urban water systems

**CO5** Propose best management practices for Indian context

**TEXT BOOKS:**


1. AnandChiplunkar, K Seetharam and CheonKheong (ed) (2012), "Good Practices in urban water management" ADB, National University Singapore.
2. Marina Alberti (2008), "Advances in Urban Ecology", SpringeR
3. Mohammad Karamouz, Ali Moridi, Sara Nazif (2010), Urban Water Engineering and Management, 1st Edition, CRC Press
4. Monzur A. Imteaz , (2019), Urban Water Resources, CRC Press


**REFERENCES:**


1. HormozPazwash (2016), "Urban storm water management", CRC Press
2. Larry W. Mays, (2004), Urban Stormwater Management Tools, McGraw-Hill Companies
3. J Parkinson, O Mark (2005) Urban Stormwater Management in Developing Countries, IWA Publishing


| Course Code | **WATER QUALITY AND MANAGEMENT** | L | T | P | C |
|---|---|---|---|---|---|
| CEPE3048 | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

- To understand the fundamentals of mathematical models and their importance in water quality modelling, and to impart the skills to use water quality modelling software for surface and groundwater quality modelling.

**UNIT I MODELLING INSIGHTS** **9**

Engineers and Mathematical models-Water quality models – historical development - different types of models-- steps in model development - importance of model building.- calibration and verification of models- finite element, finite difference and finite volume methods.

**UNIT II POLLUTION TRANSPORT** **9**

Transport phenomena – advection, diffusion, dispersion- contamination transport in surface and subsurface water - Simple transport models –steady state and time variable solutions- conservation of mass, momentum and energy balance, governing equation for contaminant fate and transport

**UNIT III SURFACE WATER QUALITY MODELLING** **9**

Water quality modeling of streams, lakes and estuaries – water quality– model sensitivity – assessing model performance; Models for dissolved oxygen, pathogens and COD, BOD-Streeter Phelp's model for point and distributed sources – modified streeter Phelp's equations.

**UNIT IV GROUNDWATER QUALITY MODELLING** **9**

Groundwater flow and mass transport of solutes – groundwater quality modelling using numerical methods – Parameters, Input-output stresses, Initial and Boundary conditions-degradation of organic compounds in subsurface – Model calibration : steady state and unsteady state – sensitivity analysis – Model validation –seawater intrusion – basic concepts and modelling.

**UNIT V WATER QUALITY MANAGEMENT MODELS** **9**

Exposure to surface water and groundwater quality modelling software's – MIKE 21, WASP, QUAL2E and MODFLOW – demonstration – case studies – Modeling multilayer groundwater flow system – Artificial recharge feasibility through modeling – Groundwater contamination, restoration and management.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

On completion of the course, the students are able to

**CO1** Know about the principles of water quality modelling.

**CO2** Understand the pollutant transport phenomena in surface and groundwater.

**CO3** Apply the knowledge of surface water quality modelling to predict the water quality of rivers, lakes and estuary.

**CO4** Predict the groundwater contamination transport.

**CO5** Predict water quality of surface and sub surface water using numerical solution.

**REFERENCES:**


1. Steven C. Chapra, "Surface Water Quality Modelling", Tata McGraw-Hill Companies, Inc., New Delhi2018.
2. "Water Quality Modelling for Rivers and Streams" Authors: Benedini, Marcello, Tsakiris, George,

Springer Netherlands2017.

3. **"**Hydrodynamics and Water Quality**:** Modelling Rivers, Lakes, and Estuaries", Zhen-Gang Ji, John Wiley & Sons,2018.
4. "Modelling Groundwater Flow and Contaminant Transport By Jacob Bear, A. H.-D. Cheng, Springer Science & Business Media,2010.
5. "Mathematical Modelling of Groundwater Pollution" Ne-Zheng Sun, Alexander Sun, Springer New York, 2012


## APPENDIX B: OPEN ELECTIVES


**APPENDIX B: OPEN ELECTIVES**


| Open Elective - I | Open Elective - II |
|---|---|
| English for Competitive Examinations | Project Report Writing |
| Applied Design Thinking | Advanced Numerical Methods |
| Sustainable Manufacturing | Random Processes |
| Principles of Management | Queuing and Reliability Modelling |
| Entrepreneurship for Engineers | Production and Operations Management for Entrepreneurs |
| Total Quality Management | Multivariate Data Analysis |
| Intellectual Property Rights | Additive Manufacturing |
| Professional Ethics | New Product Development |
| Human Resource Management | Industrial Design & Rapid Prototyping Techniques |
| Industrial Safety Engineering | Micro and Precision Engineering |
| Industrial Management | Cost Management of Engineering Projects |
| Quality Engineering | Batteries and Management system |
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**Open Elective – I:**

| Course Code | AUGMENTED REALITY/VIRTUAL REALITY | L | T | P | C |
|---|---|---|---|---|---|
| CEOE3001 | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

The main objectives of this course are to:

- To impart the fundamental aspects and principles of AR/VR technologies
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications
- To learn about the graphical processing units and their architectures
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications

**UNIT I Introduction** **7**

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System

**UNIT II VR Modelling** **6**

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

**UNIT III VR PROGRAMMING** **6**

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

**UNIT IV Applications** **6**

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

**UNIT V Augmented Reality** **5**

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and AnnotationNavigation-Wearable devices

**30 PERIODS**

**Practical Experiments**

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection types by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
9. Develop AR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.
10. Develop simple MR enabled gaming applications.

**30 PERIODS**

**COURSE OUTCOMES:**

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

CO 1: Understand the basic concepts of AR and VR
CO 2: Understand the tools and technologies related to AR/VR
CO 3: Know the working principle of AR/VR related Sensor devices
CO 4: Design of various models using modeling techniques
CO 5: Develop AR/VR applications in different domains

**TEXT BOOKS:**


1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison Wesley, 2016
3. John Vince, “Introduction to Virtual Reality”, Springer-Verlag, 2004
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application,

Design", Morgan Kaufmann, 2003'

**TOTAL: 60 PERIODS**

**Open Elective – II:**

| Course Code | ADDITIVE MANUFACTURING | L | T | P | C |
|---|---|---|---|---|---|
| CEOE3002 | | 2 | 0 | 2 | 3 |

**COURSE OBJECTIVES:**

- To introduce the development of Additive Manufacturing (AM), various business opportunities and applications.
- To familiarize various software tools, processes and techniques to create physical objects that satisfy product development / prototyping requirements, using AM.
- To be acquainted with vat polymerization and direct energy deposition processes .
- To be familiar with powder bed fusion and material extrusion processes.
- To gain knowledge on applications of binder jetting, material jetting and sheet lamination
- Processes.

**UNIT I INTRODUCTION** **6**

Overview - Need - Development of Additive Manufacturing (AM) Technology: Rapid PrototypingRapid Tooling - Rapid Manufacturing - Additive Manufacturing. AM Process Chain-ASTM/ISO52900 Classification - Benefits. Applications: Building Printing - Bio Printing - Food PrintingElectronics Printing. Business Opportunities and Future Directions – Case studies: Automobile,

Aerospace, Healthcare.

**UNIT II DESIGN FOR ADDITIVE MANUFACTURING (DfAM)** **6**

Concepts and Objectives - AM Unique Capabilities - Part Consolidation – Topology OptimizationGenerative design - Lattice Structures - Multi-Material Parts and Graded Materials – Data Processing: CAD Model Preparation - AM File formats: STL-Problems with STL- AMF Design for Part Quality Improvement: Part Orientation - Support Structure - Slicing - Tool Path Generation – Design rules for Extrusion based AM.

**UNIT III VAT POLYMERIZATION AND DIRECTED ENERGY DEPOSITION** **6**

Photo polymerization: Stereolithography Apparatus (SLA)- Materials -Process – top down and bottom up approach - Advantages - Limitations - Applications. Digital Light Processing (DLP) - Process - Advantages - Applications. Continuous Liquid Interface Production (CLIP)Technology. Directed Energy Deposition: Laser Engineered Net Shaping (LENS)- Process - Material Delivery - Materials -Benefits -Applications.

**UNIT IV POWDER BED FUSION AND MATERIAL EXTRUSION** **6**

Powder Bed Fusion: Selective Laser Sintering (SLS): Process - Powder Fusion Mechanism - Materials and Application. Selective Laser Melting (SLM), Electron Beam Melting (EBM): Materials - Process - Advantages and Applications. Material Extrusion: Fused Deposition Modeling (FDM)- Process-Materials -Applications and Limitations.

**UNIT V OTHER ADDITIVE MANUFACTURING PROCESSES 6**

Binder Jetting: Three-Dimensional Printing - Materials - Process - Benefits- Limitations - Applications. Material Jetting: Multijet Modeling- Materials - Process - Benefits - Applications. Sheet Lamination: Laminated Object Manufacturing (LOM)- Basic Principle- Mechanism: Gluing or Adhesive Bonding - Thermal Bonding- Materials-Application and Limitation.

**TOTAL: 30 PERIODS**

**ADDITIVE MANUFACTURING LABORATORY**

**Experiments**

1. Modelling and converting CAD models into STL file.
2. Manipulation and error fixing of STL file.
3. Design and fabrication of parts by varying part orientation and support structures.
4. Fabrication of parts with material extrusion AM process.
5. Fabrication of parts with vat polymerization AM process.
6. Design and fabrication of topology optimized parts.

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

At the end of this course students shall be able to:

CO1: Recognize the development of AM technology and how AM technology propagated into various businesses and developing opportunities.

CO2: Acquire knowledge on process of transforming a concept into the final product in AM technology.

CO3: Elaborate the vat polymerization and direct energy deposition processes and its applications.

CO4: Acquire knowledge on process and applications of powder bed fusion and material extrusion.

CO5: Evaluate the advantages, limitations, applications of binder jetting, material jetting and Sheet lamination processes.

**TEXT BOOKS:**

1. Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani “Additive manufacturing technologies”. 3rd edition Springer Cham, Switzerland. (2021). ISBN: 978-3-030-56126-0
2. Andreas Gebhardt and Jan-Steffen Hötter “Additive Manufacturing: 3D Printing for

Prototyping and Manufacturing", Hanser publications, United States, 2015, ISBN: 978-1-56990-582-1.

**REFERENCES:**

1. Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing", Hanser Gardner Publication, Cincinnati., Ohio, 2011, ISBN :9783446425521.
2. Milan Brandt, "Laser Additive Manufacturing: Materials, Design, Technologies, and Applications", Woodhead Publishing., United Kingdom, 2016, ISBN: 9780081004333.
3. Amit Bandyopadhyay and Susmita Bose, "Additive Manufacturing", 1st Edition, CRC Press., United States, 2015, ISBN-13: 978-1482223590.
4. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer., United States 2006, ISBN: 978-1-4614-9842-1.
5. Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press., United States, 2011, ISBN: 9780849334092.

## APPENDIX C: MANDATORY COURSES

| MANDATORY COURSE I | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **Theory/ Practical / T&P** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1. | T | MC2301 | Universal Human Values | 3 | 0 | 0 | 0 |
| 2. | T | MC2302 | Introduction to Women and Gender Studies | 3 | 0 | 0 | 0 |
| 3. | T | MC2303 | Well Being with Traditional Practices - Yoga, Ayurveda and Siddha | 3 | 0 | 0 | 0 |
| 4. | T | MC2304 | Elements of Literature | 3 | 0 | 0 | 0 |
| 5. | T | MC2305 | Film Appreciation | 3 | 0 | 0 | 0 |

| MANDATORY COURSE II | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S. No** | **Theory/ Practical / T&P** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1. | T | MC2401 | History of Science and Technology in India | 3 | 0 | 0 | 0 |
| 2. | T | MC2402 | Political and Economic Thought for a Human Society | 3 | 0 | 0 | 0 |
| 3. | T | MC2403 | State, Nation Building and Politics in India | 3 | 0 | 0 | 0 |
| 4. | T | MC2404 | Industrial Safety | 3 | 0 | 0 | 0 |
| 5. | T | MC2405 | Disaster Risk Reduction and Management | 3 | 0 | 0 | 0 |

| Course Code | UNIVERSAL HUMAN VALUES | L | T | P | C |
|---|---|---|---|---|---|
| MC2301 | | 3 | 0 | 0 | 0 |

**COURSE OBJECTIVES:**

The main objectives of this course are to:

- To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

**Course Description**

This course offers a comprehensive exploration of the fundamental principles and beliefs that underpin human behaviour and societal harmony across diverse cultures and contexts. Through interdisciplinary perspectives from psychology, philosophy, sociology, anthropology, and ethics, students will examine the core values that transcend geographical, cultural, and historical boundaries.

**Prerequisites**

There are no specific prerequisites for this course, although a basic understanding of social sciences and cultural studies would be beneficial.

**UNIT I INTRODUCTION TO VALUE EDUCATION 6+3**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)-Understanding Value Education-Practice Session PS1 Sharing about Oneself-Self-exploration as the Process for Value Education-Continuous Happiness and Prosperity – the Basic Human Aspirations-Practice Session PS2 Exploring Human Consciousness-Happiness and Prosperity – Current Scenario-Method to Fulfil the Basic Human Aspirations-Practice Session PS3 Exploring Natural Acceptance.

**UNIT II HARMONY IN THE HUMAN BEING 6+3**

Understanding Human being as the Co-existence of the Self and the Body-Distinguishing between the Needs of the Self and the Body-Practice Session PS4 Exploring the difference of Needs of Self and Body-The Body as an Instrument of the Self=Understanding Harmony in the Self- Exploring Sources of Imagination in the Self-Harmony of the Self with the Body-Programme to ensure self-regulation and Health- Exploring Harmony of Self with the Body.

**UNIT III HARMONY IN THE FAMILY AND SOCIETY 6+3**

Harmony in the Family – the Basic Unit of Human Interaction-'Trust' – the Foundational Value in Relationship-Exploring the Feeling of Trust- 'Respect' – as the Right Evaluation- Exploring the Feeling of Respect-Other Feelings, Justice in Human-to-Human Relationship- Understanding Harmony in the Society-Vision for the Universal Human Order-Exploring Systems to fulfil Human Goal potential and program to ensure a happy and prosperous life for them and for others.

**UNIT IV HARMONY IN THE NATURE/EXISTENCE 6+3**

Understanding Harmony in the Nature-Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature-Exploring the Four Orders of Nature-Realizing Existence as Co-existence at All Levels=The Holistic Perception of Harmony in Existence=Exploring Co-existence in Existence.

**UNIT V IMPLICATIONS OF THE HOLISTIC UNDERSTANDING – A LOOK AT PROFESSIONAL ETHICS 6+3**

Natural Acceptance of Human Values-Definitiveness of (Ethical) Human Conduct Exploring Ethical Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order -Competence in Professional Ethics-Exploring Humanistic Models in Education- Holistic Technologies, Production Systems and Management Models-Typical-Case Studies-Strategies for Transition towards Value-based Life and Profession-Exploring Steps of Transition towards Universal Human Order.

**COURSE OUTCOMES:**

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

CO 1: The students start exploring themselves; get comfortable to each other and to the teacher and start finding the need and relevance for the course

CO 2: The students are able to see that all physical facilities they use are required for a limited time in a limited quantity. Also they are able to see that in case of feelings, they want continuity of the naturally acceptable feelings and they do not want feelings which are not naturally acceptable even for a single moment.

CO 3: The students are able to differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them.

CO 4: Understand the whole existence; nothing is a mystery in this existence. They are also able to see the interconnectedness in nature.

CO 5: Grasp the right utilization of their knowledge in their streams of Technology/Engineering/ Management to ensure mutually enriching and recyclable productions systems.

| **TEXT BOOKS:** | | |
|---|---|---|
| 1. | A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 | |
| 2. | The Teacher's Manual Teachers‟ Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2 | |

| REFERENCES: | |
|---|---|
| 1. | JeevanVidya: EkParichaya, A Nagaraj, JeevanVidya Prakashan, Amarkantak, 1999. |
| 2. | Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. |
| 3. | The Story of Stuff (Book). |
| 4. | The Story of My Experiments with Truth - by Mohandas Karamch and Gandhi |
| 5. | Small is Beautiful - E. F Schumacher. |
| 6. | Slow is Beautiful - Cecile Andrews |
| 7. | Economy of Permanence - J C Kumarappa |
| 8. | Bharat Mein Angreji Raj – Pandit Sunderlal |
| 9. | Rediscovering India - by Dharampal |
| 10. | Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi |
| 11. | India Wins Freedom - Maulana Abdul Kalam Azad |
| 12. | Vivekananda - Romain Rolland (English) |
| 13. | Gandhi - Romain Rolland (English) |

**YouTube Resources**:

1. TED Talks: The TED platform hosts numerous talks by experts from various fields discussing topics related to human values, empathy, compassion, and social justice.

2. The School of Life: This channel explores philosophical and psychological concepts relevant to everyday life, including videos on empathy, gratitude, forgiveness, and personal growth.

3. Big Think: Big Think features interviews and discussions with leading thinkers, scientists, and philosophers addressing topics such as ethics, morality, and the human condition.

**TOTAL :45 PERIODS**

| Course Code | INTRODUCTION TO WOMEN AND GENDER STUDIES | L | T | P | C |
|---|---|---|---|---|---|
| MC2302 | | 3 | 0 | 0 | 0 |

**COURSE OBJECTIVES:**

The main objectives of this course are to:

- Understand the distinction between sex and gender, and critically analyze the concepts of masculinity, femininity, and gender roles within various social contexts.
- Explore the mechanisms of socialization and the role of patriarchy in shaping gender relations and hierarchies.
- Examine key feminist theories including liberal, Marxist, socialist, radical, psychoanalytic, postmodernist, and ecofeminist perspectives, and critically evaluate their contributions to understanding gender issues.

- Analyze the global, national, and local dynamics of women's movements, tracing their historical development, key actors, and major achievements.
- Investigate the relationship between gender and language, exploring linguistic forms, narratives, and how language both reflects and constructs gender identities and power dynamics.

**Course Description**

This course delves into the interdisciplinary field of gender studies, examining key concepts, feminist theories, women's movements, and the intersection of gender with language and representation in media

**Prerequisites**

- There are no specific prerequisites for this course, although a basic understanding of social sciences and cultural studies would be beneficial.

**UNIT I CONCEPTS** **9**

Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour

**UNIT II FEMINIST THEORY** **9**

Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

**UNIT III WOMEN'S MOVEMENTS: GLOBAL, NATIONAL AND LOCAL 9**

Rise of Feminism in Europe and America. Women's Movement in India

**UNIT IV GENDER AND LANGUAGE** **9**

Linguistic Forms and Gender. Gender and narratives

**UNIT V GENDER AND REPRESENTATION** **9**

Advertising and popular visual media. Gender and Representation in Alternative Media. Gender and social media.

**Course Format**

The course will be delivered through a combination of lectures, discussions, multimedia presentations, case studies, and hands-on activities. Guest lectures from industry experts and field visits may also be included to provide real-world perspectives.

**Assessments & Grading**

Quizzes / Assignments, Internal Assessments, Final Examination

**COURSE OUTCOMES:**

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

CO1: Critically analyze key concepts in gender studies, including sex vs. gender, patriarchy, power dynamics, and gender roles.
CO2: Evaluate diverse feminist theories and their contributions to understanding gender inequality and social change.
CO3: Examine the historical development and contemporary dynamics of women's movements globally and locally..
CO4: Analyze the relationship between gender and language, including linguistic forms, narratives, and discourses..
CO5: Evaluate the representation of gender in various media forms, including advertising, visual media, alternative media, and social media, and assess their impact on shaping perceptions and reinforcing or challenging gender norms.

**TEXT BOOKS:**

1. "Gender: Ideas, Interactions, Institutions" by Lisa Wade and Myra Marx Ferree

**REFERENCES:**

1. "Feminist Theory: From Margin to Center" by bell hooks
2. Gender Trouble: Feminism and the Subversion of Identity" by Judith Butler

**YouTube Resources**:

1. TED-Ed: Environmental Studies Playlist
2. CrashCourse: Sociology Series covering topics related to gender and feminism

**TOTAL: 45 PERIODS**

| Course Code | **WELL-BEING WITH TRADITIONAL PRACTICES-YOGA, AYURVEDA SIDDHA** | L | T | P | C |
|---|---|---|---|---|---|
| MC2303 | | 3 | 0 | 0 | 0 |

**COURSE OBJECTIVES:**

The main objectives of this course are to:

- To enjoy life happily with fun filled new style activities that help to maintain health also
- To adapt a few lifestyle changes that will prevent many health disorders
- To be cool and handbill every emotion very smoothly in every walk of life
- To learn to eat cost effective but healthy foods that are rich in essential nutrients
- To develop immunity naturally that will improve resistance against many health disorders.

**Course Description**

This course provides an introduction to the theory and practical applications of Generative Artificial Intelligence. Students will learn the fundamental concepts and techniques related to generative models and gain hands-on experience with creating and using generative AI systems.

**Prerequisites**

There are no specific prerequisites for this course, although a basic understanding of human biology and physiology would be beneficial.

**UNIT I HEALTH AND ITS IMPORTANCE 9**

**Health:** Definition - Importance of maintaining health - More importance on prevention than Treatment - Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational/Professional heath.

**Present health status** - The life expectancy-present status - mortality rate - dreadful diseases - Non-communicable diseases (NCDs) the leading cause of death - 60% - heart disease – cancer – diabetes - chronic pulmonary diseases - risk factors – tobacco – alcohol - unhealthy diet - lack of physical activities.

**Types of diseases and disorders** - Lifestyle disorders – Obesity – Diabetes – Cardiovascular diseases – Cancer – Strokes – COPD - Arthritis - Mental health issues.

**Causes of the above diseases / disorders - Importance of prevention of illness** - Takes care of health - Improves quality of life - Reduces absenteeism - Increase satisfaction - Saves time

**Simple lifestyle modifications to maintain health** - Healthy Eating habits (Balanced diet according to age) Physical Activities (Stretching exercise, aerobics, resisting exercise) - Maintaining BMI-Importance and actions to be taken

**UNIT II DIET 9**

**Role of diet in maintaining health** - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes – arthritis – hypertension – PCOD – infertility – ADHD – sleeplessness -helps to reduce the risk of heart diseases - keeps the teeth and bones strong.

**Balanced Diet and its 7 Components** - Carbohydrates – Proteins – Fats – Vitamins – Minerals - Fibre and Water.

**Food additives and their merits & demerits** - Effects of food additives - Types of food additives - Food additives and processed foods - Food additives and their reactions

**Definition of BMI and maintaining it with diet**

Importance - Consequences of not maintaining BMI - different steps to maintain optimal BM **Common cooking mistakes** Different cooking methods, merits and demerits of each method

**UNIT III ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH 9**

**AYUSH systems and their role in maintaining health** - preventive aspect of AYUSH – AYUSH as a soft therapy.

**Secrets of traditional healthy living** - Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life.

**Principles of Siddha & Ayurveda systems** - Macrocosm and Microcosm theory - Pancheekarana Theory / (Five Element Theory) 96 fundamental Principles - Uyir Thathukkal (Tri-Dosha Theory) - Udal Thathukkal

**Prevention of illness with our traditional system of medicine**

Primary Prevention - To decrease the number of new cases of a disorder or illness – Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder or illness in the population (prevalence) – Tertiary Prevention - To decrease the amount of disability associated with an existing disorder.

**UNIT IV MENTAL WELLNESS** **9**

**Emotional health** - Definition and types - Three key elements: the subjective experience – the physiological response - the behavioural response - Importance of maintaining emotional health - Role of emotions in daily life -Short term and long term effects of emotional disturbances – Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion - Expressing a full range of emotions.

**Stress management** - Stress definition - Stress in daily life - How stress affects one's life - Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement.

**Sleep -** Sleep and its importance for mental wellness - Sleep and digestion.

**Immunity -** Types and importance - Ways to develop immunity

**UNIT V YOGA** **9**

**Definition and importance of yoga** - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life

**Course Format**

The course will be delivered through a combination of lectures, discussions, practical demonstrations, and experiential learning activities. Students will engage with theoretical concepts and practical applications related to health and wellness.

**Assessments & Grading**

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

**COURSE OUTCOMES:**

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

CO1: Learn the importance of different components of health
CO2: Gain confidence to lead a healthy life
CO3: Learn new techniques to prevent lifestyle health disorders.
CO4: Understand the importance of diet and workouts in maintaining health
CO5: Apply practical techniques and lifestyle modifications to enhance personal health and well-being.

**TEXT BOOKS:**

1. Nutrition and Dietetics - Ashley Martin, Published by White Word Publications, New York, NY 10001, USA

2. Yoga for Beginners_ 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body, by Cory Martin, Copyright © 2015 by Althea Press, Berkeley, California

**REFERENCES:**

**1.** WHAT WE KNOW ABOUT EMOTIONAL INTELLIGENCE How It Affects Learning, Work, Relationships, and Our Mental Health, by Moshe Zeidner, Gerald Matthews, and Richard D.Roberts

2. A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, England The Mindful Self-Compassion Workbook, Kristin Neff, Ph.D Christopher Germer, Ph.D, Published by The Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue, Suite 1200, New York, NY 10001

**YouTube Resources**:

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/

2. Simple lifestyle modifications to maintain health https://www.niddk.nih.gov/health-information/diet-nutrition/changing-habits-betterhealth#:~:text=Make%20your%20new%20healthy%20habit,t%20have%20time%20to%20cook.

3. **Read more:** https://www.legit.ng/1163909-classes-food-examples-functions.html

4. https://www.yaclass.in/p/science-state-board/class-9/nutrition-and-health-5926

5. **Benefits of healthy eating** https://www.cdc.gov/nutrition/resources-publications/benefitsof-healthy-eating.html

6. Food additives https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/foodadditi

7. **BMI** https://www.hsph.harvard.edu/nutritionsource/healthy-weight/

https://www.who.int/europe/news-room/fact-sheets/item/a-healthy-lifestyle-whorecommendatIon

8. Yoga https://www.healthifyme.com/blog/types-of-yoga/

https://yogamedicine.com/guide-types-yoga-styles/

**Ayurveda:** https://vikaspedia.in/health/ayush/ayurveda-1/concept-of-healthy-living-inayurveda

9**. Siddha :** http://www.tkdl.res.in/tkdl/langdefault/Siddha/Sid_Siddha_Concepts.asp

10. **CAM :** https://www.hindawi.com/journals/ecam/2013/376327/

**Total: 45 PERIODS**

| Course Code | **ELEMENTS OF LITERATURE** | L | T | P | C |
|---|---|---|---|---|---|
| MC2304 | | 3 | 0 | 0 | 0 |

**COURSE OBJECTIVES:**

To make the students aware about the finer sensibilities of human existence through an art form. The students will learn to appreciate different forms of literature as suitable modes of expressing human experience.

**Course Description**

The "Introduction to Elements of Literature" course provides students with an overview of the fundamental components and genres of literature. Through the exploration of fiction, poetry, and drama, students will analyze key elements such as plot, character, perspective, emotions, figurative language, and theatrical performance

**Prerequisites**

- There are no specific prerequisites for this course, although a basic understanding of literature and language would be beneficial

**I COURSE CONTENTS**

Introduction to Elements of Literature

1. Relevance of literature
   - ✓ Enhances Reading, thinking, discussing and writing skills.
   - ✓ Develops finer sensibility for better human relationship.
   - ✓ Increases understanding of the problem of humanity without bias.
   - ✓ Providing space to reconcile and get a cathartic effect.
2. Elements of fiction
   - ✓ Fiction, fact and literary truth.
   - ✓ Fictional modes and patterns.
   - ✓ Plot character and perspective.
3. Elements of poetry
   - ✓ Emotions and imaginations.
   - ✓ Figurative language.
   - ✓ (Simile, metaphor, conceit, symbol, pun and irony).
   - ✓ Personification and animation.
   - ✓ Rhetoric and trend.
4. Elements of drama
   - ✓ Drama as representational art.
   - ✓ Content mode and elements.
   - ✓ Theatrical performance.
   - ✓ Drama as narration, mediation and persuasion.
   - ✓ Features of tragedy, comedy and satire.

**II READING**

1. An Introduction to the Study of English Literature, W.H. Hudson, Atlantic, 2007.
2. An Introduction to Literary Studies, Mario Klarer, Routledge, 2013.
3. The Experience of Poetry, Graham Mode, Open college of Arts with Open Unv Press, 1991.
4. The Elements of Fiction: A Survey, Ulf Wolf (ed), Wolfstuff, 2114.
5. The Elements of Drama, J.L.Styan, Literary Licensing, 2011.

**III OTHER SESSIONS**

1. *Tutorials:
2. *Laboratory:
3. *Project: The students will write a term paper to show their understanding of a particular piece of literature

**IV *ASSESSMENT**

1. HA:
2. Quizzes-HA:
3. Periodical Examination: one
4. Project/Lab: one (under the guidance of the teachers the students will take a volume of poetry, fiction or drama and write a term paper to show their understanding of it in a given context; sociological, psychological, historical, autobiographical etc.
5. Final Exam

**Course Format**

The course will be delivered through a combination of lectures, discussions, readings, multimedia presentations, and hands-on activities. Students will engage with literary texts through close reading, analysis, and interpretation

**Assessments & Grading**

Quizzes / Assignments, Internal Assessments, Final Examination

**COURSE OUTCOMES:**

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

Students will be able to understand the relevance of literature in human life and appreciate its aspects in developing finer sensibilities.

**TEXT BOOKS:**

1."An Introduction to the Study of English Literature" by W.H. Hudson, Atlantic, 2007.

**REFERENCE BOOKS:**

1. "An Introduction to Literary Studies" by Mario Klarer, Routledge, 2013.

2. "The Experience of Poetry" by Graham Mode, Open College of Arts with Open University Press, 1991.

**YouTube Resources**:

- CrashCourse: Literature and Writing

**TOTAL: 30 PERIODS**

| Course Code | FILM APPRECIATION | L | T | P | C |
|---|---|---|---|---|---|
| MC2305 | | 3 | 0 | 0 | 0 |

**COURSE OBJECTIVES:**

The main objectives of this course are to:

In this course on film appreciation, the students will be introduced broadly to the development of film as an art and entertainment form. It will also discuss the language of cinema as it evolved over a century. The students will be taught as to how to read a film and appreciate the various nuances of a film as a text. The students will be guided to study film joyfully.

**Course Description**

This course provides an introduction to the theory and practical applications of Generative Artificial Intelligence. Students will learn the fundamental concepts and techniques related to generative models and gain hands-on experience with creating and using generative AI systems.

**Prerequisites**

- There are no specific prerequisites for this course, although a basic understanding of literature and language would be beneficial

**Theme - A: The Component of Films**

- ✓ A-1: The material and equipment
- ✓ A-2: The story, screenplay and script
- ✓ A-3: The actors, crew members, and the director
- ✓ A-4: The process of film making… structure of a film

**Theme - B: Evolution of Film Language**

- ✓ B-1: Film language, form, movement etc.
- ✓ B-2: Early cinema… silent film (Particularly French)
- ✓ B-3: The emergence of feature films: Birth of a Nation
- ✓ B-4: Talkies

**Theme - C: Film Theories and Criticism/Appreciation**

- ✓ C-1: Realist theory; Auteurists
- ✓ C-2: Psychoanalytic, Ideological, Feminists
- ✓ C-3: How to read films?
- ✓ C-4: Film Criticism / Appreciation

**Theme – D: Development of Films**

- ✓ D-1: Representative Soviet films
- ✓ D-2: Representative Japanese films
- ✓ D-3: Representative Italian films
- ✓ D-4: Representative Hollywood film and the studio system

**Theme - E: Indian Films**

- ✓ E-1: The early era
- ✓ E-2: The important films made by the directors
- ✓ E-3: The regional films
- ✓ E-4: The documentaries in India

**READING:**

A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these

**Course Format**

Guest speakers, including filmmakers and scholars, may be invited to provide insights into specific topics.

**Assessments & Grading**

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

**COURSE OUTCOMES:**

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

CO1: Understand the various components of filmmaking, including material and equipment, story development, casting, crew roles, and the filmmaking process.
CO2: Analyze the evolution of film language, from early cinema to the emergence of talkies and beyond.
CO3: Explore different film theories and criticism, including realist theory, auteurism, psychoanalytic theory, ideological criticism, and feminist theory
CO4: Develop the skills to critically analyze and interpret films, including understanding film form, narrative structure, and visual language
CO5: Examine the development of films in different cultural contexts, including representative films from Soviet, Japanese, Italian, and Hollywood cinema.

**TEXT BOOKS:**

1."Understanding Movies" by Louis Giannetti

**REFERENCES:**

1."Film Art: An Introduction" by David Bordwell and Kristin Thompson

**YouTube Resources**:

- CrashCourse: Film History and Analysis

**TOTAL :30 PERIODS**

| Course Code | DISASTER RISK REDUCTION AND MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| MC2401 | | 3 | 0 | 0 | 0 |

**COURSE OBJECTIVE**

- To impart knowledge on concepts related to disaster, disaster risk reduction, disaster management
- To acquaint with the skills for planning and organizing disaster response

**UNIT I HAZRADS, VULNERABILITY AND DISASTER RISKS 9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies, -
-, Inter relations between Disasters and Sustainable development Goals

**UNIT II DISASTER RISK REDUCTION (DRR) 9**

Sendai Framework for Disaster Risk Reduction**,** Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.

**UNIT III DISASTER MANAGEMENT 9**

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA- DDMA-NRDF- Civic Volunteers)

**UNIT IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT 9**

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management

**UNIT V DISASTER MANAGEMENT: CASE STUDIES 9**

Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters-Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge

Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work-Mock drill -

**TEXT BOOKS:**


1. Taimpo (2016), Disaster Management and Preparedness, CRC Publications
2. Singh R (2017), Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami, Horizon Press Publications
3. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
4. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]


**REFERENCES**


1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
2. Government of India, National Disaster Management Policy, 2009.
3. Shaw R (2016), Community based Disaster risk reduction, Oxford University Press


**COURSE OUTCOME:**

CO1: To impart knowledge on the concepts of Disaster, Vulnerability and Disaster Risk reduction (DRR)

CO2: To enhance understanding on Hazards, Vulnerability and Disaster Risk Assessment prevention and risk reduction

CO3: To develop disaster response skills by adopting relevant tools and technology

CO4: Enhance awareness of institutional processes for Disaster response in the country and

CO5: Develop rudimentary ability to respond to their surroundings with potential Disaster response in areas where they live, with due sensitivity

**YouTube Resources**:

1. National Geographic: National Geographic's YouTube channel covers natural disasters, climate change impacts, and efforts to mitigate risk through scientific exploration, documentaries, and educational content.

2. GFDRR - Global Facility for Disaster Reduction and Recovery: GFDRR's YouTube channel features videos on disaster risk management projects, innovations, and partnerships around the world, as well as expert interviews and discussions.

**TOTAL : 45 PERIODS**

| Course Code | HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA | L | T | P | C |
|---|---|---|---|---|---|
| MC2402 | | 3 | 0 | 0 | 0 |

**COURSE OBJECTIVES:**

The main objectives of this course are to:

- To understand the historical development of science and technology in India, spanning from ancient civilizations to the post-independent era.
- To analyze key concepts and perspectives in the study of history, including objectivity, determinism, causation, and moral judgment, as applied to the field of science and technology
- To explore the impact of historical events, interactions, and cultural exchanges on the evolution of science and technology in India.
- To develop critical thinking, research, and analytical skills through the study of historical perspectives on science and technology in India.
- To foster an appreciation for the rich heritage and legacy of scientific knowledge and technological innovations in India, and their relevance to contemporary issues and challenges.

**Course Description**

This course delves into the historical perspectives and developments of science and technology in India, spanning from ancient times to the post-independent era. Through an exploration of key concepts, historiography, and significant historical periods, students will gain insights into the evolution of scientific thought, technological advancements, and their societal impacts.

**Prerequisites**

- There are no specific prerequisites for this course, although a basic understanding of history, science, and technology would be beneficial.

**UNIT I CONCEPTS AND PERSPECTIVES 6**

Meaning of History

Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism. Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India

**UNIT II HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA 6**

Introduction to the works of D.D. Kosambi, Dharmpal, Debiprasad Chattopadhyay, Rehman, S.Irfan Habib, Deepak Kumar, Dhruv Raina, and others

**UNIT III SCIENCE AND TECHNOLOGY IN ANCIENT INDIA 6**

Technology in pre-historic period-Beginning of agriculture and its impact on technology-Science and Technology during Vedic and Later Vedic times-Science and technology from 1st century AD to C-1200

**UNIT IV SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA 6**

Legacy of technology in Medieval India, Interactions with Arabs-Development in medical knowledge, interaction between Unani and Ayurveda and alchemy-Astronomy and Mathematics: interaction with Arabic Sciences-Science and Technology on the eve of British conquest.

**UNIT V GENDER AND REPRESENTATION** **6**

Science and the Empire-Indian response to Western Science-Growth of techno-scientific institutions

**UNIT VI SCIENCE AND TECHNOLOGY IN A POST-INDEPENDENT INDIA** **6**

Science, Technology and Development discourse-Shaping of the Science and Technology PolicyDevelopments in the field of Science and Technology-Science and technology in globalizing India-Social implications of new technologies like the Information Technology and Biotechnology

**Course Format**

The course will be delivered through a combination of lectures, readings, discussions, and presentations. Students will engage with primary and secondary sources, including works by prominent historians and scholars in the field.

**Assessments & Grading**

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

**COURSE OUTCOMES:**

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

CO1: Understand the meaning, scope, and importance of history, with a focus on the historiography of science and technology in India.
CO2: Analyze key concepts and perspectives in the study of history, including objectivity, determinism, causation, and moral judgment.
CO3: Examine the evolution of science and technology in ancient and medieval India, including technological advancements, interactions with other cultures, and the legacy of knowledge.
CO4: Evaluate the impact of colonialism on science and technology in India, including responses to Western science and the establishment of techno-scientific institutions.
CO5: Explore the role of gender in science and technology representation, and its implications for societal development.

**TEXT BOOKS:**

1. Explore the role of gender in science and technology representation, and its implications for societal development.

**REFERENCES:**


1. "The Illustrated History of Science and Invention in India" by A.K. Bag
2. "Science and Technology in Medieval India" by S. M. Ali
3. "Modern Indian History and Culture" by Raghavan Iyer


**YouTube Resources**:

1. Indian Institute of Science: Lectures on the history of science and technology in India
2. National Institute of Science, Technology and Development Studies (NISTADS): Webinars on science and technology policy in India
3. Centre for Studies in Social Sciences, Calcutta (CSSSC): Videos on gender representation in science and technology

**TOTAL:30 PERIODS**

| Course Code | POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY | L | T | P | C |
|---|---|---|---|---|---|
| MC2403 | | 3 | 0 | 0 | 0 |

**COURSE OBJECTIVES:**

The main objectives of this course are to:

This course will begin with a short overview of human needs and desires and how different political-economic systems try to full them. In the process, we will end with a critique of different systems and their implementations in the past, with possible future directions.

**Course Description**

This course offers an in-depth exploration of various socio-political and economic ideologies and systems that have shaped human societies throughout history. Through lectures, readings, and discussions, students will examine the fundamental principles, historical contexts, and key figures associated with capitalism, liberalism, fascism, communism, the welfare state, Gandhian thought, and essential elements of Indian civilization.

**Course Topics**

Considerations for humane society, holistic thought, human being's desires, harmony in self, harmony in relationships, society, and nature, societal systems. (9 lectures, 1 hour each)

(Refs: A Nagaraj, M K Gandhi, JC Kumarappa)

**Prerequisites**

There are no specific prerequisites for this course, although a basic understanding of history, political science, and economics would be beneficial.
**Capitalism** – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. **(5 lectures)**

(Refs: Adam smith, J S Mill)

**Fascism and totalitarianism**. World war I and II. Cold war. **(2 lectures)**

**Communism** – Mode of production, theory of labour, surplus value, class struggle, dialectical materialism, historical materialism, Russian and Chinese models.

(Refs: Marx, Lenin, Mao, M N Roy) **(5 lectures)**

**Welfare state.** Relation with human desires. Empowered human beings, satisfaction. **(3 lectures)**

Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one's lives. Relationship with nature. **(6 lectures)**

(Refs: M K Gandhi, Schumacher, Kumarappa)

Essential elements of Indian civilization. **(3 lectures)**

(Refs: Pt Sundarlal, R C Mazumdar, Dharampal)

Technology as driver of society, Role of education in shaping of society. Future directions. **(4 lectures)** (Refs: Nandkishore Acharya, David Dixon, Levis Mumford)

**Conclusion (2 lectures)**

**Total lectures: 39**

**GRADING:**

| | |
|---|---|
| Mid sems | 30 |
| End sem | 20 |
| Home Assign | 10 |
| Term paper | 40 |

**Course Format**

The course will be delivered through a series of lectures, readings, discussions, and assignments. Each lecture will focus on a specific topic, providing historical background, key concepts, and critical analysis

**Assessments & Grading**

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

**COURSE OUTCOMES:**

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

The students will get an understanding of how societies are shaped by philosophy, political and economic system, how they relate to fulfilling human goals & desires with some case studies of how different attempts have been made in the past and how they have fared.

**TEXT BOOKS:**

Authors mentioned along with topics above. Detailed reading list will be provided.

**TOTAL: 30 PERIODS**

| Course Code | **STATE, NATION BUILDING AND POLITICS IN INDIA** | L | T | P | C |
|---|---|---|---|---|---|
| MC2404 | | 3 | 0 | 0 | 0 |

**COURSE OBJECTIVES:**

The main objectives of this course are to:

The objective of the course is to provide an understanding of the state, how it works through its main organs, primacy of politics and political process, the concept of sovereignty and its changing contours in a globalized world. In the light of this, an attempt will be made to acquaint the students with the main development and legacies of national movement and constitutional development in India, reasons for adopting a Parliamentary-federal system, the broad philosophy of the Constitution of India and the changing nature of Indian Political System. Challenges/ problems and

issues concerning national integration and nation-building will also be discussed in the contemporary context with the aim of developing a future vision for a better India.

**Course Description**

This course provides an in-depth understanding of the political landscape of India, focusing on the development of the nation-state, the role of the state and politics, the organs of the state, and the challenges of nation-building and national integration

**Prerequisites**

There are no specific prerequisites for this course, although a basic understanding of political science, history, and sociology would be beneficial.

**Course Topics**

Understanding the need and role of State and politics.

Development of Nation-State, sovereignty, sovereignty in a globalized world.

Organs of State – Executive, Legislature, Judiciary. Separation of powers, forms of government unitary - federal, Presidential-Parliamentary,

The idea of India.

1857 and the national awakening.

1885 Indian National Congress and development of national movement – its legacies.
Constitution making and the Constitution of India.

Goals, objective and philosophy.

Why a federal system?

National integration and nation-building.

Challenges of nation-building – State against democracy (Kothari)

New social movements.

The changing nature of the Indian Political System, the future scenario. What can we do?

**COURSE OUTCOMES:**

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

It is expected that this course will make students aware of the theoretical aspect of the state, its organs, its operationalization aspect, the background and philosophy behind the founding of the present political system, broad streams and challenges of national integration and nation-building in India. It will equip the students with the real understanding of our political system/ process in correct perspective and make them sit up and think for devising ways for better participation in the system with a view to making the governance and delivery system better for the common man who is often left unheard and unattended in our democratic setup besides generating a lot of dissatisfaction and difficulties for the system.

**Course Format**

The course will be delivered through a combination of lectures, readings, discussions, and assignments.

**TEXT BOOKS:**

1. "Indian Polity" by M. Laxmikanth

**You tube Resources:**

1. https://youtu.be/q4oyQ_Yse-M?t=6
2. https://youtu.be/q4oyQ_Yse-M?t=6
3. https://youtu.be/q4oyQ_Yse-M?t=6
4. https://youtu.be/q4oyQ_Yse-M?t=6
5. https://youtu.be/q4oyQ_Yse-M?t=6

**TOTAL: 30 PERIODS**

| Course Code | INDUSTRIAL SAFETY | L | T | P | C |
|---|---|---|---|---|---|
| MC2405 | | 3 | 0 | 0 | 0 |

**COURSE OBJECTIVES:**

The main objectives of this course are to:

- To Understand the Introduction and basic Terminologies safety.
- To enable the students to learn about the Important Statutory Regulations and standards.
- To enable students to Conduct and participate in the various Safety activities in the Industry.
- To have knowledge about Workplace Exposures and Hazards.
- To assess the various Hazards and consequences through various Risk Assessment Techniques

.**Course Description**

This course focuses on workplace safety and health, covering various safety terminologies, standards, regulations, safety activities, and hazard identification techniques. Students will learn about hazards, risks, control measures, safety standards, regulations, safety activities, and techniques for identifying and assessing workplace hazards.

**Prerequisites**

There are no specific prerequisites for this course, although a basic understanding of workplace safety concepts and regulations would be beneficial.

**UNIT I SAFETY TERMINOLOGIES 9**

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold LimitValue (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

**UNIT II STANDARDS AND REGULATIONS 9**

Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006.

**UNIT III SAFETY ACTIVITIES** **9**

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment

**UNIT IV WORKPLACE HEALTH AND SAFETY** **9**

Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety-Toxic gas Release

**UNIT V HAZARD IDENTIFICATION TECHNIQUES** **9**

Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment

**Course Format**

The course will be delivered through a combination of lectures, workshops, case studies, discussions, and practical exercises. Each session will focus on specific topics related to workplace safety, providing theoretical knowledge, practical insights, and hands-on training.

**Assessments & Grading**

Quizzes / Assignments, Project, 3 Internal Assessments, Final Examination

**COURSE OUTCOMES:**

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

CO1: Understand key safety terminologies, including hazards, risks, control measures, and safety standards.
CO2: Identify and assess various workplace hazards, including chemical, physical, ergonomic, and environmental hazards
CO3: Interpret and comply with relevant safety regulations and standards, such as the Indian Factories Act and ISO 45001:2018.
CO4: Demonstrate knowledge of safety activities, including toolbox talks, safety committees, safety training, and emergency action plans
CO5: Analyze and mitigate workplace health and safety risks, such as noise hazards, musculoskeletal disorders, and electrical hazards.

**TEXT BOOKS:**

1. "Occupational Health and Safety Management: A Practical Approach" by Charles D. Reese

**REFERENCES:**

1. "Safety and Health for Engineers" by Roger L. Brauer
2. "Industrial Safety and Health Management" by C. Ray Asfahl and David W. Rieske.

3. "Introduction to Occupational Health and Safety" by Matthew Granger

**YouTube Resources**:

1. National Safety Council: Videos on workplace safety tips and best practices
2. OSHA: Occupational Safety and Health Administration's training videos on various safety topics

**TOTAL: 45 PERIODS**