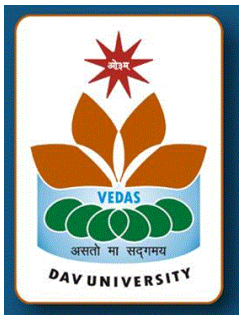
# DAVUNIVERSITY JALANDHAR




## Scheme & Syllabus

## Bachelor of Technology

## In

## Civil Engineering

## Batch 2023 onwards

## 1st to 8th SEMESTER

**Program Educational Objectives (PEOs) - B. Tech. Civil Engineering**

**PEO 1**: Attain the analytical expertise to create, analyse, formulate, and solve challenging problems in the field of Civil Engineering; and recognize and develop the necessary and suitable tools for the same.

**PEO 2**: Develop technical and management flair to take responsibility for engineering projects and research programs significantly.

**PEO 3**: Uncover multidisciplinary approach and co-relate engineering issues to social and human background in broader sense, in which their engineering helping hand will be utilised.

**PEO 4**: Develop attitude of lifelong learning for becoming successful civil engineers.

**PEO 5**: Implant sensitivity towards ethics, public policies and their responsibilities towards the society.

**Program Outcomes (POs) - B. Tech. Civil Engineering**

After the successful completion of undergraduate course, Electrical Engineering, Graduates will be able to:

**PO1.** Graduates will apply knowledge of mathematics and science in civil engineering.

**PO2.** Graduates will demonstrate an ability to identify the civil engineering problems and to simulate them into mathematical models.

**PO3.** Graduates will demonstrate an ability to test the materials used for construction and interpret data.

**PO4.** Graduates will demonstrate an ability to design civil engineering systems as per needs and standards.

**PO5.** Graduates will demonstrate an ability to plan, execute and manage the technical and financial aspects of construction project individually and/or in team.

**PO6.** Graduates will demonstrate skills to use modern engineering tools, software and equipment to solve civil engineering problems.

**PO7.** Graduates will demonstrate knowledge of professional and ethical responsibilities.

**PO8.** Graduates will be able to communicate effectively both in oral and written form.

**PO9.** Graduates will be aware of impact of engineering constructions on environment and society.

**PO10.** Graduates will develop the skills for self-learning and continual improvement of knowledge.

**Program Specific Outcomes (PSO) - B. Tech. Civil Engineering**

**PSO1**: Ability to design and solve problems in the field of Civil Engineering by applying the knowledge acquired from concrete practices planning and executing civil projects, billing, structural analysis and other allied subjects.

**PSO2**: Provide with quality technical education & professional skills for preparing students effectively for solving real time industrial needs and higher studies.

**Scheme of Courses**
**B.Tech. in Civil Engineering**
**Semester-1**

| S.NO. | Paper Code | Course Title | L | T | P | Cr | Nature of Course |
|---|---|---|---|---|---|---|---|
| 1 | MTH | Engineering Mathematics-I | 3 | 1 | 0 | 4 | BS |
| 2 | PHY | Engineering Physics | 3 | 0 | 2 | 4 | BS |
| 3 | EED | Basic Electrical Engineering | 3 | 0 | 2 | 4 | ES |
| 4 | MEC | Engineering Graphics | 2 | 0 | 4 | 4 | ES |
| 5 | | Design Thinking Lab | 0 | 0 | 2 | 1 | ES |
| 6 | SGS | Human Values and General Studies | 2 | 1 | 0 | 3 | VAC-C |
| | | | 13 | 2 | 10 | 20 | |

**L: Lectures T: Tutorial P: Practical Cr: Credits**

**Scheme of Courses**
**B. Tech. in Civil Engineering**
**Semester-2**

| S.NO. | Paper Code | Course Title | L | T | P | Cr | Nature of Course |
|---|---|---|---|---|---|---|---|
| 1 | MTH152A | Engineering Mathematics-II | 4 | 0 | 0 | 4 | BSC |
| 2 | PHY151B | Engineering Physics | 4 | 0 | 0 | 4 | BSC |
| 3 | MEC103 | Mechanical Engineering Fundamentals | 4 | 0 | 0 | 4 | ESC |
| 4 | ELE105 | Electrical and Electronics Technology | 4 | 0 | 0 | 4 | ESC |
| 5 | SGS107B | Human Values and General Studies | 4 | 0 | 0 | 0 | MC |
| 6 | MEC104 | Manufacturing Practice | 0 | 0 | 4 | 2 | ESC |
| 7 | PHY152 | Engineering Physics Lab | 0 | 0 | 2 | 1 | BSC |
| 8 | ELE102 | Electrical and Electronics Technology Lab | 0 | 0 | 2 | 1 | ESC |
| | | | 20 | | 8 | 20 | |

**L: Lectures T: Tutorial P: Practical Cr: Credits**

**Scheme of Courses**
**B. Tech. in Civil Engineering**
**Semester-3**

| S.NO. | Paper Code | Course Title | L | T | P | Cr | Nature of Course |
|---|---|---|---|---|---|---|---|
| 1 | CED201 | Building Materials & Construction Technology | 3 | 0 | 0 | 3 | Core |
| 2 | CED203 | Strength of Materials | 3 | 1 | 2 | 5 | Core |
| 3 | CED205 | Surveying and Geomatics | 3 | 0 | 2 | 4 | Core |
| 4 | CED207 | Environment Engineering-I | 3 | 0 | 0 | 3 | Core |
| 5 | CED209 | Introduction to Civil Engineering | 3 | 0 | 0 | 3 | DE |
| 6 | | Community Engagement Course | 1 | 0 | 2 | 2 | Training, D & P |
| 7 | CED213 | Summer internship** | 0 | 0 | 0 | 2 | Training, D&P |
| | | | 16 | 0 | 6 | 22 | |

**L: Lectures T: Tutorial P: Practical Cr: Credits**

**Summer internship of duration 100 hours in the summer break after second semester in which student must attend in house soft skill training/Any MOOC courses of same credits

**Scheme of Courses**
**B. Tech. in Civil Engineering**
**Semester-4**

| S.NO. | Paper Code | Course Title | L | T | P | Cr | Nature of Course |
|---|---|---|---|---|---|---|---|
| 1 | CED202 | Structural Engineering-I | 3 | 1 | 2 | 5 | Core |
| 2 | CED204 | Introduction to fluid mechanics | 3 | 1 | 2 | 5 | Core |
| 3 | CED206 | Engineering Geology | 3 | 1 | 0 | 4 | Core |
| 4 | CED208 | Material testing and evaluation | 3 | 0 | 2 | 4 | Core |
| 5 | CED210 | Building Planning | 3 | 0 | 0 | 3 | Core |
| 6 | CED212 | Concrete Technology | 3 | 0 | 0 | 3 | Core |
| | | | 15 | 2 | 6 | 24 | |

**L: Lectures T: Tutorial P: Practical Cr: Credits**

***Note:*** *At the end of the examination of 4th Semester the students will undergo compulsory survey camp to be held in hilly area for a period of 2-4 weeks duration. Every student will submit the Camp/Training Report within two weeks from the start of teaching for 5thSemester. The marks for this will be included in the 5th Semester.*

**Scheme of Courses**
**B. Tech. in Civil Engineering**
**Semester-5**

| S.NO. | Paper Code | Course Title | L | T | P | Cr | Nature of Course |
|---|---|---|---|---|---|---|---|
| 1 | CED301 | Geotechnical Engineering | 3 | 1 | 2 | 5 | Core |
| 2 | CED303 | Hydrology and Water Resource Engineering | 3 | 0 | 0 | 3 | Core |
| 3 | CED305 | Engineering Economics Estimation & Costing | 3 | 0 | 0 | 3 | Core |
| 4 | CED307 | Design of Concrete Structures-I | 3 | 1 | 0 | 4 | Core |
| 5 | CED309 | Transportation Engineering | 3 | 0 | 2 | 4 | Core |
| 6 | | Departmental Specific Elective-I | 3 | 0 | 0 | 3 | DSE |
| | CED311 | Survey Camp | 0 | 0 | 0 | 2 | Training, D & P |
| | | | 18 | 1 | 4 | 23 | |

**L: Lectures T: Tutorial P: Practical Cr: Credits**

**Scheme of Courses**
**B. Tech. in Civil Engineering**
**Semester-6**

| S.NO. | Paper Code | Course Title | L | T | P | Cr | Nature of Course |
|---|---|---|---|---|---|---|---|
| 1 | CED302 | Environment Engineering-II | 3 | 0 | 0 | 3 | Core |
| 2 | CED304 | Design of Steel Structures-I | 3 | 1 | 0 | 4 | Core |
| | CED306 | Foundation Engineering | 3 | 1 | 0 | 4 | Core |
| 3 | CED3XX | Departmental Specific Elective-II | 3 | 0 | 0 | 3 | DSE |
| 4 | CED3XX | Departmental Specific Elective-III | 3 | 0 | 0 | 3 | DSE |
| 5 | CED3XX | Departmental Specific Elective-IV | 3 | 0 | 0 | 3 | DSE |
| 6 | CED308 | Computer Aided Drawing | 0 | 0 | 2 | 1 | Core |
| | | | 18 | 2 | 2 | 21 | |

**Note:**

- Department specific elective will be chosen from the basket of "Department Specific Electives".
- At the end of the examination of 6th Semester the students will undergo compulsory industrial training for a period of 6 weeks duration in reputed industries. Every student will submit the training report within two weeks from the start of teaching of 7th Semester. The marks for this will be included in the 7th semester.

**Scheme of Courses**

**B. Tech. in Civil Engineering**
**Semester-7**

| S.NO. | Paper Code | Course Title | L | T | P | Cr | Nature of Course |
|---|---|---|---|---|---|---|---|
| 1 | CED401 | Design of Steel Structures-II | 3 | 1 | 0 | 4 | Core |
| 2 | CED4XX | Departmental Specific Elective-V | 3 | 0 | 0 | 3 | DSE |
| 3 | CED4XX | Departmental Specific Elective-VI | 3 | 0 | 0 | 3 | DSE |
| 4 | CED4XX | Departmental Specific Elective-VII | 3 | 0 | 0 | 3 | DSE |
| 5 | XXX | Generic Elective - I | 3 | 0 | 0 | 3 | OE* |
| 6 | XXX | Generic Elective - II | 3 | 0 | 0 | 3 | OE* |
| 7 | CED403 | Engineering Project-I | 1 | 0 | 4 | 3 | Training, D & P |
| 8 | CED405 | Software Training* | 0 | 1 | 0 | 2 | Training, D & P |
| | | | 19 | 0 | 8 | 24 | |

**L: Lectures T: Tutorial P: Practical Cr: Credits**

***Note:***

- Department specific elective will be chosen from the basket of "Department Specific Electives".
- Generic elective - I will be chosen from the "Generic Elective Basket"

**Scheme of Courses**
**B. Tech. in Civil Engineering**
**Semester-8**

| S.NO. | Paper Code | Course Title | L | T | P | Cr | Nature of Course |
|---|---|---|---|---|---|---|---|
| 1 | CED402 | Capstone Project /DSE | 0 | 0 | 18 | 9 | |
| | | | 0 | 0 | 18 | 9 | |

**L: Lectures T: Tutorial P: Practical Cr: Credits**

**Note:**

- Department specific elective will be chosen from the basket of "Department Specific Electives".
- Generic elective-II will be chosen from the "Generic Elective Basket"

***Student can opt for any MOOC Course instead of Generic Elective/ Engineering Project-II of Same credits.**

- **DSE- If any student wants to do MOOC course against any of the department specific elective, that particular MOOC course should be on similar topic with at least 75% course content similar to that of DSE. The MOOC course of same credits can only be taken with the prior approval of the department for content verification.**

## Department Specific Elective Basket

| S.NO. | Paper Code | Course Title | L | T | P | Cr | Nature of Course |
|---|---|---|---|---|---|---|---|
| 1 | CED350 | FOUNDATION ENGINEERING | 3 | 0 | 0 | 3 | Geo-technical Engineering |
| 2 | CED351 | OFFSHORE ENGINEERING | 3 | 0 | 0 | 3 | Geo-technical Engineering |
| 3 | CED352 | SOIL DYNAMICS | 3 | 0 | 0 | 3 | Geo-technical Engineering |
| 4 | CED353 | BIOLOGICAL PROCESSES FOR CONTAMINATS REMOVAL | 3 | 0 | 0 | 3 | Environment |
| 5 | CED354 | ENVIRONMENT LAWS AND POLICIES | 3 | 0 | 0 | 3 | Environment |
| 6 | CED355 | ENVIRONMENT IMPACT ASSESSMENT & LIFE CYCLE ANALYSIS | 3 | 0 | 0 | 3 | Environment |
| 7 | CED356 | INTELLIGENT TRANSPORTATION SYSTEMS | 3 | 0 | 0 | 3 | Transportation |
| 8 | CED357 | RAILWAY AND AIRPORT ENGINEERING | 3 | 0 | 0 | 3 | Transportation |
| 9 | CED358 | TRANSPORTATION ECONOMICS | 3 | 0 | 0 | 3 | Transportation |
| 10 | CED359 | INDUSTRIAL STRUCTURES | 3 | 0 | 0 | 3 | Structural Engineering |
| 11 | CED360 | EARTHQUAKE RESISTANCE DESIGN | 3 | 0 | 0 | 3 | Structural Engineering |
| 12 | CED361 | STRUCTURAL DYNAMICS | 3 | 0 | 0 | 3 | Structural Engineering |
| 13 | CED362 | RELAIBILITY ANALYSIS OF STRUCTURES | 3 | 0 | 0 | 3 | Structural Engineering |
| 14 | CED363 | PRE-STRESSED CONCRETE | 3 | 0 | 0 | 3 | Structural Engineering |
| 15 | CED364 | DESIGN OF STRUCTURAL SYSTEMS | 3 | 0 | 0 | 3 | Structural Engineering |
| 16 | CED450 | MASONARY STRUCTURES | 3 | 0 | 0 | 3 | Structural Engineering |
| 17 | CED451 | SUSTAINABLE CONSTRUCTION METHODS | 3 | 0 | 0 | 3 | Construction management |
| 18 | CED452 | CONSTRUCTION EQUIPMENT AND AUTOMATION | 3 | 0 | 0 | 3 | Construction management |
| 19 | CED453 | CONSTRUCTION COST ANALYSIS | 3 | 0 | 0 | 3 | Construction management |
| 20 | CED454 | ECOLOGICAL ENGINEERING | 3 | 0 | 0 | 3 | Environment |
| 21 | CED455 | AIR & NOISE POLLUTION CONTROL | 3 | 0 | 0 | 3 | Environment |
| 22 | CED456 | SOLID WASTE MANAGEMENT | 3 | 0 | 0 | 3 | Environment |
| 23 | CED457 | DESIGN OF CONCRETE STRUCTURES-II | 3 | 0 | 0 | 3 | Structural Engineering |
| 24 | CED458 | MATRIX METHODS FOR STRUCTURAL ANALYSIS | 3 | 0 | 0 | 3 | Structural Engineering |
| 25 | CED459 | ENVIRONMENTAL GEOTECHNOLOGY | 3 | 0 | 0 | 3 | Structural Engineering |
| 26 | CED460 | PORT AND HARBOUR ENGINEERING | 3 | 0 | 0 | 3 | Transportation |
| 27 | CED461 | DESIGN OF HYDRAULIC STRUCTURES | 3 | 0 | 0 | 3 | Structural |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | Engineering |
| 28 | CED462 | REPAIR AND REHABLITATION OF STRUCTURES | 3 | 0 | 0 | 3 | Structural Engineering |
| 29 | CED463 | MATERIAL CHARACTERIZATION | 3 | 0 | 0 | 3 | Structural Engineering |
| 30 | CED464 | STRUCTURAL ENGINEERING-II | 3 | 0 | 0 | 3 | Structural Engineering |
| 31 | CED465 | FLUID MECHANICS | 3 | 0 | 0 | 3 | Hydraulics |

## Generic Elective Basket

| S.NO. | Paper Code | Course Title | L | T | P | Cr |
|---|---|---|---|---|---|---|
| 1 | ELE801A | Electro-Mechanical Energy Conversion | 3 | 0 | 0 | 3 |
| 2 | ELE802A | Transducers and Signal Conditioning | 3 | 0 | 0 | 3 |
| 3 | CHL801A | Industrial Pollution Control | 3 | 0 | 0 | 3 |
| 4 | CHL802A | Fuel Cell Technology | 3 | 0 | 0 | 3 |
| 5 | MEC801A | Industrial Engineering Techniques | 3 | 0 | 0 | 3 |
| 6 | MEC802A | Energy Resources | 3 | 0 | 0 | 3 |
| 7 | CSE801A | Software Engineering & Project Management | 3 | 0 | 0 | 3 |
| 8 | CSE802A | Computer Networks | 3 | 0 | 0 | 3 |
| 9 | ECE801A | Communication and Media Foundations | 3 | 0 | 0 | 3 |
| 10 | ECE802A | Electronic Displays | 3 | 0 | 0 | 3 |
| 11 | ECE803A | Everyday Electronics | 3 | 0 | 0 | 3 |
| 12 | **CIV 801** | **Construction Materials and Techniques** | 3 | 0 | 0 | 3 |
| 13 | **CIV 802** | **Railway and Tunnel Engineering** | 3 | 0 | 0 | 3 |
| 14 | **CIV 803** | **Metro Systems and Engineering** | 3 | 0 | 0 | 3 |
| 15 | **CIV 804** | **Disaster Preparedness and Planning** | 3 | 0 | 0 | 3 |
| 16 | **CIV 805** | **Road Safety** | 3 | 0 | 0 | 3 |
| 17 | MGT001A | Fundamentals of Management | 3 | 0 | 0 | 3 |
| 18 | MGT002A | Fundamentals of Advertising | 3 | 0 | 0 | 3 |
| 19 | MGT003A | Fundamentals of Stock Market | 3 | 0 | 0 | 3 |

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|---|---|---|---|---|---|---|
| 20 | MGT004A | Fundamentals of Research Methods | 4 | 0 | 0 | 3 |
| 21 | XXX | Economic Policies in India | 3 | 0 | 0 | 3 |
| 22 | XXX | Soft Skills and Interpersonal Communication | 3 | 0 | 0 | 3 |
| 23 | XXX | Cyber Law and Ethics | 3 | 0 | 0 | 3 |
| 24 | XXX | Human Resource Development and Organizational Behavior | 3 | 0 | 0 | 3 |

**B. Tech. in Civil Engineering**
**SEMESTER 3**

| In hours | | | |
|---|---|---|---|
| L | T | P | Credit |
| 3 | 0 | 0 | 3 |

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|---|---|---|---|---|---|---|---|
| Course Code | **CED201** | | | | | | |
| Course Title | **Building Materials & Construction Technology** | | | | | | |
| Course Outcomes | CO1: Comprehend construction materials and their properties for building durability and stability.<br>CO2: Comprehend the production, characteristics, and application of cement, aggregates, and concrete in construction.<br>CO3: Explore various architectural elements including foundations, walls, lintels, arches, and their design principles.<br>CO4: Gain insights into techniques for addressing dampness issues, roof and floor classifications, and finishing processes like plastering and pointing. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| Syllabus | | | | | | | CO Mapping |
| Unit 1 | Building Stones: General, Uses of stones, natural bed of stones, qualities of a good building stone, deterioration of stones, preservation of stones, artificial stones, common building stones of India and their uses. | | | | | | CO1 |
| | Bricks: General, Composition of good brick earth, Harmful ingredients in brick earth, qualities of good bricks, tests for bricks, classification of bricks. | | | | | | CO1 |
| | Timber: Definition, classification of trees, structure of a tree, felling of trees, seasoning of timber, storage of timber, market forms of timber. | | | | | | CO1 |
| Unit 2 | Lime: General, some definitions calcination, Hydraulicity, setting, slacking, sources of lime, classification of limes, uses of lime, tests for limestone. | | | | | | CO2 |
| | Cement: Constituents of Cement, Manufacture of Portland cement | | | | | | CO2 |
| | Aggregates: Fine aggregate: Natural and manufactured: Sieve analysis, zoning, specify gravity, bulking, moisture content, deleterious materials. Coarse aggregate: Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests. | | | | | | CO2 |
| | Concrete : Introduction, Constituents of concrete, Batching of materials, Manufacturing process of cement concrete, workability and factors affecting it, Methods to determine workability, segregation and bleeding of concrete, Strength of concrete and factors affecting it. Miscellaneous materials: Paints, Distempering, Glass, Plastics | | | | | | CO2 |
| Unit 3 | Foundation and Walls: Definition, types of foundations, Types of walls and thickness considerations. | | | | | | CO3 |
| | Brick and stone masonry: Terms used, Types of bonds & their merits and demerits, rubble and ashlars joints in stone masonry, cement concrete hollow blocks and their advantages and disadvantage. | | | | | | CO3 |
| | Lintels and Arches: Definition, function and classification of lintels, Balconies, chejja and canopy. Arches; Elements and Stability of an Arch. | | | | | | CO3 |

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|---|---|---|
| Unit 4 | Damp Proofing: Sources, causes and bad effects of dampness, preventive measures for dampness in buildings | CO4 |
| | Roofs & Floors: Terms used, Classification of roofs and roof trusses, Different roof covering material. General, Types of floors used in building & and their suitability, factors for selecting suitable floor for building. | CO4 |
| | Plastering and pointing: Objects, Methods of plastering, Materials and types, Defects in plastering, special material for plastered surface, Distempering white washing and color washing | CO4 |
| Text Book/s | 1. Rangwala S.C. "EngineeringMaterials" Charotar Publishing House Anand India, 1989.<br>2. Bindra SP, Arora KR "Building construction" DhanpatRai Publications, Delhi 1970. 3. ShettyMS , "Concrete Technology" S. Chand & Co. N. Delhi, 2005<br>4. Punmia BC, "Building construction" Laxmi Publications Pvt. Ltd. 2008.<br>5. KumarSushil , "Building Construction" Standard Publishers Distributors, 2006<br>6. Fundamentals of Building Construction: Materials and Methods by Edward Allen and Joseph Iano<br>7. Materials for Civil and Construction Engineers by Michael S. Mamlouk , John P. Zaniewski<br>8. Building Construction: Principles, Materials, and Systems by Madan L Mehta Ph.D. , Walter Scarborough, Diane Armpriest | |
| Reference Book/s | 1. Rangwala S.C. "EngineeringMaterials" Charotar Publishing House Anand India, 1989.<br>2. Bindra SP, Arora KR "Building construction" DhanpatRai Publications, Delhi 1970. | |

| In hours | | | |
|---|---|---|---|
| L | T | P | Credit |
| 3 | 1 | 2 | 5 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Course Code | **CED203** | | | | | | |
| Course Title | **STRENGTH OF MATERIALS** | | | | | | |
| Course Outcomes | CO1: Comprehend stress and strain concepts, elasticity-plasticity differentiation, Hooke's law, and stress-strain diagrams for various materials.<br>CO2: Analyze bending moments, shear forces, and their diagrams in beams, calculating maximum values and points of contraflexure.<br>CO3: Apply principles of flexural stresses, determining bending equations, neutral axis, and section moduli for different cross-sections.<br>CO4: Evaluate deformation and strain, analyze statically determinate trusses, explore material properties, and multiaxial stress-strain relationships in structures. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | - | 25% | - | 35% | 25% | 5% |
| Syllabus | | | | | | | CO Mapping |
| Unit 1 | Simple Stresses and Strains- Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications. | | | | | | CO1 |
| | Compound Stresses and Strains- Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants. | | | | | | CO1 |
| Unit 2 | Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments. | | | | | | CO2 |
| Unit 3 | Flexural Stresses-Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections, Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's | | | | | | CO3 |

| | | |
|---|---|---|
| | method and Conjugate Beam. Use of these methods to calculate slope and deflection for determinant beams. | |
| Unit 4 | Deformation and Strain covering description of finite deformation, Infinitesimal deformation; Analysis of statically determinate trusses; Stability of dams, retaining walls and chimneys; Force-deformation Relationships and Static Indeterminacy, Uniaxial Loading and Material Properties, Trusses and Their Deformations, Statically Determinate and Indeterminate trusses, Multiaxial Stress and Strain, Multiaxial Strain and Multiaxial Stress-strain Relationships | CO4 |
| Text Book/s | 1 Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.<br>2. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.<br>3. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004<br>4. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids.2nd edition. New York, NY: McGraw Hill, 1979<br>*5.* Laboratory Manual of Testing Materials - William Kendrick Hall<br>6. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf– TMH 2002.<br>7. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi. | |
| Reference Book/s | 1. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi<br>2. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf– TMH 2002. | |
| Course Title | **STRENGTH OF MATERIALS LABORATORY** | |
| Course Outcomes | CO1: Evaluate the importance of physical properties of steel , Identify and comprehend code provisions for testing different properties of steel ,Develop stress-strain curve for axial compression, axial tension and shear, Assess hardness and impact strength of steel , Assess flexural strength of a given material , Evaluate fatigue and impact strength of steel | |
| Syllabus | | CO Mapping |
| | List of Experiments | |
| | 1. Determination of physical properties of steel including strength and ductility.<br>2. Study of tensile and compressive stress-strain behaviour of steel.<br>3. Compression test on brick.<br>4. Development of shear stress-strain curve for steel in torsion.<br>5. Determination of hardness of a material by Rockwell and Brinell hardness testing machine.<br>6. Determination of impact strength of a material by Izod and Charpy tests.<br>7. Determination of bending strength of a wooden beam specimen.<br>8. Determination of fatigue strength of a material.<br>9. Study of behavior of columns and struts with different end conditions.<br>10. To verify the moment area theorem for slope and deflection of a given beam. | CO1 |
| Text Book/s | 1.Laboratory Manual of Testing Materials, William Kendrick Hall | |
| Reference Book/s | 1.Laboratory Manual of Testing Materials, William Kendrick Hall | |

| In hours | | | |
|---|---|---|---|
| L | T | P | Credit |
| 3 | 0 | 2 | 4 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Course Code | **CED205** | | | | | | |
| Course Title | **Surveying & Geomatics** | | | | | | |
| Course Outcomes | CO1: Develop competence in employing diverse surveying methods and principles for accurate data collection and analysis.<br>CO2: Apply leveling techniques, theodolite measurements, and control methods to achieve precision in surveying tasks and map creation.<br>CO3: Master curve layout, modern field survey systems, and GPS technology for efficient and precise spatial data acquisition.<br>CO4: Acquire proficiency in photogrammetry, remote sensing fundamentals, and digital image processing for spatial data interpretation and mapping. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | - | 25% | - | 35% | 25% | 5% |
| Syllabus | | | | | | | CO Mapping |
| Unit 1 | Introduction to Surveying: Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, traversing with compass | | | | | | CO1 |
| | Plane table surveying methods of plane table survey, two and three point problems, Lehmann's Rules, errors. | | | | | | CO1 |
| Unit 2 | Leveling: Principles of leveling- booking and reducing levels; differential, reciprocal leveling, profile leveling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses; areas and volumes | | | | | | CO2,CO3 |
| | Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - methods -triangulation - network- Signals. Baseline - choices - instruments and accessories - extension of base lines - corrections - Satellite station - reduction to center – Intervisibility of height and distances - Trigonometric leveling - Axis single corrections. | | | | | | CO2,CO3 |
| Unit 3 | Curves: Elements of simple and compound curves – Method of setting out– Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve - Vertical curves | | | | | | CO3 |
| | Modern Field Survey Systems: Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories – Advantages and Applications Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations. | | | | | | CO3,CO4 |
| Unit 4 | Photogrammetry Surveying: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic | | | | | | CO3, CO4 |

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| | mapping- mapping using paper prints, mapping using stereoplotting instruments. | |
| | Remote Sensing: Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing. | CO3,CO4 |
| Text Book/s | 1. Punmia B C "Surveying" Vol.1 & 2 Laxmi Publications Pvt. Ltd., New Delhi, 2002. 2. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.<br>3. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011<br>4. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010<br>5. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited,2002.<br>6. Anji Reddy, M., Remote sensing and Geographical information system, B.S.Publications, 2001.<br>7. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.<br>8. Kanetkar T P and Kulkarni S V "Surveying and leveling" Vol. I & II PVG Prakashan, Pune, 1994.<br>9. Basak N N "Surveying and leveling" Tata McGraw Hill, New Delhi, 2000. | |
| Reference Book/s | 1. Punmia B C "Surveying" Vol.1 & 2 Laxmi Publications Pvt. Ltd., New Delhi, 2002.<br>2. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006. | |
| Course Title | **SURVEYING LABORATORY** | |
| Course Outcomes | CO1: Apply basic fundamentals of surveying in various civil engineering applications related experiments. | |
| Syllabus | | CO Mapping |
| | List of Experiments | |
| | 1. Setting up of survey lines between survey stations, their measurements and ranging.<br>2. Measurement of bearing and angles with compass.<br>3. Levelling Exercises, height of instrument and rise & fall methods.<br>4. Measurement of horizontal and vertical angle by theodolite.<br>5. Determination of tachometric constants and determination of reduced levels by tacheometric observations.<br>6. Plane table survey, different methods of plotting.<br>7. Two point & three-point problem.<br>8. Determination of height of an inaccessible object with tacheometer.<br>9. Setting out a transition curve in the field.<br>10. Surveying with Total Station (Detailed layout of a Traverse). | CO1 |
| Text Book/s | 1. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.<br>2. Punmia B C "Surveying" Vol.1 & 2 Laxmi Publications Pvt. Ltd., New Delhi, 2002.<br>3. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total | |

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| | Station, GIS and Remote Sensing, Pearson India, 2006. | |
| Reference Book/s | 1. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.<br>2. Punmia B C "Surveying" Vol.1 & 2 Laxmi Publications Pvt. Ltd., New Delhi, 2002.<br>3. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006. | |

| In hours | | | |
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| Course Code | **CED207** | | | | | | |
| Course Title | **Environment Engineering-1** | | | | | | |
| Course Outcomes | CO1: Analyze water sources, demand, quality, and treatment processes, comprehend water distribution systems, and comprehend plumbing fixtures.<br>CO2: Evaluate sewage systems, design parameters, and disposal methods, and explain sewage treatment techniques and effluent standards.<br>CO3: Assess air composition, quantify pollutants, examine air pollution sources, standards, and control methods, and describe noise pollution measurements.<br>CO4: Examine solid waste types, characteristics, segregation, collection, transportation, disposal, and hazardous waste management in accordance with Indian norms. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| Syllabus | | | | | | | CO Mapping |
| Unit 1 | Water: -Sources of water, beneficial uses of water, Water demand, water quality standards, water safety plans, water Supply systems, need for planned water supply schemes, components of water supply system, Distribution system, various valves used in W/S systems, water treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, plumbing fixtures, Government authorities and their roles in water supply | | | | | | CO1 |
| Unit 2 | Sewage: - Introduction to wastewater Engineering, basic terms related to sewerage systems, estimation of sewage flow, storm water, conveyance of sewage, different materials used for conveyance of sewage, Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems, Efficient sewage disposal, Sludge Treatment, National River cleaning plans, basic sewage treatment, general effluent discharge standards | | | | | | CO2 |
| Unit 3 | Air: -Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution automobile pollution, Air quality standards, Control measures for Air pollution, construction and limitations<br>Noise: -Introduction to noise pollution, measurement and various control methods, Noise pollution standards | | | | | | CO3 |
| Unit 4 | Solid waste Management: -Introduction to solid waste, different types of solid waste, basic terminologies, Characteristics of solid waste, management: Segregation, collection, transportation and disposal of solid waste Municipal solid waste, Composition and various chemical and physical parameters of MSW, 3 R's of solid waste management. Solid waste norms in India, Hazardous waste management | | | | | | CO4 |

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| Text Book/s | Peavy, H.s, Rowe, D.R, Tchobanoglous, G. *Environmental Engineering*, Mc-Graw - Hill International Editions, New York 1985<br>Introduction to Environmental Engineering and Science by Gilbert Masters, PrenticeHall, New Jersey<br>MetCalf and Eddy. *Wastewater Engineering, Treatment, Disposal and Reuse*, TataMcGraw-Hill, New Delhi.<br>Integrated Solid Waste Management, Tchobanoglous, Theissen& Vigil. McGraw Hill Publication | |
| Reference Book/s | Peavy, H.s, Rowe, D.R, Tchobanoglous, G. *Environmental Engineering*, Mc-Graw - Hill International Editions, New York 1985<br>Introduction to Environmental Engineering and Science by Gilbert Masters, PrenticeHall, New Jersey | |

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| Course Code | **CED209** | | | | | | |
| Course Title | **Introduction to Civil Engineering** | | | | | | |
| Course Outcomes | CO1: Comprehend Civil Engineering's historical evolution, disciplines, and career prospects, acknowledging significant achievements of eminent engineers.<br>CO2: Analyze the nexus between construction industry, architecture, and town planning, including smart city development and sustainable building practices.<br>CO3: Evaluate diverse construction methods, modern project management systems, and the significance of contracts management while considering environmental sustainability.<br>CO4: Examine various structural types, transportation infrastructure, and rehabilitation techniques, addressing challenges and advancements in sustainable engineering and urban development. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| Syllabus | | | | | | | CO Mapping |
| Unit 1 | Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career. History of Civil Engineering Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers | | | | | | CO1 |
| Unit 2 | Overview of National Planning for Construction and Infrastructure Development Position of construction industry vis-à-vis other industries, five-year plan outlays for construction; current budgets for infrastructure works; Fundamentals of Architecture & Town Planning Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design & town planning; Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings; Development of Smart cities ,Fundamentals of Building Materials Stones, bricks, mortars, Plain, | | | | | | CO2 |
| Unit 3 | Basics of Construction Management & Contracts Management Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management Environmental ,Engineering & Sustainability Water treatment systems; Effluent treatment systems; various types of foundations; basics of rock mechanics & tunneling. | | | | | | CO3 |
| Unit 4 | Power Plant Structures Chimneys, Natural & Induced Draught Colling towers, coal handling systems, ash handling systems; nuclear containment structures; hydro power projects Structural Engineering Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; Experimental Stress Analysis; Transportation Engineering Investments in | | | | | | CO4 |

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| | transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbour and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety under heterogeneous traffic; Sustainable and resilient pavement materials, design, construction and management; Case studies and examples. Repairs & Rehabilitation of Structures: Basics of corrosion phenomena and other structural distress mechanisms; some simple systems of rehabilitation of structures. | |
| Text Book/s | 1. Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract<br>2. The National Building Code, BIS, (2017)<br>3.RERA Act, (2017)<br>4.Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset<br>5.Chandiramani, Neelima (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai<br>6.Avtarsingh (2002), Law of Contract, Eastern Book Co.<br>7.Dutt (1994), Indian Contract Act, Eastern Law House<br>8.Anson W.R.(1979), Law of Contract, Oxford University Press<br>9.Kwatra G.K.(2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration | |
| Reference Book/s | 1. Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract<br>2. The National Building Code, BIS, (2017)<br>3.RERA Act, (2017) | |

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| Course Code | **CED213** | | | | | | |
| Course Title | **Summer Internship** | | | | | | |
| Course Outcomes | CO1: learn soft skill training or any other MOOC course of same credit. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Lab performance | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | - | 20% | - | 30% | - | 50% | - |
| Syllabus | | | | | | | CO Mapping |
| | **Summer internship of duration 100 hours in the summer break in which student must attend in house soft skill training/Any MOOC courses of same credits | | | | | | CO1 |

## B. Tech. in Civil Engineering
### SEMESTER 4

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| Course Code | **CED202** | | | | | |
| Course Title | **Structural Engineering-I** | | | | | |
| Course Outcomes | CO1: Comprehend energy principles, stability, and design safety in structures, emphasizing the role of engineers, architects, and users.<br>CO2: Apply analysis techniques to trusses, beams, and frames, employing energy theorems and virtual work for structural systems.<br>CO3: Evaluate influence lines for shear, bending moment, and reactions, and comprehend the behavior of structures under rolling loads.<br>CO4: Analyze arches and cable structures, focusing on their stability, moment, shear, and normal thrust distributions for different configurations. | | | | | |
| Examination Mode | Theory | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | - | 25% | - | 35% | 25% | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Introduction- concepts of energy principles, safety, sustainable development in performance; what makes a structure; principles of stability, equilibrium; what is a structural engineer, role of engineer, architect, user, builder; what are the functions' what do the engineers design, first principles of process of design, Planning and Design Process; Materials, Loads, and Design Safety. Need of analysis, techniques of structural idealization, basic tools of analysis, reactions in structure, notations and sign conventions, free – body diagrams, static determinacy, stability of structures, principle of superposition, loads on structures. | | | | | | CO1 |
| Unit 2 | Introduction to the analysis and design of structural systems. Analyses of determinate trusses, beams, and frames and design philosophies for structural engineering. Pure Bending, Moment-curvature Relationship, Beam Deflection, Symmetry, Superposition, and Statically Indeterminate Beams, Shear and Torsion, Beam in bending, shear and torsion; General energy theorems, Castigliano's theorem, Maxwell Bettie's reciprocal theorem; Virtual work and unit load method for deflection, Application to problems of beams and frames. Stability of columns, Euler's formula, end conditions and effective length factor, Columns with eccentric and lateral load. | | | | | | CO2 |
| Unit 3 | Rolling Loads Introduction to rolling loads and influence lines, Determination of shear force, bending moment at a section and absolute shear force and bending moment due to single point load, uniformly distributed load, several point loads | | | | | | CO3 |

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| | etc.<br>Influence lines: Introduction, moving loads, influence lines, influence lines for reactions, shear force and bending moment, influence lines for beams, trusses and arches, absolute maximum B. M. & S. F, Muller Breslau Principle. | |
| Unit 4 | Arches: Introduction, curved beams, arch versus a beam, three hinged arch, moment, shears and normal thrust in three hinged arches,<br>Introduction, shape of a loaded cable, cable carrying point loads and UDL, cables with ends at different level, suspension bridge with two hinged and three hinged stiffening girders. | CO4 |
| Text Book/s | 1 Reddy C. S. ;"Basic structural Analysis", Tata McGraw-Hill Education, 2003.<br>2Vazirani & Ratwani;"Analysis of Structures Vol- I and Vol.-II", Khanna Publishers, 1999.<br>3 Wang C. K. ;"Intermediate structural Analysis", McGraw-Hill, 1983.<br>4 Jain A. K. ;"Advanced Structural Analysis", Nem Chand & Bros., Roorkee, 1990.<br>5 Gupta S. P. & Pandit G. S.; "Theory of Structures, Vol. I", Tata McGraw Hill, New Delhi, 2008.<br>6 Menon Devdas; "Advanced Structural Analysis", Alpha Science International Publisher, 2009. | |
| Reference Book/s | 1 Jain A. K. ;"Advanced Structural Analysis", Nem Chand & Bros., Roorkee, 1990.<br>2 Gupta S. P. & Pandit G. S.; "Theory of Structures, Vol. I", Tata McGraw Hill, New Delhi, 2008. | |
| Course Title | **Structure Engineering Lab** | |
| Course Outcomes | CO1: Apply various methods to test engineering structures types under different loading conditions. | |
| Syllabus | | CO Mapping |
| | **List of Experiments**<br>1. Deflection of a simply supported beam and verification of Clark-Maxwell's theorem.<br>2. To determine the Flexural Rigidity of a given beam.<br>3. To verify the Moment- area theorem for slope and deflection of a given beam.<br>4. Deflection of a fixed beam and influence line for reactions.<br>5. Deflection studies for a continuous beam and influence line for reactions.<br>6. Study of behavior of columns and struts with different end conditions.<br>7. Experiment on three-hinged arch and experiment on two-hinged arch.<br>8. Deflection of a statically determinate pin jointed truss.<br>9. Forces in members of redundant frames.<br>10. Experiment on curved beams and unsymmetrical bending of a cantilever beam | CO1 |

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| Course Code | **CED204** | | | | | | |
| Course Title | **Introduction to fluid mechanics** | | | | | | |
| Course Outcomes | CO1: Analyze fluid properties & distinctions between phases, fluid behavior, viscosity, surface tension, and cavitation phenomena.<br>CO2: Examine fluid kinematics, particle motion, flow classification. Evaluate velocity, streamlines, continuity equation, and potential functions.<br>CO3: Investigate fluid dynamics using Bernoulli's equation & Euler's equation. Explore energy changes, impulse-momentum, vortex motion, and steady flows.<br>CO4: Apply dimensional analysis, similarity laws, and Pi method. Explore drag, lift on bodies, and flow measurement techniques including manometers and meters. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | - | 25% | - | 35% | 25% | 5% |
| Syllabus | | | | | | | CO Mapping |
| Unit 1 | Fluid and their properties: Concept of fluid, difference between solids, liquids and gases; ideal and real fluids; Continuum concept of fluid: density, specific weight and relative density; viscosity and its dependence on temperature; surface tension and capillarity, vapor pressure and cavitation's, compressibility band bulk modulus; Newtonian and non-Newtonian fluids | | | | | | CO1 |
| | Fluid Statics: Concept of pressure, Pascal's law and its engineering hydrostatic paradox. Action of fluid pressure on plane (horizontal, vertical and inclined) submerged surface, resultant force and centre of pressure, force on a curved surface due to hydrostatic pressure. Buoyancy and flotation, stability of floating and submerged bodies, Meta centric height and its determination. | | | | | | CO1 |
| Unit 2 | Fluid Kinematics: Classification of fluid flows, velocity and acceleration of fluid particle, local and convective acceleration, normal & tangential acceleration streamline, pathline and streakline, flow rate and discharge mean velocity continuity equation in Cartesian co-ordinates. Rotational flows- Rotational velocity and circulation, stream & velocity potential function | | | | | | CO2 |
| Unit 3 | Fluid Dynamics: Euler's equation, Bernoulli's equation and steady flow energy equation; representation of energy changes in fluid system, impulse momentum equation, kinetic energy and momentum correction factors, flow along a curved streamline, free and forced vortex motion | | | | | | CO3 |
| Unit 4 | Dimensional Analysis and Similitude: Fundamental and derived units and dimensions, dimensional homogeneity, Rayleigh's and Buckingham's Pi method for dimensional analysis, dimension less number and their significance, | | | | | | CO4 |

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| | geometric, kinematic and dynamic similarity, model studies. | |
| | Flow Past immersed bodies: Drag and lift deformation Drag and pressure drag. Drag on a sphere, cylinder and Air foil: lift-Magnus Effect and circulation lift on a circular cylinder. | CO4 |
| | Flow Measurement: - Manometers, Pitot tubes, venture meter and orifice meters, orifices, mouthpieces, notches (Rectangular and V-notches) and weirs (Sharp crested Weirs). | CO4 |
| Text Book/s | 1. Bansal R.K., "*Fluid Mechanics & Hydraulic Machines*" Laxmi Publications Ltd. 2005.<br>2. ModiP.N. &Seth S.M., "Hydraulic and Fluid Mechanic". Standard Book House, New Delhi, 1991.<br>3. GardeR.J. &MirajgaokerA.G., "Engineering Fluid Mechanics" Nem Chand Publishers, Roorkee,1965.<br>4. Munson Young okiishi, "Fundamentals of fluid mechanics", by Wiley Publisher 1997.<br>5. VL & Wylie EB, "Fluid Mechanics: Streetes", Mcgraw Hill book company 2003<br>6. Chow, "Fluid Mechanics", IBH publisher 2001.<br>7. Subramanean, "Open Channel flow", Mcgraw Hill book company, 1997. | |
| Reference Book/s | 1. Bansal R.K., "*Fluid Mechanics & Hydraulic Machines*" Laxmi Publications Ltd. 2005.<br>2. GardeR.J. &MirajgaokerA.G., "Engineering Fluid Mechanics" Nem Chand Publishers, Roorkee,1965. | |
| Course Title | **INTRODUCTION TO FLUID MECHANICS LABORATORY** | |
| Course Outcomes | CO1: Apply basic fundamentals of fluid mechanics in various applications related experiments. | |
| Syllabus | | CO Mapping |
| | List of Experiments | |
| | 1. To determine the meta-centric height of a floating vessel under loaded and unloaded conditions.<br>2. To study the flow through a variable area duct and verify Bernoulli's energy equation.<br>3. To determine the coefficient of discharge for an obstruction flow meter (venturimeter)<br>4. To determine the discharge coefficient for a Vee notch or rectangular notch.<br>5. To determine the hydraulic coefficients for flow through an orifice.<br>6. To determine the friction coefficient for pipes of different diameter.<br>7. To determine the head loss in a pipe line due to sudden expansion / sudden contraction/ bend.<br>8. To determine the velocity distribution for pipe line flow with a pitot static probe | CO1 |
| Text Book/s | 1. Bloomer John J. "Practical Fluid Mechanics for Engineering Applications (Mechanical Engineering) Marcel Dekker Inc. New York, 1999.<br>2. Singh Sarabjit "Fluid Mechanics Practical Manual"PHI Learning Pvt. Ltd.New Delhi, 2009. | |

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| Reference Book/s | 1. Bloomer John J. “Practical Fluid Mechanics for Engineering Applications (Mechanical Engineering) Marcel Dekker Inc. New York, 1999.<br>2. Singh Sarabjit “Fluid Mechanics Practical Manual”PHI Learning Pvt. Ltd.New Delhi, 2009. | |

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| Course Code | **CED206** | | | | | | |
| Course Title | **Engineering geology** | | | | | | |
| Course Outcomes | CO1: Explore geological time scales, earth structure, and surface processes, emphasizing their relevance to Civil Engineering projects.<br>CO2: Examine minerals, rocks, and their properties in connection with Civil Engineering applications and differentiate various rock types and their significance.<br>CO3: Analyze rock deformation, structural elements, and geological hazards, emphasizing their impact on engineering operations and mitigation measures.<br>CO4: Evaluate the characteristics of rock masses as construction materials, assess factors influencing rock properties, and geological considerations for dam and reservoir site selection. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | General Geology: Scope of geology in Civil Engineering - the earth, its structure and environment - Standard geological time scale, unit & fossils. physiographic, stratigraphic and tectonic divisions of India - geomorphological (surface) processes – weathering – types , weathered products, assessment of degree of weathering , Fluvial processes, glaciation, wind action, and their significance in Civil Engineering | | | | | | CO1 |
| Unit 2 | Mineralogy and Petrology: Physical properties of minerals – classification - study of important rock forming minerals – Quartz family, feldspar family, Augite, Hornblend, Mica family, calcite, Iron oxide minerals, Augite, Hornblend, and Clay minerals and their behavior and significance in the field of Civil Engineering . Classification of rock - mode of formation - distinction between igneous, sedimentary and metamorphic rocks. Formation, textures, structure, Classification, and Engineering, Characteristic of rocks. Study of imp rocks granite, syenite, diorite, gabbro, pegmatite, dolerite , basalt , sand stone, limestone, shale, breccia , conglomerate , gneiss, quartzite, marble, slate, schist, phyllite and conglomerate | | | | | | CO 2 |
| Unit 3 | Strength Behavior of Rocks- Stress and Strain in rocks. Concept of Rock Deformation & Tectonics. Dip and Strike. Outcrop and width of outcrop. Inliers and Outliers. Main types of discontinuities according to size. Fold- Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field, effects on outcrops. Joints & Unconformity; Types, Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding, Earthquake and Subsidence. Strength of Igneous rock structures. | | | | | | CO3 |

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| | Geological Hazards- Rock Instability and Slope movement: Concept of sliding blocks. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. . Types of landslide. Prevention by surface drainage, slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Case study on black clay. Ground water: Factors controlling water bearing capacity of rock. Pervious & impervious rocks and ground water. Lowering of water table and Subsidence. Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence | CO3 |
| Unit 4 | Rock masses as construction material: Definition of Rock masses. Main features constituting rock mass. Main features that affects the quality of rock engineering and design .Basic element and structures of rock those are relevant in civil engineering areas. Main types of works connected to rocks and rock masses. Important variables influencing rock properties and behavior such as Fresh rock Influence from some minerals. Effect of alteration and weathering. Measurement of velocity of sound in rock. Classification of Rock material strength. Core logging .Rock Quality Designation. Rock mass description. | CO4 |
| | . Geology of dam and reservoir site- Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures | CO4 |
| Text Book/s | 1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.<br>2. Text Book of Engineering Geology, N. Chenna Kesavulu, 2nd Edition (2009), Macmillan Publishers India.<br>3. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).<br>4. Reddy,D.," Engineering Geology for Civil Engineers", Oxford & IBH , 1995<br>5. Leggot, R.F.," Geology and Engineers ", McGraw Hill , New York.2002 2.<br>6. Blyth, F.G.M., " A Geology for Engineers", Arnold, Londo,(2003.<br>7. Bell.F.G, " Fundamentals of Engineering Geology" Butterworth, 1983 | |
| Reference Book/s | 1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.<br>2. Text Book of Engineering Geology, N. Chenna Kesavulu, 2nd Edition (2009), Macmillan Publishers India. | |

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| Course Code | **CED208** | | | | | | |
| Course Title | **Material testing and evaluation** | | | | | | |
| Course Outcomes | CO1: Identify and analyze diverse engineering materials, including concrete, ceramics, polymers, and composites, focusing on properties and applications.<br>CO2: Evaluate mechanical behaviors like elasticity, plasticity, hardness, and deformation through tests and principles of materials' mechanical characteristics.<br>CO3: Apply practical knowledge gained from laboratory tests on materials, covering elastic and plastic deformation, impact, fracture mechanics, fatigue, and creep.<br>CO4: Conduct comprehensive testing on various construction materials such as concrete, metals, polymers, and composites, assessing their quality and performance in engineering applications. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | - | 25% | - | 35% | 25% | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | **Introduction to Engineering Materials** covering, Cements, M-Sand, Concrete (plain, reinforced and steel fibre/ glass fibre-reinforced, light-weight concrete, High Performance Concrete, Polymer Concrete) Ceramics, and Refractories, Bitumen and asphaltic materials, Acoustical material and geo-textiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses of these.<br>Concrete as a Structural material, constituent materials of concrete. Cement, testing of cement: Fineness, consistency, setting times, strength, Mechanical properties: physical Properties. Soundness of aggregate – Thermal properties – Sieve analysis – Fineness modulus. Physical Properties of Fresh Concrete: Workability: factors affecting, methods of determination of workability, Density of fresh concrete. | | | | | | CO1 |
| Unit 2 | **Mechanical behavior and mechanical characteristics**; Elasticity – principle and characteristics; Plastic deformation of metals; Tensile test – standards for different material (brittle, quasi-brittle, elastic and so on) True stress – strain interpretation of tensile test; hardness tests; Bending and torsion test; strength of ceramic; Internal friction, creep –fundaments and characteristics; Brittle fracture of steel – temperature transition approach; Background of fracture mechanics; discussion of CO3fracture toughness testing. | | | | | | CO2 |
| Unit 3 | **Laboratory for mechanical testing;** Discussion about mechanical testing; Naming systems for various irons, steels and nonferrous metals; Discussion about elastic deformation; Plastic deformation; Impact test and transition temperatures; Fracture mechanics – background; Fracture toughness – different materials; Fatigue of material; Creep. | | | | | | CO3 |
| Unit 4 | **Various Tests of bricks**, testing of sand, Tests & testing of concrete, Tests & | | | | | | CO4 |

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| | testing of soils, Tests & testing of bitumen & bituminous mixes, Tests & testing of polymers and polymer based ,Materials, Tests & testing of metals, Tests & testing of other special materials, composites and cementitious materials. | |
| Text Book/s | 1. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth-Heinemann<br>2. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand& Bros, Fifth Edition<br>3. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materialsused for Civil Engineering applications<br>4. Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella<br>5. E.N. Dowling (1993), Mechanical Behaviour of Materials,Prentice Hall International Edition<br>6. American Society for Testing and Materials (ASTM), *Annual Book of ASTM Standards*(post 2000)<br>7. Related papers published in international journals | |
| Reference Book/s | **REFERENCES**<br>1. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth-Heinemann<br>2. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand& Bros, Fifth Edition<br>3. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materialsused for Civil Engineering applications<br>4. Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella<br>5. E.N. Dowling (1993), Mechanical Behaviour of Materials,Prentice Hall International Edition<br>6. American Society for Testing and Materials (ASTM), *Annual Book of ASTM Standards*(post 2000)<br>7. Related papers published in international journals | |
| Course Title | **Material Testing and Evaluation Lab** | |
| Course Outcomes | CO1: Apply basic material testing methods to identify various engineering properties of engineering materials. | |
| Syllabus | | CO Mapping |
| | **List of Experiments**<br>1. Gradation of coarse and fine aggregates<br>2. Compressive strength test on aggregates<br>3. Elastic Behavior of metals & materials<br>4. Concrete - Early Age Properties<br>5. Compression – Directionality<br>5. Soil Classification<br>6. Consolidation and Strength Tests<br>7. Torsion test | CO1 |

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| | 8. Hardness tests (Brinnel's and Rockwell)<br>9. Tests on closely coiled and open coiled springs<br>10. Bituminous Mix Design and Tests on bituminous mixes - Marshall method | |

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| Course Code | **CED210** | | | | | | |
| Course Title | **BUILDING PLANNING** | | | | | | |
| Course Outcomes | CO1: Develop insight into building planning's significance and grasp fundamental concepts in civil engineering design and architectural drawings.<br>CO2: Analyze site selection factors, site features, and energy-efficient building orientation, adhering to Indian building codes and regulations.<br>CO3: Comprehend functional aspects of residential, commercial, and industrial design, applying principles of space allocation and universal accessibility.<br>CO4: Acquire knowledge of plumbing, electrical, HVAC systems, and sustainable practices, integrating renewable energy sources for holistic building solutions. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| Syllabus | | | | | | | CO Mapping |
| Unit 1 | Introduction to Building Planning | | | | | | |
| | Importance of building planning in civil engineering ,Basic concepts of building design and layout ,Understanding architectural drawings and symbols | | | | | | CO1 |
| Unit 2 | Site Analysis and Design Considerations | | | | | | |
| | Site selection criteria and factors affecting site selection ,Site analysis: topography, soil conditions, climate, and surroundings ,Building orientation for energy efficiency and aesthetics ,Building codes and regulations in India related to site planning | | | | | | CO2 |
| Unit 3 | Functional Planning and Space Allocation | | | | | | |
| | Functional aspects of building design: residential, commercial, and industrial ,Principles of space allocation and circulation ,Room layout and sizes for various functions ,Universal design principles for accessibility | | | | | | CO3 |
| Unit 4 | Building Services and Utilities | | | | | | |
| | Basics of plumbing and sanitary systems, Electrical systems and their integration into building design, HVAC (Heating, Ventilation, and Air Conditioning) considerations ,Sustainable building practices and incorporating renewable energy sources | | | | | | CO4 |
| Text Book/s | 1."Building Construction"** by Sushil Kumar (Indian author) - This book covers the fundamentals of building construction techniques, materials, and methods. It provides a solid foundation for understanding the practical aspects of building planning.<br>2. Basic Civil Engineering"** by S.S. Bhavikatti (Indian author) - This book offers an introduction to various civil engineering disciplines, including building planning. It covers topics like site selection, foundation design, and building services. | | | | | | |

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| | 3. Building Planning and Drawing"** by I.K. International Publishing House (Indian author) - This book specifically focuses on building planning and drawing techniques. It includes detailed explanations of architectural drawings and layout design. | |
| Reference Book/s | 1."Building Construction"** by Sushil Kumar (Indian author) - This book covers the fundamentals of building construction techniques, materials, and methods. It provides a solid foundation for understanding the practical aspects of building planning.<br>2. Basic Civil Engineering"** by S.S. Bhavikatti (Indian author) - This book offers an introduction to various civil engineering disciplines, including building planning. It covers topics like site selection, foundation design, and building services.<br>3. Building Planning and Drawing"** by I.K. International Publishing House (Indian author) - This book specifically focuses on building planning and drawing techniques. It includes detailed explanations of architectural drawings and layout design. | |

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| Course Code | **CED212** | | | | | | |
| Course Title | **Concrete Technology** | | | | | | |
| Course Outcomes | CO1: Analyze cement, aggregates, and additives; comprehend IS codes; assess concrete behavior, cracking, and durability mechanisms.<br>CO2: Demonstrate concrete production, compaction, and handling; manage extreme environments; grasp concrete mix design principles.<br>CO3: Evaluate concrete defects, deterioration; conduct strength and durability tests; employ destructive and non-destructive concrete testing.<br>CO4: Differentiate special concrete types; explain reinforced, polymer, lightweight, high strength, pre-stressed, self-compacting, pervious, and self-healing concretes. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Concrete and its ingredients: Properties of cement, aggregate, admixture, water and other additives; Related Indian Standard codes & guidelines. | | | | | | CO1 |
| | Concrete behavior in fresh and hardened states: Workability, Elasticity, Shrinkage, Creep, Fatigue, Strength in compression, tension, shear and bond; Influence of various factors on test results; Concrete cracking and type of cracks; Permeability and durability characteristics of concrete including resistance to sulphate & acid attack, alkali-aggregate reaction, freezing and thawing; Fire resistance. | | | | | | CO1 |
| Unit 2 | Production of concrete: Mixing, handling, placing, compaction of concrete and related issues; Quality control; Behaviour in extreme environmental conditions like hot weather, cold weather and under water conditions. Concrete mix design | | | | | | CO2 |
| Unit 3 | Inspection and testing of concrete: Defects in concrete; Deterioration of concrete; Strength tests including compressive, split tensile, flexural, pullout etc.; Durability tests including permeability, carbonation, rapid chlorine ion penetration etc.; Destructive and Non-destructive testing of concrete; Acceptance and compliance requirements of concrete as per IS codes. | | | | | | CO3 |
| Unit 4 | Special concretes: Types and specifications; Fibre reinforced and steel reinforced concrete; Polymer concrete; Light weight concrete, High strength concrete, Pre-stressed concrete, Self-Compacting Concrete, Pervious Concrete, Self-Healing Concrete. | | | | | | CO4 |
| Text Book/s | 1. 'Properties of Concrete', A. M. Neville, Prentice Hall<br>2. 'Concrete Technology', M. S. Shetty, S.Chand & Co.<br>3. 'Concrete Technology', M. L. Gambhir, Tata McGraw Hill Publishers, NewDelhi<br>4. 'Concrete Technology', A. R. Santha Kumar, Oxford University Press, New Delhi | | | | | | |
| Reference Book/s | 1. 'Properties of Concrete', A. M. Neville, Prentice Hall<br>2. 'Concrete Technology', M. S. Shetty, S.Chand & Co. | | | | | | |

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| | 3. 'Concrete Technology', M. L. Gambhir, Tata McGraw Hill Publishers, NewDelhi<br>4. 'Concrete Technology', A. R. Santha Kumar, Oxford University Press, New Delhi | |

**B. Tech. in Civil Engineering**
**Semester-5**

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| Course code | **CED301** | | | | | | |
| Course Title | **GEOTECHNICAL ENGINEERING** | | | | | | |
| Course Outcomes | CO1: Comprehend the different types of soil based on their formation mechanism, particle size distribution and index properties<br>CO2 : Determine the permeability of soil, its effective stress and the compactive effort required to obtain necessary degree of compaction in-situ<br>CO3: Evaluate the consolidation process of soil and its difference from compaction.<br>CO4 : Evaluate the stiffness of soil using shear strength parameters | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | - | 25% | - | 35% | 25% | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | **Introduction** | | | | | | |
| • | Types of soils, their formation and deposition, Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering. Comparison and difference between soil and rock. Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume& weight, voids ratio- moisture content, unit weight- percent air voids, saturation- moisture content, moisture content-specific gravity etc. | | | | | | CO1 |
| • | Determination of various parameters such as: Moisture content by oven dry method, pycnometer, sand bath method, torsional balance method, alcohol method and sensors. Specific gravity by density bottle method, pycnometer method, measuring flask method. Unit weight by water displacement method, submerged weight method, core-cutter method, sand-replacement method. | | | | | | CO1 |
| • | **Plasticity Characteristics of Soil**: Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit and shrinkage limit. Use of consistency limits. Classification of Soils-Introduction of soil classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups. | | | | | | CO1 |
| Unit 2 | **Permeability of Soil:** Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling- | | | | | | CO2 |

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| | head method. Field method: pumping- in test, pumping- out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets. | |
| • | **Effective Stress Principle: Introduction**, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition. | CO2 |
| • | **Compaction of Soil:** Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control | CO2 |
| Unit 3 | **Consolidation of Soil:** Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation | CO3 |
| • | spring analogy for primary consolidation, interpretation of consolidation test results | CO3 |
| • | Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation. | CO3 |
| Unit 4 | **Shear Strength**: Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behaviour of UU, CU and CD tests, pore-pressure measurement, computation of effective shear strength parameters, unconfined compression test, vane shear test. | CO4 |
| • | **Stability of Slopes**: Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts. | CO4 |
| Text Book/s | 1. Murthy V.N.S., "Soil Mech. & Foundation Engg". CBS Publishers & Distributors, 2001.<br>2. Arora K.R., "Soil Mech. & Foundation Engg", Standard Publishers Distributors, 2003.<br>3. Purshotam Raj P., "Geotechnical Engineering", Tata Mcgraw Hill, 2006.<br>4. Principles of Foundation Engineering, by Braja M. Das, Cengage Learning. | |
| Reference Book/s | 1. Craig R.F, " Soil Mechanics", Chapman & Hall.<br>2. Taylor, "Fundamentals of Soil Engineering", John Wiley & Sons<br>3. Holtz R.D. and Kovacs, W.D., "An Introduction to Geotechnical Engineering", Prentice Hall, NJ<br>4. Das B.M., "Principle of Geotechnical Engineering", Cengage Publisher, 2006.<br>5. Ranjan Gopal & Rao A.S.R. ;"Basic and applied Soil Mechanics", New Age International Publishers, 2008. | |
| Course Title | **Geotechnical Engineering Laboratory** | |
| Course Outcomes | CO1: Evaluate fundamental soil properties and their determination techniques.<br>CO2: Analyze and interpret soil particle characteristics and their engineering significance.<br>CO3: Gain practical knowledge of geotechnical testing methods for soil mechanics analysis. | |
| **Syllabus** | | **CO Mapping** |

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| 1 | Determination of natural moisture content of soil using oven drying method. | CO 1 |
| 2 | Determination of specific gravity of soil solids by pycnometer method. | CO 1 |
| 3 | Determination of in-situ density by core cutter method and sand replacement method. | CO 1 |
| 4 | Grain size analysis of sand and determination of uniformity coefficient (Cu) and coefficient of curvature (Cc). | CO 2 |
| 5 | Determination of Atterberg's limits. | CO 2 |
| 6 | Compaction test of different soils. | CO 3 |
| 7 | Determination of coefficient of permeability of soil using Constant-head and Fallinghead method. | CO 3 |
| 8 | Unconfined Compression Strength Test for fine grained soil. | CO 3 |
| 9 | Direct Shear Test. | CO 3 |
| 10 | Relative density test | CO 3 |
| Reference Book/s | Prakash Shamsher& Jain P.K., "Soil Testing Engineering Manual" Nem Chand & Brother, 1997 | |

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| Course Code | **CED303** | | | | | | |
| Course Title | **HYDROLOGY AND WATER RESOURCE ENGINEERING** | | | | | | |
| Course Outcomes | CO1: Comprehend hydrologic processes, precipitation measurement, and water abstractions, including evaporation, evapotranspiration, and infiltration.<br>CO2: Learn runoff estimation, hydrograph analysis, and groundwater principles, including aquifer properties and well hydraulics.<br>CO3: Explore water usage, irrigation methods, and crop water requirements, along with canal and dam design considerations.<br>CO4: Gain knowledge of canal systems, dam types, their forces, failures, and site selection, addressing water management and engineering challenges. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Introduction- hydrologic cycle, water-budget equation, water balance, need of hydrology in engineering, Different forms of precipitation, precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth area- duration relationships, maximum intensity/depth-duration-frequency relationship | | | | | | CO1 |
| • | Abstractions from precipitation- evaporation process, evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration and its measurement, potential evapotranspiration over India, actual evapotranspiration, interception, depression storage, infiltration, infiltration capacity. | | | | | | CO1 |
| Unit 2 | Runoff- runoff volume, estimation of runoff volume, flow duration curve, flow-mass curve, hydrographs, unit hydrograph, surface and ground water resources of India | | | | | | CO2 |
| • | Ground water and well hydrology- forms of subsurface water, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers. | | | | | | CO2 |
| Unit 3 | Water withdrawals and uses–Different uses of water: agriculture, hydroelectric generation; flood control. Analysis of surface water supply, Water requirement of Crops, crop seasons in India, cropping pattern, duty and delta | | | | | | CO3 |
| • | Quality of irrigation water; Soil-water relationships, root zone soil water, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation. | | | | | | CO3 |
| Unit 4 | Canals and Dams - canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime channels. | | | | | | CO4 |
| • | Canal outlets, Water logging: causes, effects and remedial measures. Lining of canals, types of lining. Drainage of irrigated lands: necessity, methods, different types of dams, forces acting on dam, different type of dam failures, selection of | | | | | | CO4 |

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| | suitable dam sites. | |
| Text Book/s | 1. A.P.H. Laurie, "Elements of Irrigation Engineering", S. Chand & Co.<br>2. K. C. Naik, "Hydrology and Water Resources Engineering", Tata McGraw-Hill Education.<br>3. S. K. Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers. | |
| Reference Book/s | 1. Peter W. Guthrie, "Hydrology for Engineers", Spon Press.<br>2. Ven Te Chow, "Applied Hydrology", McGraw-Hill Education.<br>3. C. T. Haan, "Statistical Methods in Hydrology and ydroclimatology", Kluwer Academic Publishers. | |

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|---|---|---|---|---|---|---|---|
| Course Code | **CED305** | | | | | | |
| Course Title | **ENGINEERING ECONOMICS, ESTIMATION & COSTING** | | | | | | |
| Course Outcomes | CO1: Analyze fundamental economic principles, supply-demand dynamics, market structures, macroeconomic concepts, and government policies' impact.<br>CO2: Develop skills in estimating, planning, and analyzing construction projects, including building, road, and irrigation works.<br>CO3: Learn to formulate accurate cost estimates, interpret rates, and create effective construction specifications.<br>CO4: Grasp the essentials of contracts, accounts division, and arbitration procedures within the context of construction management. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | B**asic Principles and Methodology of Economics.** Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income). | | | | | | CO1 |
| • | Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes<br>**Public Sector Economics:** Introduction to Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank | | | | | | CO1 |
| • | **Elements of Business/Managerial Economics and forms of organizations:** Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation | | | | | | CO1 |
| • | Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method. | | | | | | CO1 |
| Unit 2 | Estimates: Types, complete set of estimate, working drawings, site plan, layout plan, index plan, plinth area administrative approval and Technical Sanction. | | | | | | CO2 |
| • | Estimate of buildings, Estimate of R. C.C. works, Estimate of sloped roof and steel structures, Estimate of water supply and sanitary works, Estimates of roads (a) Earthwork (b) Bridges and culverts c) Pavement, Estimate of Irrigation works. | | | | | | CO2 |
| Unit 3 | Analysis of Rates: For earthwork, concrete works, D. P. C., Brickwork, stone masonry, plastering, pointing, road work, carriage of materials. | | | | | | CO3 |
| • | Specifications- For different classes of building and Civil engineering works | | | | | | CO3 |
| Unit 4 | Contracts: Types of contracts, tender, tender notice, tender form, submission and opening of tender, earnest money, security money, measurement book, | | | | | | CO4 |

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| | muster roll, piecework agreement and work order | |
| • | Accounts: Division of accounts, cash, receipts of money, cashbook, temporary advance, imprest and accounting procedure. | CO4 |
| • | Arbitration: Arbitration, arbitrator, and arbitration act, powers of arbitrator, arbitration awards. | CO4 |
| Text Book/s | 1. Datta B. N. ;"Estimating and Costing", UBSPD, New Delhi, 2008.<br>2. BirdiG.S. ;"Estimating and Costing", DhanpatRai Publication New Delhi, 2007.<br>3. ChakravortyV.N. ;"Estimating and Costing", Calcutta publisher, 2010.<br>4. PatilB.S. ;"Civil Engg. Contracts & Estimates", Orient-Longman Ltd., New Delhi, 2001. | |
| Reference Book/s | 5. Mankiw Gregory N. (2002), Principles of Economics, Thompson Asia<br>6. V. Mote, S. Paul, G. Gupta(2004), Managerial Economics, Tata McGraw Hill<br>7. Misra, S.K. and Puri (2009), Indian Economy, Himalaya<br>8. PareekSaroj (2003), Textbook of Business Economics, Sunrise Publishers | |

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| L | T | P | Credit |
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| Course Code | **CED307** | | | | | | |
| Course Title | **Design of Concrete Structures-I** | | | | | | |
| Course Outcomes | CO1: Apply design methods (LSDM, WSM) for structural elements, compute moment of resistance, and analyze characteristic values.<br>CO2: Analyze shear, torsion, and serviceability in structural design, ensuring safe and stable performance of components.<br>CO3: Design singly and doubly reinforced beams, flanged beams, and slabs, considering various failure modes and load conditions.<br>CO4: Formulate compression member designs using axial load, bending, and charts, ensuring stability and load-carrying capacity. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | INTRODUCTION | | | | | | |
| • | **Introduction to Limit State** Design Method- Introduction to Working Stress Method and Limit State Method, Characteristic values, characteristic strength, characteristic loads, design values for materials and loads, factored loads | | | | | | CO1 |
| • | Determination of Neutral Axis Depth and Computation of Moment of Resistance for both singly and doubly reinforced sections | | | | | | CO1 |
| Unit 2 | **Limit State of Collapse** | | | | | | |
| • | **Shear, bond and torsion:** Introduction Design for shear, structural components subjected to torsion, design of rectangular beam section for torsion, development length. | | | | | | CO2 |
| • | **Limit State of Serviceability** Deflection, effective span to effective depth ratio, modification factors for singly reinforced, doubly reinforcement and flanged beams, crack formation and its control. | | | | | | CO2 |
| Unit 3 | **Analysis and design** | | | | | | |
| • | **Design of singly reinforced,** doubly reinforced beams and flanged beams. Types of failures and assumptions. | | | | | | CO3 |
| • | Reinforced Concrete Slabs: One way and Two way slabs. | | | | | | CO3 |
| Unit 4 | **Compression Members** | | | | | | CO4 |
| • | Definitions, Classifications, Guidelines and Assumptions, Design of Short Axially Loaded Compression Members | | | | | | CO4 |
| • | Design of Short Compression Members under Axial Load with Uniaxial and biaxial Bending, Preparation of Design Charts, Design of Slender Columns | | | | | | CO4 |
| Text Book/s | *1.* Ramamrutham Design of concrete structures, Dhanpat Rai Publications,2016 | | | | | | |

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| | 2. S.S Bhavakatti Desgin of concrete structures, New Age International publishers,<br>3. Krishna RajuN.; "Advanced Design of Structures", New Age International Publishers, 2003. | |
| Reference Book/s | 1. Ramachandra; "Limit State Design", scientific publishers, 2007.<br>2. Jain A.K.; "Limit State Design", Laxmi Publications, 2007.<br>3. Vergese P.C.; "Limit State Design of Reinforced Concrete" PHI Learning publishers, 2008.<br>4. Pillai&Menon"Reinforced concrete design", Tata Mcgraw hills, 2009. | |

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| Course Code | **CED309** | | | | | | |
| Course Title | **TRANSPORTATION ENGINEERING** | | | | | | |
| Course Outcomes | CO1: Comprehend transportation modes, historical road development, and highway economics for effective transportation system management.<br>CO2: Learn highway geometric design principles, aligning roads, ensuring safe sight distances, and designing smooth horizontal and vertical alignments.<br>CO3: Comprehend highway materials, construction techniques, drainage importance, maintenance, and pavement evaluation for durable road infrastructure.<br>CO4 Gain knowledge of pavement design, elementary traffic engineering, traffic studies, road safety elements, intersections, and traffic management essentials. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | - | 25% | - | 35% | 25% | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | INTRODUCTION | | | | | | |
| • | **Introduction:** Importance and role of transportation systems; different modes of transportation, historical development of road construction, Highway Economics. | | | | | | CO1 |
| • | **Highway Planning & Project Preparation:** Planning surveys, Highway alignment, Highway Location surveys, soil and material surveys, Highway Projects: drawing and report. | | | | | | CO1 |
| Unit 2 | **Highway Geometric Design:** cross-sectional elements, camber, sight distance-definition analysis of stopping sight and passing sight distances, passing zones. Design of horizontal alignment-super elevation. | | | | | | CO2 |
| • | Extra widening on curves, transition curves. Design of vertical alignment, gradients, types of vertical curves & their design | | | | | | CO2 |
| Unit 3 | **Highway materials and construction:** Desirable properties of soil, Road aggregates, bitumen, cement & cement concrete as highway materials. Various types of roads & their construction-earth roads, gravel roads, W.B.M., bituminous roads and quality control during construction | | | | | | CO3 |
| • | **Highway Drainage and Maintenance:** Importance of drainage and maintenance, Surface Drainage and Subsoil Drainage, Construction in Water-logged areas, Pavement Failures, Pavement Evaluation, Maintenance and Strengthening Measures, Introduction to soil stabilization | | | | | | CO3 |
| Unit 4 | **Pavement Design:** Design of flexible and rigid Pavements | | | | | | CO4 |
| • | Elementary Traffic Engineering-Traffic Engineering studies (speed, volume, O & D, parking and accident studies), | | | | | | CO4 |
| • | traffic signs, traffic signals, road markings, road intersection, highway lighting | | | | | | CO4 |
| | 1. Khanna S.K., and Justo, C.E.G. "Highway Engineering", Nem Chand and | | | | | | |

| | | |
|---|---|---|
| Text Book/s | Brothers, Roorkee, 1998.<br>2. Kadiyali, L.R. "Principles and Practice of Highway Engineering", Khanna Publishers, New Delhi, 1997.<br>3. Flaherty, C.A.O. "Highway Engineering", Volume 2, Edward Arnold, London, 1986. | |
| Reference Book/s | 1. Sharma, S.K. "Principles, Practice & Design of Highway Engineering", S.Chand & Company Ltd., New Delhi, 1985.<br>2. Mannering, "Principles of Highway Engineering & Traffic Analysis", Wiley Publishers, New Delhi, 2007.<br>3. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7th Edition, Wiley Student Edition, 2009.<br>Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011. | |
| Course Title | **TRANSPORTATION ENGINEERING LABORATORY** | |
| Course Outcomes | CO1: To Evaluate the mechanical properties of aggregates and their suitability for use in construction.<br>CO2: To analyze the properties of bitumen and assess its quality for road construction.<br>CO3: To assess the geometric properties of aggregates and their impact on the performance of road materials. | |
| **Syllabus** | | **CO Mapping** |
| 1 | To determine the impact value of aggregates. | CO1 |
| 2 | To determine the crushing value of aggregates. | CO 1 |
| 3 | To determine the abrasion value of aggregates by Los Angeles test | CO 1 |
| 4 | To determine flakiness and elongation index of aggregates (shape test). | CO 3 |
| 5 | To determine the water absorption and specific gravity of coarse aggregates | CO 3 |
| 6 | To determine grade of bitumen by penetration test | CO 2 |
| 7 | To determine the ability of bitumen to stretch by ductility test. | CO 2 |
| 8 | To Determine flash and fire point of bitumen. | CO 2 |
| 9 | To Determine softening point of bitumen by ring and ball apparatus. | CO 2 |
| 10 | To determine the bitumen content in a road sample by bitumen extraction test. | CO 2 |
| Reference Book/s | 1. Highway material and pavement testing by Khanna & Justo<br>2. Laboratory manual in Highway Engineering by Ajay K Duggal | |

| In hours | | | |
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| **L** | **T** | **P** | **Credit** |
| 0 | 0 | 0 | 2 |

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|---|---|---|---|---|---|---|---|
| Course Code | **CED311** | | | | | | |
| Course Title | **Survey camp** | | | | | | |
| Course Outcomes | CO1: Students gain practical hands-on experience in applying surveying techniques, tools, and equipment to real-world situations. | | | | | | |
| Examination Mode | Practical | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | - | - | - | - | - | -100% | - |
| **Syllabus** | | | | | | | **CO Mapping** |
| | INTRODUCTION | | | | | | |
| • | Survey Camp of 4 weeks duration will be held immediately after IVth semester at a Hilly Terrain. The students are required to prepare the Topographical Map of the area by traditional method. Students should also be exposed to modern Survey Equipment and practices, like Total Station, Automatic Level, GPS etc. | | | | | | CO1 |

**B. Tech. in Civil Engineering**
**Semester-6**

| In hours | | | |
|---|---|---|---|
| **L** | **T** | **P** | **Credit** |
| 3 | 0 | 0 | 3 |

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|---|---|---|---|---|---|---|---|
| Course Code | **CED302** | | | | | | |
| Course Title | **Environment Engineering-II** | | | | | | |
| Course Outcomes | CO1: Analyze soil and groundwater contamination sources, movement of contaminants, and waste containment principles.<br>CO2: Comprehend groundwater contamination behavior, measurement methods, and remediation techniques for soil and groundwater.<br>CO3: Explore hazardous waste management, solid waste disposal, engineered landfill design, and regulatory guidelines.<br>CO4: Gain insights into waste handling criteria, disposal techniques, and practical case studies in environmental geo-technology. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | **Soil Contamination** | | | | | | |
| • | Introduction to Geo environmental engineering, Development of environmental geo-technology sources, Environmental cycles production and classification of waste, Waste Containment. | | | | | | CO1 |
| • | Contaminant's movements in soil, Contaminant transport in sub surface: advection, diffusion, dispersion, governing equations. | | | | | | CO1 |
| Unit 2 | **Groundwater contamination** | | | | | | CO2 |
| • | Water quality standards, Sources of contamination, Hydro chemical behavior of contaminants | | | | | | CO2 |
| • | Trace metals - Trace nonmetals - Nitrogen, organic substances - Measurement of parameters - Velocity - Dispersity - chemical partitioning | | | | | | CO2 |
| Unit 3 | **Remediation of contaminants from soil and Ground water** | | | | | | CO3 |
| • | contaminant transformation: sorption, biodegradation, ion exchange, precipitation: ex-situ and in-situ remediation | | | | | | CO3 |
| • | solidification, bio–remediation, soil washing, electro kinetics, soil heating, verification, bio venting, Ground water remediation – pump and treat, air spraying, reactive well. | | | | | | CO3 |
| Unit 4 | **Engineered landfill** | | | | | | CO4 |
| • | Site selection, dumping, Design of landfill: CNS layer, leachate and air collection units, Case studies. CPCB rules and regulations on waste handling and management - Criteria for selection of sites for waste disposal - Disposal techniques -Disposal systems for typical wastes. | | | | | | CO4 |

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| Text Book/s | 1. K. R. Arya, "Environmental Geotechnology", New Age International Publishers.<br>2. C. Venkatramaiah, "Groundwater Contamination and Its Control", PHI Learning Private Ltd.<br>3. R. S. Khoiyangbam, "Solid Waste Management: Principles and Practice", TERI Press.<br>4. Foreign Authors: | |
| Reference Book/s | 1. F. D. Kutz, "Environmental Engineering: Principles and Practice", Wiley.<br>2. R. N. Yong, "Geo-Environmental Engineering: Principles and Applications", CRC Press.<br>3. P. N. Cheremisinoff, "Handbook of Solid Waste Management and Waste Minimization Technologies", Butterworth-Heinemann | |

| In hours | | | |
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| L | T | P | Credit |
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|---|---|---|---|---|---|---|---|
| Course Code | **CED304** | | | | | | |
| Course Title | **Design of Steel Structures-I** | | | | | | |
| Course Outcomes | CO1: Analyze riveted, bolted, and welded connections, analyzing stresses, strengths, and failures in joints for effective structural design.<br>CO2: Grasp the design principles of tension and compression members, considering axial loads, bending, and empirical formulas.<br>CO3: Learn the intricacies of column bases, foundations, and industrial building design, including gantry girders and column brackets.<br>CO4: Acquire the skills to design plate girders and roof trusses, accounting for loads, forces, and joint calculations in structural systems. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | **Design of Structural Elements** | | | | | | |
| • | **Structural Joining Techniques:** Rivets and riveting, stresses in rivets, strength & failure of riveted joints. Advantages and disadvantages of bolted connections, stresses in bolts and design of bolted connections. Types of welds & welded joints, stresses in welds, design of welded joints. | | | | | | |
| • | **Tension Members:** Types of tension members, net & gross areas, permissible stresses. Design of members subjected to axial loads, combined bending moments & axial loads, lug angles. | | | | | | CO1 |
| Unit 2 | **Compression Members:** | | | | | | CO2 |
| • | Failure modes of columns, end conditions & effective length of columns, various empirical formulae. IS code formula | | | | | | CO2 |
| • | General codal provisions for design of compression members, built up compression members, lacing and battening of compression members | | | | | | CO2 |
| Unit 3 | **Design Concepts** | | | | | | CO3 |
| • | **Column Bases and Foundations:** Types of column bases, design of slab base, Gusseted base& grillage foundations. | | | | | | CO3 |
| • | **Design of complete industrial building with design of:** Design of Gantry Girders, Design of Column bracket. | | | | | | CO3 |
| Unit 4 | **Plate girder and roof truss Design** | | | | | | |
| • | **Design of plate Girders:** Components of a plate girder, basic design assumptions, stiffeners inflate girders. | | | | | | CO4 |
| • | **Roof Trusses:** Types of roof trusses loads on roof trusses, calculation of forces | | | | | | CO4 |

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| | due to combination of different loads. Design of members and joints. | |
| Text Book/s | 1. Chandra R "Design of Steel Structures" Standard Publishing House, 1999.<br>2. Limit state design of steel structures: S K Duggal, McGraw, 2009.<br>3. Raghupathi M "Design of Steel Structures" Tata McGraw-Hill, New Delhi,1998.<br>4. Arya A S and Ajmani J L "Design of Steel Structures" Nem Chand Bros. Roorkee,2000. | |
| Reference Book/s | 1. Kazimi S M A and Jindal R S "Design of Steel Structures" Prentice Hall of India, New Delhi,1999.<br>2. Dayaratnam P "Design of Steel Structures" Wheeler Publishers, New Delhi,1999.<br>3. L.S Negi, "Design of steel structure", Tata McGraw-Hill, New Delhi, 200 | |

| In hours | | | |
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| **L** | **T** | **P** | **Credit** |
| 3 | 1 | 0 | 4 |

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|---|---|---|---|---|---|---|---|
| Course Code | **CED306** | | | | | | |
| Course Title | **Foundation Engineering** | | | | | | |
| Course Outcomes | CO1: Comprehend soil investigation methods, sampling techniques, and borehole logging for structural design.<br>CO2: Analyze earth pressure theories, stresses in soils, and influence factors for retaining walls and loaded areas.<br>CO3: Learn about shallow foundation types, bearing capacity, settlement calculations, plate load tests, and SPT.<br>CO4: Gain knowledge of pile foundations, caissons, and wells including types, load tests, stability analysis, and group behavior. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | **Soil Investigation** | | | | | | |
| • | Object of soil investigation for new and existing structures. Depth of exploration for different structures. Spacing of bore Holes. Methods of soil exploration and relative merits and demerits. Types of soil sample. | | | | | | |
| • | Design features of sampler affecting sample disturbance. Introduction to the essential features and application of the following types of samples-Open Drive samples, Stationery piston sampler, Rotary sampler, Geophysical exploration by seismic and resistivity methods. Bore Hole log for S.P.T. | | | | | | CO1 |
| Unit 2 | **Geotechnical Analysis & Earth Pressure** | | | | | | CO2 |
| • | **Earth Pressure:** Terms and symbols used for a retaining wall. Movement of wall and the lateral **e**arth pressure. Rankine's and Coulomb's theory for lateral earth pressure. Culmann's graphical construction and Rebhan's graphical construction. | | | | | | CO2 |
| • | **Stresses in soils:** Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart. Contact pressure under rigid and flexible area, computation of displacements from elastic theory. | | | | | | CO2 |
| Unit 3 | **Shallow Foundation** | | | | | | CO3 |
| • | Types of shallow foundations, definitions Terzaghi's analysis. Types of failures. Factors affecting bearing capacity. Skemption's equation. B. I. S. recommendations for shape, depth and inclination factors. | | | | | | CO3 |
| • | Plate Load Test and Standard Penetration Test. Contact pressure distribution. Causes of settlement of structures comparison of immediate and consolidation settlement Calculation of settlement by plate load test. | | | | | | CO3 |

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| Unit 4 | **Pile Foundation, Caissons & Wells** | |
| • | **Pile Foundation:** Necessity and uses of piles, classification of piles. Merits and demerits of different types based on composition. Types of pile driving hammers & their comparison. Effect of pile driving on adjacent ground. Use of Engineering news formula and Hiley's formula for determination of allowable load. Pile Load Test, separation of skin friction and point resistance using cyclic pile load test data. Related Numerical problems. Determination of point resistance and frictional resistance of a single pile by static formula. Piles in clay, safe load on a friction and point bearing pile. Pile in sand spacing of piles in a group, factors affecting capacity of a pile group. Efficiency of pile group bearing capacity of a pile group in clay. Settlement of pile groups in clay and sand Negative skin friction. | CO4 |
| • | **Caissons and wells:** Major area of use of caissons Advantages and disadvantages of open box and pneumatic caissons. Essential part of a pneumatic caisson. Components of a well. Calculation of allowable bearing pressure. Conditions for stability of a well. Terzaghi's analysis for Lateral stability of a well, embedded in sand. Forces acting on a well foundation. Computation of scour depth, Tilts & Shifts. | CO4 |
| Text Book/s | 1. David F. McCarthy, "Essentials of Soil Mechanics and Foundations: Basic Geotechnics".<br>2. Arora K. R. ;"Soil Mech. & Foundation Engg", Standard Publishers Distributors, 2005<br>3. Purshotama P. "Geotechnical Engineering", Pearson education, 2008.<br>4. Murthy V N S ;"Soil Mech. & Foundation Engg" , Mercel Dekker, 2003.<br>5. Das B.M. ;"Principle of Foundation Engineering" , CL Engineering publications, 2002.<br>6. RanjanGopal&Rao A.S.R. ; "Basic and applied Soil Mechanics", New Age International Publishers, 2008. | |
| Reference Book/s | 1. Muni Budhu "Soil Mech. & Foundations", John Wiley & Sons, 2008.<br>2. Gulhati and Datta ;"Geotechnical Engineering", Tata McGraw - Hill Education, 2009.<br>3. Varghese P.C ;"Foundation Engineering", PHI Learning 2005<br>4. Verma B. P.; "Problems in Soil mechanics and Foundation Engineering", Khanna Publication, 2007.<br>5. Bowles J.E; "Foundation Analysis and Design", Tata McGraw - Hill Education, 2010. | |

| In hours | | | |
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| L | T | P | Credit |
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|---|---|---|---|---|---|---|---|
| Course Code | **CED308** | | | | | | |
| Course Title | **Computer Aided Drawing** | | | | | | |
| Course Outcomes | CO1: Produce accurate concrete and steel drawings using AutoCAD.<br>CO2: Apply design principles for efficient structural detailing.<br>CO3: Create annotated plans for common building components.<br>CO4: Demonstrate proficiency in interpreting architectural and engineering drawings | | | | | | |
| Examination Mode | Practical | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | - | 20% | - | 30% | - | 50% | - |
| **Syllabus** | | | | | | | **CO Mapping** |
| 1 | Basic Shapes<br>Create accurate drawings of basic geometric shapes (rectangle, circle, triangle) using AutoCAD's drawing tools. | | | | | | CO 1, 4 |
| 2 | Drawing Annotations: Practice adding text annotations to your drawings, such as labels and dimensions, to enhance the clarity of your designs. | | | | | | CO 1, 3 |
| 3 | Column Design: Design a simple rectangular concrete column by drawing its plan and elevation, adding dimensions and annotations. | | | | | | CO 1, 2 |
| 4 | Beam Design: Design a steel beam by drawing its cross-section and lengthwise elevation, including relevant annotations. | | | | | | CO 1, 2 |
| 5 | Foundation Plan: Create a foundation plan for a small building, incorporating concrete footings and detailing. | | | | | | CO 1, 2&3 |
| 6 | Reinforcement Detailing: Draw reinforcement details for a concrete slab, indicating the arrangement of rebar using appropriate symbols. | | | | | | CO 1, 2 |
| 7 | Staircase Design: Design a basic concrete staircase, illustrating the plan, elevation, and relevant dimensions. | | | | | | CO 1, 2 |
| 8 | Truss Structure: Design a simple truss structure using steel members, highlighting the connections and load-bearing points. | | | | | | CO 1, 2 |
| 9 | Retaining Wall: Create a drawing of a retaining wall, displaying the different components and dimensions required for stability. | | | | | | CO 1, 2& 3 |
| 10 | Assembly Drawing: Generate an assembly drawing for a small structure, combining components like beams, columns, and slabs. | | | | | | CO 1, 2& 4 |

**B. Tech. in Civil Engineering**
**Semester-7**

| In hours | | | |
|---|---|---|---|
| **L** | **T** | **P** | **Credit** |
| 3 | 1 | 0 | 4 |

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|---|---|---|---|---|---|---|---|
| Course Code | **CED401** | | | | | | |
| Course Title | **Design of Steel Structures-II** | | | | | | |
| Course Outcomes | CO1: Comprehend plate girder elements, design principles, flange curtailment, and various stiffener types in structural steel systems.<br>CO2: Develop expertise in designing steel foot bridges with welded joints, parallel booms, wooden decking, and safe load-bearing capacities.<br>CO3: Master the design aspects of an industrial shed encompassing gantry girders, column brackets, bents, and bracing for stability.<br>CO4: Gain proficiency in designing single-track railway bridges, including lattice girders, welded joints, girders, bracings, and bearing systems. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | | | | | | | |
| • | Elements of a plate girder, design of a plate girder, curtailment of flanges, various type of stiffeners | | | | | | CO1 |
| Unit 2 | | | | | | | |
| • | Design of steel foot bridge with parallel booms and carrying wooden decking, using welded joints. | | | | | | CO2 |
| Unit 3 | | | | | | | |
| • | Complete design of an industrial shed including: i) Gantry girder ii) Column bracket iii) Mill bent with constant moment of inertia iv) Lateral and longitudinal bracing for column bent | | | | | | CO3 |
| Unit 4 | | | | | | | |
| • | Design of single track railway bridge with lattice girders having parallel chords (for B.G.) i) Stringer ii) Cross girder iii) Main girders with welded joints iv) Portal sway bracings v) Bearing rocker and rollers | | | | | | CO4 |
| Text Book/s | 1) Limit state design of steel structures: S K Duggal<br>2) Design of steel structures: N Subramanian<br>3) Design of steel structures (Vol. 2): Ram Chandra<br>4) Design of steel structures: L S Negi | | | | | | |
| Reference Book/s | 5) Design of steel structures (by limit state method as per IS: 800-2007): S S Bhavikatti 6) IS 800: 2007 (General construction in steel-Code of practice)* 7) SP: 6(1) (Handbook for structural engineers-Structural steel sections)* * permitted in Examination | | | | | | |

| In hours | | | |
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| **L** | **T** | **P** | **Credit** |
| 1 | 0 | 4 | 3 |

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|---|---|---|---|---|---|---|---|
| Course Code | **CED403** | | | | | | |
| Course Title | **Engineering Project-I** | | | | | | |
| Course Outcomes | CO1: Apply appropriate techniques and tools to solve complex structural problems.<br>CO2: Exhibit good communication skill to the engineering community and society.<br>CO3: Demonstrate professional ethics and work culture.<br>CO4: Contribute in efficient technology transfer to the society. | | | | | | |
| Examination Mode | Theory/ Practical/ Theory + Practical | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | | | 25% | 25% | 35% | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| • | The student will submit a detailed Project Report on the work approved by Departmental committee in a specified format and will also deliver a Presentation on the topic chosen at the end of semester. | | | | | | CO 1, 2, 3&4 |

| In hours | | | |
|---|---|---|---|
| **L** | **T** | **P** | **Credit** |
| 0 | 1 | 0 | 2 |

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| Course Code | **CED405** | | | | | | |
| Course Title | **Software Training** | | | | | | |
| Course Outcomes | CO1: Apply appropriate software, techniques and tools to solve complex structural problems.<br>CO2: Exhibit good communication skill to the engineering community and society.<br>CO3: Demonstrate professional ethics and work culture.<br>CO4: Contribute in efficient technology transfer to the society. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| | At the end of the examination of 6th Semester the students will undergo compulsory software training for a period of 6-8 weeks duration in reputed industries. Every student will submit the training report within two weeks from the ending of teaching of 7th Semester. The marks for this will be included in the 7th semester.<br>The student will submit a detailed Project Report on the work approved by Departmental committee in a specified format and will also deliver a Presentation on the topic chosen at the end of semester. | | | | | | CO 1, 2, 3&4 |

**B. Tech. in Civil Engineering**
**Semester-8**

| In hours | | | |
|---|---|---|---|
| **L** | **T** | **P** | **Credit** |
| 0 | 0 | 18 | 9 |

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|---|---|---|---|---|---|---|---|
| Course Code | **CED402** | | | | | | |
| Course Title | Capstone Project /DSE | | | | | | |
| Course Outcomes | CO1: Apply appropriate techniques and tools to solve complex structural problems.<br>CO2: Exhibit good communication skill to the engineering community and society.<br>CO3: Demonstrate professional ethics and work culture.<br>CO4: Contribute in efficient technology transfer to the society. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| | At the end of the examination of 7th Semester the students will undergo compulsory industrial training for a period of 6 months duration in reputed industries. Every student will submit the training report at the end of 8th Semester. The marks for this will be included in the 8th semester.<br>The student will submit a detailed Project Report in a specified format and will also deliver a Presentation on the topic chosen at the end of the semester.<br>If a student fails to receive training confirmation in any firm, then he/she must undertake selective courses to clear 8 credits in the 8th semester. | | | | | | CO 1, 2, 3&4 |

| In hours | | | |
|---|---|---|---|
| L | T | P | Credit |
| 3 | 0 | 0 | 3 |

## DEPARTMENTAL ELECTIVES

| Course Code | **CED350** | | | | | | |
|---|---|---|---|---|---|---|---|
| Course Title | **FOUNDATION ENGINEERING** | | | | | | |
| Course Outcomes | CO1: To determine the depth of exploration and method of explorations for soil investigation.<br>CO2: To determine the earth pressures and stresses in soils under different types of foundation loads.<br>CO3: To calculate the bearing capacity of soil under shallow foundations.<br>CO4: To comprehend the need of deep foundations like piles and well foundations and also to analyze the allowable load. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | *Soil Investigation* | | | | | | |
| • | Object of soil investigation for new and existing structures. Depth of exploration for different structures. Spacing of bore Holes. Methods of soil exploration and relative merits and demerits. | | | | | | CO1 |
| • | Types of soil sample. Design features of sampler affecting sample disturbance. | | | | | | CO1 |
| • | Introduction to the essential features and application of the following types of samples-Open Drive samples, Stationery piston sampler, Rotary sampler, Geophysical exploration by seismic and resistivity methods. Bore Hole log for S.P.T. | | | | | | CO1 |
| Unit 2 | *Earth Pressure* | | | | | | |
| • | Terms and symbols used for a retaining wall. Movement of wall and the lateral earth pressure. Rankine's and Coulomb's theory for lateral earth pressure. Culmann's graphical construction and Rebhan's graphical construction. | | | | | | CO2 |
| • | Stresses in soils: Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart. Contact pressure under rigid and flexible area, computation of displacements from elastic theory. | | | | | | CO2 |
| Unit 3 | *Shallow Foundation* | | | | | | |
| • | Types of shallow foundations, definitions Terzaghi's analysis. Types of failures. Factors affecting bearing capacity. | | | | | | CO3 |
| • | Skemption's equation. B. I. S. recommendations for shape, depth and inclination factors. Plate Load Test and Standard Penetration Test. Contact pressure distribution. | | | | | | CO3 |
| • | Causes of settlement of structures comparison of immediate and consolidation settlement Calculation of settlement by plate load test. | | | | | | CO3 |
| Unit 4 | *Pile Foundation* | | | | | | |
| • | Necessity and uses of piles, classification of piles. Merits and demerits of | | | | | | CO4 |

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| | different types based on composition. Types of pile driving hammers & their comparison. Effect of pile driving on adjacent ground. Use of Engineering news formula and Hiley's formula for determination of allowable load. Pile Load Test, separation of skin friction and point resistance using cyclic pile load test data. Related Numerical problems | |
| • | Determination of point resistance and frictional resistance of a single pile by static formula. Piles in clay, safe load on a friction and point bearing pile. Pile in sand spacing of piles in a group, factors affecting capacity of a pile group. Efficiency of pile group bearing capacity of a pile group in clay. Settlement of pile groups in clay and sand Negative skin friction. | CO4 |
| • | Caissons and wells: Major area of use of caissons Advantages and disadvantages of open box and pneumatic caissons. Essential part of a pneumatic caisson. Components of a well. Calculation of allowable bearing pressure. Conditions for stability of a well. Terzaghi's analysis for Lateral stability of a well, embedded in sand. Forces acting on a well foundation. Computation of scour depth, Tilts & Shifts. | CO4 |
| Text Book/s | 1. Arora K. R. ;"Soil Mech. & Foundation Engg", Standard Publishers Distributors, 2005<br>2. Purshotama P. "Geotechnical Engineering", Pearson education, 2008.<br>3. Murthy V N S ;"Soil Mech. & Foundation Engg" , Mercel Dekker, 2003.<br>4. David F. McCarthy, "Essentials of Soil Mechanics and Foundations: Basic Geotechnics". | |
| Reference Book/s | 1. Das B.M. ;"Principle of Foundation Engineering" , CL Engineering publications, 2002.<br>2. Ranjan Gopal & Rao A.S.R. ; "Basic and applied Soil Mechanics", New Age International Publishers, 2008.<br>3. Muni Budhu "Soil Mech. & Foundations", John Wiley & Sons, 2008.<br>4. Gulhati and Datta ;"Geotechnical Engineering", Tata McGraw - Hill Education, 2009.<br>5. Varghese P.C ;"Foundation Engineering", PHI Learning 2005<br>6. Verma B. P.; "Problems in Soil mechanics and Foundation Engineering", Khanna Publication, 2007.<br>7. Bowles J.E; "Foundation Analysis and Design", Tata McGraw - Hill Education, 2010. | |

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|---|---|---|---|---|---|---|---|
| Course Code | **CED351** | | | | | | |
| Course Title | **OFFSHORE ENGINEERING** | | | | | | |
| Course Outcomes | CO1: Introduce offshore structures, their construction stages, constructability principles, and relevant codes of practice.<br>CO2: Explore offshore project management, site investigations, deep-sea construction, materials properties, and related considerations.<br>CO3: Examine in-situ testing, geological aspects, and the development of design stratigraphies for offshore projects.<br>CO4: Investigate methods and equipment for underwater exploration, instrumentation in soil engineering, and practical field visits for data collection and reporting. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | *Introduction* | | | | | | |
| • | Introduction to offshore structures, Construction stages for offshore structure, Principle of constructability, codes of practice. | | | | | | CO1 |
| Unit 2 | | | | | | | |
| • | Offshore project management, offshore site investigations, geophysical methods; offshore sediment sampling, Construction in deep sea, Considerations and Phenomena for Deep-Sea Operations, Properties of Materials for the Deep Sea | | | | | | CO2 |
| Unit 3 | | | | | | | |
| • | In-situ testing, geological aspects; development of design stratigraphies | | | | | | CO3 |
| Unit 4 | | | | | | | |
| • | Investigation below sea/river bed – methods and equipment – interpretation of offshore exploration, Instrumentation in soil engineering - strain gauges - resistance and inductance type - load cells, earth pressure cells - settlement and heave gauges - piezometers and slope indicators -inclinometer, Field visit, data and report preparation. | | | | | | CO4 |
| Text Book/s | 1. Hand book of Offshore Engineering – S.K. Chakrabarti, Elsevier Publications 2005. Vol-I & II | | | | | | |
| Reference Book/s | 1. Hvorsler M. "Subsurface exploration and sampling of soil for Civil Engg. purposes. | | | | | | |

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| Course Code | **CED352** | | | | | | |
| Course Title | **SOIL DYNAMICS** | | | | | | |
| Course Outcomes | CO1: Analyze dynamic load effects and vibrations in structures, applying theory of vibrations and dynamic earth pressures.<br>CO2: Evaluate dynamic bearing capacity and foundations under dynamic earth pressure, considering shallow foundation design principles.<br>CO3: Investigate wave propagation in soil, liquefaction phenomena, and compute dynamic soil properties for engineering applications.<br>CO4: Design machine foundations for diverse machinery types, implement vibration isolation techniques, and comprehend vibration control strategies in engineering practice. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | *Introduction* | | | | | | |
| • | Nature of Dynamic Loads, Theory of Vibrations | | | | | | CO1 |
| Unit 2 | | | | | | | |
| • | Dynamic Earth pressure and dynamic bearing capacity of shallow foundations. | | | | | | CO2 |
| Unit 3 | | | | | | | |
| • | Liquefaction of Soils Wave propagation in elastic, homogeneous and isotropic medium Determining dynamic soil parameters. | | | | | | CO3 |
| Unit 4 | | | | | | | |
| • | Machine foundations for reciprocating, impact type and Rotary machines. Vibration isolation and screening. | | | | | | CO4 |
| Text Book/s | 1. Barken D D "Dynamics of bases and foundations" McGraw Hill, New York, 1962.<br>2. Saran S "Soil Dynamics and Machine Foundations", Galogotia Publications Pvt. Ltd,New Delhi, 1999. | | | | | | |
| Reference Book/s | 1. Rao N D V K "Vibration Analysis and Foundation Dynamics" Wheeler Publishing Div. of A. H. Wheeler & Co. Ltd. New Delhi, 1998.<br>2. Krammer S "Geotechnical Earthquake Engineering" Pearson Education Pvt. Ltd. New Delhi, 2003.<br>3. Prakash S "Soil Dynamics" McGraw Hill Book Company, New York, 1981. | | | | | | |

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| Course Code | **CED353** | | | | | | |
| Course Title | **BIOLOGICAL PROCESSES FOR CONTAMINATS REMOVAL** | | | | | | |
| Course Outcomes | CO1: Analyze the various waste water constituents and also the design principles of bio reactors.<br>CO2: Evaluate the design process of waste water treatment systems.<br>CO3: Investigate the phenomenon of aeration in the biological treatment.<br>CO4: Comprehend the anaerobic processes of waste water treatment. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | *Introduction* | | | | | | |
| • | Constituents of wastewaters- sources –significant parameter - fundamentals of process kinetics, zero order, first order, second order reactions, enzyme reactions – bio reactors- types-classification – design principles. | | | | | | CO1 |
| Unit 2 | | | | | | | |
| • | Design of wastewater treatment systems-primary, secondary and tertiary treatments. Evaluation of bio-kinetic parameters-activated sludge and its process – modifications, biological nitrification and denitrification. | | | | | | CO2 |
| Unit 3 | | | | | | | |
| • | Aeration -fundamentals of gas transfer - attached growth biological treatment systems trickling filters-rotating biological contactors - activated bio filters | | | | | | CO3 |
| Unit 4 | | | | | | | |
| • | Anaerobic processes- process fundamentals-standard, high rate and hybrid reactors, anaerobic filters-expanded/fluidized bed reactors - up flow anaerobic sludge blanket reactors, expanded granular bed reactors- two stage / phase anaerobic reactors, sludge digestion, sludge disposal. | | | | | | CO4 |
| Text Book/s | 1. Process Chemistry for Water and Wastewater treatment, Benefield, L.D, Judkins, J.F and Weand, B.L Prentice-Hall, Inc. Eaglewood Cliffs, New Jersey<br>2. Microbiology, Pelczar, M.J., Chan E.C.S. and Krieg, N.R. Tata McGraw Hill, New Delhi | | | | | | |
| Reference Book/s | 1. Arceivala, S.J., Wastewater Treatment for Pollution Control, TMH, New Delhi, Second Edition, 2000.<br>2. Metcalf & Eddy, INC, 'Wastewater Engineering – Treatment and Reuse, Fourth Edition, Tata Mc Graw-Hill Publishing Company Limited, New Delhi, 2003. | | | | | | |

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| Course Code | **CED354** | | | | | | |
| Course Title | **ENVIRONMENT LAWS AND POLICIES** | | | | | | |
| Course Outcomes | CO1: Analyze the Indian legal system, judiciary, and environmental law principles including precautionary and sustainable development.<br>CO2: Evaluate wildlife and biodiversity laws, their evolution, and statutory frameworks, including the Biological Diversity Act and Forest Rights Act.<br>CO3: Examine air, water, and marine laws, covering pollution prevention, water management, judicial remedies, and coastal zone regulations.<br>CO4: Appraise the Environment (Protection) Act 1986, its genesis, powers delegation, EIA notification, waste management, and roles of stakeholders. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | *Introduction* | | | | | | |
| • | An introduction to the legal system; Constitution, Acts, Rules, Regulations; Indian Judiciary, Doctrine of precedents, judicial review, Writ petitions, Judicial activism. | | | | | | CO1 |
| • | Introduction to environmental laws in India; Constitutional provisions, Stockholm conference; Rio conference. General principles in Environmental law: Precautionary principle; Polluter pays principle; Sustainable development. | | | | | | CO1 |
| Unit 2 | | | | | | | |
| • | Wildlife and Biodiversity related laws: Evolution and Jurisprudence of forest and Wildlife laws; Colonial forest policies; Forest policies after independence Statutory framework on Forests, Wildlife and Biodiversity: Biological Diversity Act, 2002; Forest Rights Act, 2006. | | | | | | CO2 |
| Unit 3 | | | | | | | |
| • | Air, Water and Marine Laws: National Water Policy and some state policies Laws relating to prevention of pollution, access and management of water and institutional mechanism: Water Act, 1974; Water Cess Act, 1977, EPA, 1986. | | | | | | CO3 |
| • | Pollution Control Boards Ground water and law Judicial remedies and procedures Marine laws of India; Coastal zone regulations. Legal framework on Air pollution: Air Act,1981; EPA, 1986. | | | | | | CO3 |
| Unit 4 | | | | | | | |
| • | Environment (Protection) Act 1986 Genesis of the Act – delegation of powers – Role of Central Government - EIA Notification – Sitting of Industries – Coastal Zone Regulation - Responsibilities of local bodies mitigation scheme etc., for Municipal Solid Waste Management - Responsibilities of Pollution Control Boards under Hazardous Waste rules and that of occupier, authorization – | | | | | | CO4 |

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| | Biomedical waste rules – responsibilities of generators and role of Pollution Control Boards | |
| • | | |
| Text Book/s | 1. Birnie P. (2009) et al., International Law and the Environment, 3rd ed., Oxford.<br>2. Leelakrishnan P. (2006) Environmental Law Case Book, 2nd ed, Lexis Nexis, India. | |
| Reference Book/s | 1. Sands P. (2002) Principles of International Environmental Law, 2nd ed, Cambridge | |

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| Course Code | **CED355** | | | | | | |
| Course Title | **ENVIRONMENT IMPACT ASSESSMENT AND LIFE CYCLE ANALYSIS** | | | | | | |
| Course Outcomes | CO1: Acquire comprehension of the principles, process and the necessary techniques foe EIA.<br>CO2: Assess the environment impact of the proposed project on the surrounding environment with the help of different EIA Tools.<br>CO3: Identify, predict and evaluate the economic, environmental and social impact of developmental activities.<br>CO4: Promote sound and sustainable development through LCA and the identification of appropriate alternatives and mitigation measures. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | *Introduction* | | | | | | |
| • | Definition and history of environmental impact assessment, related law necessary for EIA, Objectives of Environmental Impact Assessment, Process for EIA, Components of EIA Reports | | | | | | CO1 |
| Unit 2 | | | | | | | |
| • | Tools for assessment of environmental impacts: checklist, networks, matrices, overlays, baseline study, scoping & scales, network overlays, index methods. Planning of environmental Factors. | | | | | | CO2 |
| Unit 3 | | | | | | | |
| • | Prediction and assessment of impacts on air and noise; soil and land use; water quantity and quality; biological: terrestrial ecology-forest and wildlife, coastal habitat; human use, quality of life, socio-economic. Consideration of human values in design & execution of projects. | | | | | | CO3 |
| Unit 4 | | | | | | | |
| • | Mitigation and Monitoring process for environmental impact assessment. Environmental Impact Analysis-laws & statuses in India, Elements of Environmental Auditing, Impact Analysis of hydropower, thermal power projects etc. Elements of LCA – Life Cycle Costing, Eco Labelling, Design for the Environment – International Environmental Standards – ISO 14001 | | | | | | CO4 |
| Text Book/s | 1. Canter L.W. Environmental Impact Assessment. McGraw-Hill, Inc.<br>2. Eccleston, H.C. 2000. Environmental Impact Statements. John Wiley & Sons, Inc.<br>3. Lee, N. and C. George (editors). 2000. Environmental Assessment in Developing and Transitional Countries. John Wiley & Sons Ltd. | | | | | | |
| Reference Book/s | 1. Wathern P. 1995. Environmental Impact Assessment: Theory and Practice. BiddlesLtd, Guildford and King's Lynn. | | | | | | |

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| | 2. Westmman W. E. 1985. Ecology, Impact Assessment, and Environmental Planning. John Wiley & Sons, Inc. | |

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| Course Code | **CED356** | | | | | | |
| Course Title | **INTELLIGENT TRANSPORTATION SYSTEMS** | | | | | | |
| Course Outcomes | CO1: Define ITS and its objectives, trace historical development, and elucidate benefits and data collection techniques.<br>CO2: Explain the significance of telecommunications in ITS, explore TMCs, and analyze vehicle-roadside communication and positioning systems.<br>CO3: Explore various ITS functional areas like ATMS, ATIS, CVO, AVCS, APTS, ARTS, and analyze user needs and services.<br>CO4: Examine advanced vehicle safety systems, Information Management, Automated Highway Systems, and global ITS implementations and trends. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | *Introduction* | | | | | | |
| • | Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS, Data collection techniques -Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection | | | | | | CO1 |
| Unit 2 | | | | | | | |
| • | Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Road side communication – Vehicle Positioning System; | | | | | | CO2 |
| Unit 3 | | | | | | | |
| • | ITS functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveller Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS); ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management | | | | | | CO3 |
| Unit 4 | | | | | | | |
| • | Advanced Vehicle safety systems, Information Management; Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries. | | | | | | CO4 |
| Text Book/s | 1. Chowdhury, M. A., and Sadek, A., Fundamentals of Intelligent Transportation Systems Planning, Artech House 2003 | | | | | | |

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| | 2. Sussman, J. M., Perspectives on Intelligent Transportation Systems (ITS), Springer | |
| Reference Book/s | 1. Turban, E., and Aronson, J. E., Decision Support Systems and Intelligent Systems, 5th Edition, Prentice Hall | |

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| Course Code | **CED357** | | | | | | |
| Course Title | **RAILWAY AND AIRPORT ENGINEERING** | | | | | | |
| Course Outcomes | CO1: Comprehend permanent way components and technicalities of rails.<br>CO2: Design the geometry of railway track and explain the types and functions of sleepers and ballast.<br>CO3: Know the necessity and functionality of points and crossings along with signaling and interlocking.<br>CO4: Analyze different components and laws governing the site selection of airport and also to design various components of airport. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | | | | | | | |
| • | Railway Engineering: Permanent way, gauges in railway tracks, typical railway track cross-section, coning of wheels, Function of rails, requirement of rails, types of rail sections –comparison of rail types, length of rail, rail wear, rail failures, creep of rails, rail fixtures and fastenings–Fish plates, spikes, bolts, chairs, keys, bearing plates. | | | | | | CO1 |
| Unit 2 | | | | | | | |
| • | Sleepers: Functions and requirements of sleepers, classification of sleepers, timber, metal and concrete sleeper, comparison of different types of sleepers, spacing of sleepers and sleeper density. | | | | | | CO2 |
| • | Ballast: Function and requirements of ballast, types, comparison of ballast materials. Geometric design: alignment, horizontal curves, super elevation, equilibrium, cant and cant deficiency, length of transition curve, gradients and grade compensation. Stations and yards, and their classification. | | | | | | CO2 |
| Unit 3 | | | | | | | |
| • | Points and crossings: Introduction, necessity of points and crossings, turnouts, points and crossings, design of a simple turnout. | | | | | | CO3 |
| • | Track Recording: Equipment, Mechanized Maintenance, High Speed Trans, Present & Future. | | | | | | CO3 |
| • | Signaling and interlocking: objects of signaling, engineering principle of signaling, classification of signaling, control of train movements, interlocking definition, necessity and function of interlocking, methods of interlocking, mechanical devices for inter locking. Traction and tractive resistance, stresses in track, modernization of railway track. | | | | | | CO3 |
| Unit 4 | | | | | | | |
| • | Airport Engineering: Airport site selection, various surveys for site selection. | | | | | | CO4 |

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| | Classifications of obstructions, Imaginary surfaces, Approach zone and turning zone. Runway orientation, basic runway length, corrections for elevation, temperature & gradient, airport classification. | |
| • | Runway & Taxiway Design: Geometric design of runway, airport capacity, factors controlling taxiway layout, geometric design standards for taxiway holding aprons, Wind-rose diagram, Structural design of runway pavements LCN/PCN method of rigid pavement design, Pavement Evaluation for runway & taxiway, design of overlay, Terminal area, building area, parking area, apron, hanger typical airport layouts. | CO4 |
| Text Book/s | 1. Rangawal S C "Railway Engineering" Charotar Publishers, Anand, 2002.<br>2. Arora S P and Saxena (2001), "Railway Engineering", DhanpatRai Publishers, New Delhi, 2001<br>3. Khanna, Arora and Jain "Airport Planning & Design" Nem Chand & Bros., Roorkee 2002 | |
| Reference Book/s | 1. Horren Jeff, "Airport, Planning & Design" Chapman Hall, London, 2000.<br>2. Srinivasan R and Rangwala S C "Harbours" Charotar Publishers, Anand, 1999 | |

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|---|---|---|---|---|---|---|---|
| Course Code | **CED358** | | | | | | |
| Course Title | **TRANSPORTATION ECONOMICS** | | | | | | |
| Course Outcomes | CO1: Develop skills in transportation project development, budgeting, and financial planning for effective decision-making in transportation projects.<br>CO2: Analyze transportation costs, user costs, and cost functions, and assess road pricing strategies for efficient transportation systems.<br>CO3: Evaluate vehicle operating costs, economic impact of congestion, and apply economic analysis methods to transportation projects for informed decision-making.<br>CO4: Examine indirect costs/benefits, financing methods, PPP, risk analysis, and real-world case studies for road project viability assessment. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | | | | | | | |
| • | Introductory Concepts in Transportation Decision Making: Overall transportation project development, budgeting, financial planning, the process of transportation project development, models associated with transportation impact evaluation; | | | | | | CO1 |
| Unit 2 | | | | | | | |
| • | Transportation costs - Classification of transportation costs, transportation agency costs, transportation user costs, general structure and behavior of cost functions and road pricing. | | | | | | CO2 |
| • | Estimating Transportation Demand and Supply - supply equilibration, dynamics of transportation demand and supply, elasticity of travel demand and supply, classification of elasticity. | | | | | | CO2 |
| Unit 3 | | | | | | | |
| • | Vehicle operating costs: Fuel costs - Maintenance and spares, Depreciation - Crew costs - Value of travel time savings - Accident costs. | | | | | | CO3 |
| • | Economics of traffic congestion - Pricing policy; Economic analysis of projects - Methods of evaluation - Cost-benefit ratio, first year rate of return, net present value, and internal-rate of return methods. | | | | | | CO3 |
| Unit 4 | | | | | | | |
| • | Indirect costs and benefits of transport projects; Financing of road projects - methods – Private Public Partnership (PPP) - Toll collection - Economic viability of Design-Build-Operate-Transfer Schemes – Risk Analysis – Value for Money analysis - Case Studies. | | | | | | CO4 |
| Text Book/s | 1. Highway investment in Developing countries - Thomas Telford Ltd., Institute of Civil Engineers, 3rdEdition, 1983 | | | | | | |

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| | 2. Winfrey R, "Economic Analysis for Highways", International Text Book Co., Pennsylvania, 1969.<br>3. Ian Heggie, "Transport Engineering Economics", McGraw, 3rdEdition, 1972. | |
| Reference Book/s | 1. Dickey, J.W., "Road Project Appraisal for Developing countries", John Wiley and Sons. 4th Edition, 1984.<br>2. Road User Cost Study - Final Report - Central Road Research Institute, New Delhi. | |

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| Course Code | **CED359** | | | | | | |
| Course Title | **INDUSTRIAL STRUCTURES** | | | | | | |
| Course Outcomes | CO1: Analyze the planning and functional requirements of Industrial steel structures like crane girders, communication towers etc.<br>CO2: Learn the design of chimneys by considering all the forces like earthquake, wind load and temperature effect etc.<br>CO3: Design the Silos and bunkers by various theories.<br>CO4: Evaluate the design of shell structures and machine foundation design. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | | | | | | | |
| • | Industrial steel building frames: Types of frames, bracing, crane girders and columns, workshop sheds, trussed bents, Pressed steel tank, circular tank; Transmission and Communication towers: Types and configuration. | | | | | | CO1 |
| Unit 2 | | | | | | | |
| • | Analysis and design; Chimneys; Loads and stresses in chimney shaft, Earthquake and wind effect, Stresses due to temperature difference, combined effect of loads and temperature. | | | | | | CO2 |
| Unit 3 | | | | | | | |
| • | Design of Silos and Bunkers; Jassen's theory, Airy's theory, Shallow and deep bins, Steel Stacks; introduction, force acting on a steel stack, design consideration, design example of Stacks | | | | | | CO3 |
| Unit 4 | | | | | | | |
| • | Concrete Shell Structures: Folded plate and cylindrical shell structures; Introduction structural behavior of long and short shells, beam and arch action, Machine foundations; introduction, machine vibration, structural design of foundation to rotary machines. | | | | | | CO4 |
| Text Book/s | 1. Duggal, S.K., "Design of Steel Structures", 3rd Edition, Tata McGraw-Hill<br>2. Publications, 2006.<br>3. Planning of industrial structures by C.W. Dunham. | | | | | | |
| Reference Book/s | 1. IS: 456 – 2000, IS: 800 – 2007, IS: 875 – 1964, BIS, New Delhi<br>2. Subrahmanyam, N., "Space Structures", 1st Edition, Wheeler & Co., Allahabad, 1999.<br>3. "National Building Code", BIS, New Delhi, 2005. | | | | | | |

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| Course Code | **CED360** | | | | | | |
| Course Title | **EARTHQUAKE RESISTANCE DESIGN** | | | | | | |
| Course Outcomes | CO1: Analyze seismic principles, damage patterns, and design criteria for reliable earthquake-resistant structures with diverse structural forms.<br>CO2: Apply lateral load analysis methods, seismic force estimation, and response spectrum analysis to ensure seismic stability in structures.<br>CO3: Evaluate seismic behavior and design aspects of concrete, steel, and masonry structures in adherence to relevant code provisions (IS 4326, IS 13920).<br>CO4: Execute seismic design, detailing, and reinforcement techniques for reinforced concrete and masonry structures, emphasizing flexural strength, ductility, and joint performance. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | | | | | | | |
| • | **Philosophy of earthquake resistant design**: Ductility, Redundancy & Over strength, Damping, Review of damage in past earthquakes. Criteria for earthquake resistant design, principles of reliable seismic behaviour, structural forms for earthquake resistance, earthquake forces versus other forces. | | | | | | CO1 |
| Unit 2 | | | | | | | |
| • | **Lateral Load Analysis:** Idealization of structures and selection of analysis, equivalent lateral force concepts, response spectrum analysis, seismic forces as per IS: 1893 – 1984 and IS: 1893 – 2000.Introduction to provisions of IS 1893-2002 Part-I for buildings. Estimation of lateral forces due to earthquake. | | | | | | CO2 |
| Unit 3 | | | | | | | |
| • | **Seismic behaviour of Structures:** Characteristics of Concrete structures, Steel and masonry structures, Material properties, influence of bond and anchorage and confinement of concrete. Code Provisions.<br>Introduction to provisions of IS 4326.<br>Introduction to provision of IS 13920 | | | | | | CO3 |
| Unit 4 | | | | | | | |
| • | **Design detailing of Concrete Structures:** Seismic design concepts and detailing of reinforced concrete and masonry buildings (IS 13920; IS 13 827: IS 13828; IS 4326) and flexural strength and ductility of RC members, shear behaviour of RC members, beam column joints in moment resisting frames. | | | | | | CO4 |
| Text Book/s | 1. Paz M "Structural Dynamics – Theory and Computation" CBS Publishers and Distributors, New Delhi, 2003. | | | | | | |

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| | 2. Chopra A K "Structural Dynamics" John Wiley & Sons, New Delhi, 2002.<br>3. Dowrick D J "Earthquake Resistant Design for Engineers and Architects" John Wiley & Sons, New York, 2000. | |
| Reference Book/s | 1. Paulay and Priestley "Seismic Design of Reinforced Concrete and Masonry Buildings" John Wiley and sons, New York, 1992.<br>2. Rao.S.S.,"Mechanical Vibrations" Pearson Education Publishers, 2004.<br>3. Aggarwal, P., ShriKhande, M., Earthquake Resistant Design of Structures, McGraw Hills (2003). | |

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| Course Code | **CED361** | | | | | | |
| Course Title | **STRUCTURAL DYNAMICS** | | | | | | |
| Course Outcomes | CO1: Analyze dynamic loading and idealize structures for free and forced vibrations, including damping effects.<br>CO2: Formulate equations of motion, solve for free vibrations of single degree of freedom systems using stiffness methods.<br>CO3: Examine damped vibrations, identify damping types, and analyze critically-damped and under-damped systems, considering logarithmic decrement.<br>CO4: Evaluate structural earthquake response, focusing on behavior of Concrete and Steel structures under varying loadings. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | **Theory of Vibrations:** Difference between Static and Dynamic Loading – Degree of freedom, Idealization of structures, Idealization of structure for single degree of freedom, Effect of Damping – free and forced vibrations of damped and undamped structures- Response to Periodic and Harmonic forces. | | | | | | CO1 |
| Unit 2 | **Undamped free vibrations of single degree of freedom systems:** Introduction, definitions, characteristics of a dynamic problem, degrees of freedom, Newton's law of motion, De Alembert's Principal, free body diagram, derivations of differential equation of motion, solution of differential equation of motion, equivalent stiffness of spring combinations, springs in series, springs in parallel. | | | | | | CO2 |
| Unit 3 | **Damped free vibrations of single degree of freedom systems:** Introduction, types of damping, free vibrations with viscous damping, over-damped, critically- damped and under- damped systems, logarithmic decrement, structural damping. | | | | | | CO3 |
| Unit 4 | **Response of structures to earthquake:** Effect of earthquake on different type of structures –Behaviour of Reinforced Concrete structures and Steel structures under different type of loadings. | | | | | | CO4 |
| Text Book/s | 1. Paz M "Structural Dynamics – Theory and Computation" CBS Publishers and Distributors, New Delhi, 2003.<br>2. Chopra A K "Structural Dynamics" John Wiley & Sons, New Delhi, 2002.<br>3. Paulay and Priestley "Seismic Design of Reinforced Concrete and Masonry Buildings" John Wiley and sons, New York, 1992.<br>4. A.K. Chopra, Earthquake Engineering Primer<br>5. Timoshenko, S. P., Vibration Problems in Engineering, D. Van Nostrand Company Inc. (2007). | | | | | | |

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| Reference Book/s | 1. Paz M “Structural Dynamics – Theory and Computation” CBS Publishers and Distributors, New Delhi, 2003.<br>2. Chopra A K “Structural Dynamics” John Wiley & Sons, New Delhi, 2002.<br>3. Paulay and Priestley “Seismic Design of Reinforced Concrete and Masonry Buildings” John Wiley and sons, New York, 1992.<br>4. A.K. Chopra, Earthquake Engineering Primer<br>5. Timoshenko, S. P., Vibration Problems in Engineering, D. Van Nostrand Company Inc. (2007). | |

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| Course Code | **CED362** | | | | | | |
| Course Title | **RELAIBILITY ANALYSIS OF STRUCTURES** | | | | | | |
| Course Outcomes | CO1: Analyze structural safety concepts, design methods, and basic statistics for engineering applications.<br>CO2: Assess resistance distributions, probabilistic load analysis, and basic structural reliability methods for practical engineering design.<br>CO3: Apply Monte Carlo simulation, Level 2 reliability methods, and reliability-based design in complex structural engineering scenarios.<br>CO4: Evaluate reliability-based design criteria, safety factors, and their application to structural systems conforming to Indian standards. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Concepts of Structural Safety: General, Design methods. Basic Statistics: Introduction, Data reduction, Histograms, Sample correlation. Probability Theory: Introduction, Random events, Random variables, Functions of random variables, Moments and expectation, Common probability distribution, External distribution. | | | | | | CO1 |
| Unit 2 | Resistance Distributions and Parameters: Introduction, Statistics of properties of concrete, Statistics of properties of steel, Statistics of strength of bricks and mortar, Dimensional variations, Characterization of variables, Allowable stresses based on specified reliability. Probabilistic Analysis of Loads: Gravity loads, Wind load. | | | | | | CO2 |
| Unit 3 | Basic Structural Reliability: Introduction, Computation of structural reliability. Monte Carlo Study of Structural Safety: General, Monte Carlo method, Applications. Level 2 Reliability Methods: Introduction, Basic variables and failure surface, First-order second moment methods (FOSM). | | | | | | CO3 |
| Unit 4 | Reliability Based Design: Introduction, Determination of partial safety factors, Safety checking formats, Development of reliability based design criteria, Optimal safety factors, Summary of results of study for Indian standard – RCC design. Reliability of Structural Systems: Preliminary concepts as applied to simple structures. | | | | | | CO4 |
| Text Book/s | 1. Ranganatham, R. “Structural Reliability Analysis and Design”<br>2. Melchers, R.E. “Structural Reliability” | | | | | | |

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| | 3. Ditlevsen, O. and Madsen, H.O. , Structural Reliability methods, John Wiley & Sons (2007).<br>4. Madsen, H.O., Krenk, S. and Lind, N.C, Methods of structural safety, John Wiley & Sons (1999). | |
| Reference Book/s | 1. Ranganatham, R. "Structural Reliability Analysis and Design"<br>2. Melchers, R.E. "Structural Reliability"<br>3. Ditlevsen, O. and Madsen, H.O. , Structural Reliability methods, John Wiley & Sons (2007).<br>4. Madsen, H.O., Krenk, S. and Lind, N.C, Methods of structural safety, John Wiley & Sons (1999). | |

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| Course Code | **CED363** | | | | | | |
| Course Title | **PRE-STRESSED CONCRETE** | | | | | | |
| Course Outcomes | CO1: Analyze materials & systems for pre-stressed concrete. Examine high strength concrete, tensile steel, & pre-stressing methods.<br>CO2: Evaluate prestress effects & stresses. Analyze bending stresses, load balancing, loss of prestress & beam deflection in structures.<br>CO3: Assess strength in flexure, shear & torsion. Apply strain compatibility, IS: 1343 code, & limit state design to prestressed sections.<br>CO4: Design prestressed beams & slabs. Develop transfer methods, anchorage reinforcement, cable profiles & slabs in various configurations. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | **Materials for pre-stressed concrete and pre-stressing systems:** High strength concrete and high tensile steel – tensioning devices – pre-tensioning systems – post tensioning systems. | | | | | | CO1 |
| Unit 2 | **Analysis of prestress and bending stresses:** Analysis of prestress – resultant stresses at a sector – pressure line or thrust line and internal resisting couple – concept of load balancing – losses of prestress – deflection of beams. | | | | | | CO2 |
| Unit 3 | **Strength of prestressed concrete sections in flexure, shear and torsion:** Types of flexural failure – strain compatibility method – IS: 1343 code procedure – design for limit state of shear and torsion. | | | | | | CO3 |
| Unit 4 | **Design of prestressed concrete beams and slabs:** Transfer of prestress in pre tensioned and post tensioned members – design of anchorage zone reinforcement – design of simple beams – cable profiles – design of slabs. | | | | | | CO4 |
| Text Book/s | 1. N. Krishna Raju, "Prestressed concrete", Tata McGraw Hill, 2005.<br>2. T.Y. Lin, Ned H. Burns, "Design of Prestressed Concrete Structures", John Wiley & Sons, 2001.<br>3. P. Dayaratnam, "Prestressed Concrete", Oxford & IBH, 2003.<br>**4.** R. Rajagopalan, "Prestressed Concrete".<br>5. IS 1343 2012 Code of Practice for Prestressed Concrete | | | | | | |
| Reference Book/s | 1. N. Krishna Raju, "Prestressed concrete", Tata McGraw Hill, 2005.<br>2. T.Y. Lin, Ned H. Burns, "Design of Prestressed Concrete Structures", John Wiley & Sons, 2001.<br>3. P. Dayaratnam, "Prestressed Concrete", Oxford & IBH, 2003.<br>**4.** R. Rajagopalan, "Prestressed Concrete".<br>5. IS 1343 2012 Code of Practice for Prestressed Concrete | | | | | | |

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| Course Code | **CED364** | | | | | | |
| Course Title | **DESIGN OF STRUCTURAL SYSTEMS** | | | | | | |
| Course Outcomes | CO1: Develop skills in structural planning, material selection, and design criteria formulation in construction processes.<br>CO2: Apply knowledge of loads, safety, and functional requirements to choose optimal structural schemes effectively.<br>CO3: Utilize computer-aided tools for preliminary design and proportioning, incorporating formulated design criteria.<br>CO4: Analyze structural response, cost, and value to make informed decisions in the construction and design field. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Planning and Design Process of structure, Materials and Structural Design Criteria | | | | | | CO1 |
| Unit 2 | Loads and Design Safety of functional requirements, selection of structural scheme | | | | | | CO2 |
| Unit 3 | Formulation of design criteria, preliminary and computer- aided proportioning | | | | | | CO3 |
| Unit 4 | Analysis of response, cost, and value | | | | | | CO4 |
| Text Book/s | 1. Galambos, T.V., Lin, F.J., Johnston, B.G., *Basic Steel Design with LRFD*, Prentice Hall, 1996<br>2. Segui, W. T., *LRFD Steel Design*, 2nd Ed., PWS Publishing, Boston.<br>3. Salmon, C.G. and Johnson, J.E., *Steel Structures: Design and Behavior*, 3rd Edition, Harper & Row, Publishers, New York, 1990.<br>4. MacGregor, J. G., *Reinforced Concrete: Mechanics and Design*, 3rd Edition, Prentice Hall, New Jersey, 1997.<br>5. Nawy, E. G., *Reinforced Concrete: A Fundamental Approach*, 5th Edition, Prentice Hall, New Jersey.<br>6. Wang C-K. and Salmon, C. G., *Reinforced Concrete Design*, 6th Edition, Addison Wesley, New York.<br>7. Nawy, E. G. *Prestressed Concrete: A Fundamental Approach*, Prentice Hall, NJ, (2003).<br>8. PCI, *PCI Design Handbook: Precast and Prestressed Concrete*, Precast/Prestressed Concrete Institute, IL, 1992.<br>9. Smith, J. C., *Structural Analysis*, Harpor and Row, Publishers, New York.<br>10. W. McGuire, R. H. Gallagher and R. D. Ziemian. " Matrix Structural Analysis", 2nd Edition, John Wiley and Sons, 2000.<br>11. ACI, *Building Code Requirements for Structural Concrete (ACI 318-99) and Commentary (ACI 318R-99)*, American Concrete Institute, 1999.<br>12. AISC, *Load and Resistance Factor Design - Manual for Steel Construction*, American Institute of Steel Construction. | | | | | | |

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| Reference Book/s | 1. Galambos, T.V., Lin, F.J., Johnston, B.G., *Basic Steel Design with LRFD*, Prentice Hall, 1996<br>2. Segui, W. T., *LRFD Steel Design*, 2nd Ed., PWS Publishing, Boston.<br>3. Salmon, C.G. and Johnson, J.E., *Steel Structures: Design and Behavior*, 3rd Edition, Harper & Row, Publishers, New York, 1990.<br>4. MacGregor, J. G., *Reinforced Concrete: Mechanics and Design*, 3rd Edition, Prentice Hall, New Jersey, 1997.<br>5. Nawy, E. G., *Reinforced Concrete: A Fundamental Approach*, 5th Edition, Prentice Hall, New Jersey.<br>6. Wang C-K. and Salmon, C. G., *Reinforced Concrete Design*, 6th Edition, Addison Wesley, New York.<br>7. Nawy, E. G. *Prestressed Concrete: A Fundamental Approach*, Prentice Hall, NJ, (2003).<br>8. PCI, *PCI Design Handbook: Precast and Prestressed Concrete*, Precast/Prestressed Concrete Institute, IL, 1992.<br>9. Smith, J. C., *Structural Analysis*, Harpor and Row, Publishers, New York.<br>10. W. McGuire, R. H. Gallagher and R. D. Ziemian. " Matrix Structural Analysis", 2nd Edition, John Wiley and Sons, 2000.<br>11. ACI, *Building Code Requirements for Structural Concrete (ACI 318-99) and Commentary (ACI 318R-99)*, American Concrete Institute, 1999.<br>12. AISC, *Load and Resistance Factor Design - Manual for Steel Construction*, American Institute of Steel Construction. | |

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| Course Code | **CED450** | | | | | | |
| Course Title | **MASONARY STRUCTURES** | | | | | | |
| Course Outcomes | CO1: Analyze masonry materials and construction, including defects and errors, to ensure structural integrity and quality.<br>CO2: Apply stress analysis techniques to determine permissible stresses and design considerations for different masonry wall types.<br>CO3: Evaluate load considerations and design masonry walls under various axial load scenarios, including walls with openings and supports.<br>CO4: Formulate designs for masonry walls exposed to concentrated axial and eccentric loads, ensuring stability and load distribution. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Masonry Units, Materials, types and masonry construction: Bricks, Stone and Block masonry units- strength, modulus of elasticity and water absorption of masonry materials – classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.<br>Strength and Stability: Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae. | | | | | | CO1 |
| Unit 2 | Permissible stresses: Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.<br>Design Considerations: Effective height of walls and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars | | | | | | CO2 |
| Unit 3 | Load considerations and design of Masonry subjected to axial loads: Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers. | | | | | | CO3 |
| Unit 4 | Design of walls subjected to concentrated axial loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings.<br>Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads – problems on eccentrically loaded solid walls, cavity walls, walls with piers. | | | | | | CO4 |
| Text Book/s | 1. Masonry Designers' Guide, 3rd Edition, Edited by John H. Matthys, The Masonry Society, 2001, Boulder, CO. | | | | | | |

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| | 2. Building Code Requirements for Masonry Structures, American Concrete Institute, 2002, Farmington Hills, MI.<br>3. Minimum Design Loads for Buildings and Other Structures (ASCE 7-10), American Society of Civil Engineers, New York, 2010<br>4. Masonry Structural Design, R. E. Klingner, McGraw-Hill, 2010.<br>5. .Masonry Structures - Behavior and Design 3rd Edition, R. G. Drysdale and A. A.• Hamid, The Masonry Society, Boulder, Colorado, 2008. | |
| Reference Book/s | 1. Masonry Designers' Guide, 3rd Edition, Edited by John H. Matthys, The Masonry Society, 2001, Boulder, CO.<br>2. Building Code Requirements for Masonry Structures, American Concrete Institute, 2002, Farmington Hills, MI.<br>3. Minimum Design Loads for Buildings and Other Structures (ASCE 7-10), American Society of Civil Engineers, New York, 2010<br>4. Masonry Structural Design, R. E. Klingner, McGraw-Hill, 2010.<br>5. Masonry Structures - Behavior and Design 3rd Edition, R. G. Drysdale and A. A.• Hamid, The Masonry Society, Boulder, Colorado, 2008. | |

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| Course Code | **CED451** | | | | | | |
| Course Title | **SUSTAINABLE CONSTRUCTION METHODS** | | | | | | |
| Course Outcomes | CO1: Explore sustainability principles, environmental challenges, global warming, and green building concepts for sustainable urban development.<br>CO2: Examine energy conservation, HVAC systems, energy audits, and the shift from fossil fuels to renewables for efficient building practices.<br>CO3: Investigate green materials, indoor environmental quality, and building commissioning to enhance sustainable construction and occupant well-being.<br>CO4: Analyze economics of green construction, life-cycle analysis, and feasibility assessment for informed decision-making in green building projects. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Principles of Sustainability Introduction to Sustainability Major Environmental Challenges Global Warming Introduction to Green Buildings; LEED Greening Our Campus Sustainable Urban Development Sustainable Sites - LEED Credits. | | | | | | CO1 |
| Unit 2 | Energy Conservation Energy Conservation in Buildings HVAC Systems Energy and Atmosphere - LEED Credits eQuest Energy Simulations Conducting an Energy Audit Fossil Fuels vs. Renewable Energy | | | | | | CO2 |
| Unit 3 | Green Materials and Resources - LEED Credits Building Deconstruction, C&D Recycling Indoor Environmental Quality – Basic IEQ - LEED Credits Building Commissioning | | | | | | CO3 |
| Unit 4 | Economics of Green Construction ,Economics of Green Buildings LCC/LCA Green Home Construction Evaluate feasibility of alternative products and solutions based on life-cycle analysis (LCA) methods | | | | | | CO4 |
| Text Book/s | 1. Main text: C.J. Kibert (2008) "Sustainable Construction: Green Building Design and Delivery", 2nd Ed., John Wiley, Hoboken, New Jersey<br>2. Complementary text: G.T. Miller Jr. (2004) "Living in the Environment Principles, Connections, and Solutions", 14th Ed., Brooks Cole, Pacific Grove, California<br>3. High Performance Buildings, ASHRAE publication, http://www.HPBmagazine.com. | | | | | | |
| Reference Book/s | 1. Main text: C.J. Kibert (2008) "Sustainable Construction: Green Building Design and Delivery", 2nd Ed., John Wiley, Hoboken, New Jersey<br>2. Complementary text: G.T. Miller Jr. (2004) "Living in the Environment Principles, Connections, and Solutions", 14th Ed., Brooks Cole, Pacific Grove, California<br>3. High Performance Buildings, ASHRAE publication, http://www.HPBmagazine.com | | | | | | |

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| Course Code | **CED452** | | | | | | |
| Course Title | **CONSTRUCTION EQUIPMENT AND AUTOMATION** | | | | | | |
| Course Outcomes | CO1: Compare conventional and mechanized construction methods, highlighting mechanization's advantages.<br>CO2: Identify diverse construction equipment for tasks like earthmoving, concreting, and material transport, emphasizing their roles.<br>CO3: Examine heavy machinery like cranes and hoists, discussing their functions, productivity, and material transportation equipment.<br>CO4: Explore advanced surveying techniques: aerial surveying, GIS, GPS, drones, and robots, emphasizing their applications in construction. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Introduction to Conventional construction methods Vs Mechanized methods and advantages of latter | | | | | | CO1 |
| Unit 2 | Different equipment used in construction: - Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; plastering machines; Pre-stressing jacks and grouting equipment. | | | | | | CO2 |
| Unit 3 | Heavy Machinery: - Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities; | | | | | | CO3 |
| Unit 4 | Aerial and Satellite Surveying: GIS and GPS in Construction; use of Drones for spread out sites; Use of robots for repetitive activities | | | | | | CO4 |
| Text Book/s | 1.Construction Planning and Equipment - R.L.Peurifoy - Tata McGraw Hill, New Delhi<br>2. Construction Equipment & Planning and Application. - Mahesh VermaArtec Publication.<br>3. GPS satellite surveying- Alfred Leick,.Wiley. | | | | | | |
| Reference Book/s | 1.Construction Planning and Equipment - R.L.Peurifoy - Tata McGraw Hill, New Delhi<br>2. Construction Equipment & Planning and Application. - Mahesh VermaArtec Publication.<br>3. GPS satellite surveying- Alfred Leick,.Wiley | | | | | | |

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| Course Code | **CED453** | | | | | | |
| Course Title | **CONSTRUCTION COST ANALYSIS** | | | | | | |
| Course Outcomes | CO1: Apply scientific principles to construction costs and analyze factors affecting them in engineering contexts.<br>CO2: Analyze direct and overhead costs, markups, and profits, employing statistical measures for informed decision-making.<br>CO3: Calculate project funds, manage cash flow, and evaluate contract-based cash inflow/outflow, aligning with project expectations.<br>CO4: Master cost recording, cash custody, and payment types for effective construction cost accounts and financial controls. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Introduction to the application of scientific principles to costs and estimates of costs in construction engineering, concepts and statistical measurements of the factors involved in construction cost. | | | | | | CO1 |
| Unit 2 | Concepts and statistical measurements of the factors involved in direct costs, general overhead costs, cost markups and profits. | | | | | | CO2 |
| Unit 3 | Determining the funds required for a construction job; preparing cash flow statements; cash inflow and outflow during contract period; project expectations. | | | | | | CO3 |
| Unit 4 | The fundamentals of cost recording for construction cost accounts and cost controls. Precautions in custody of cash, imprest account and temporary advance; maintenance of temporary advance; and advance account; different types of payment, first, running, advance and final payments. | | | | | | CO4 |
| Text Book/s | 1. Mueller, F.W. Integrated cost and schedule control for construction projects.<br>2. Gobourne: Cost control in the construction industry.<br>3. Schedule of rates, specification manuals etc. from PWD<br>4. Chris Hendrickson and Tung Au: Project Management for Construction<br>5. Datta : Material Management Procedures, Text and Cases, 2e Prentice Hall<br>6. Gopalakrishnan ,P,Sundaresan , M: Material Management - an Integrated Approach, Prentice Hall.. | | | | | | |
| Reference Book/s | 1. Mueller, F.W. Integrated cost and schedule control for construction projects.<br>2. Gobourne: Cost control in the construction industry.<br>3. Schedule of rates, specification manuals etc. from PWD<br>4. Chris Hendrickson and Tung Au: Project Management for Construction<br>5. Datta : Material Management Procedures, Text and Cases, 2e Prentice Hall<br>6. Gopalakrishnan ,P,Sundaresan , M: Material Management - an Integrated Approach, Prentice Hall. | | | | | | |

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| Course Code | **CED454** | | | | | | |
| Course Title | **ECOLOGICAL ENGINEERING** | | | | | | |
| Course Outcomes | CO1: Define ecology, analyze ecosystem types, explore biotic-abiotic interactions, examine population dynamics, and comprehend community structure.<br>CO2: Analyze eco technology classification, assess environmental system interactions, and evaluate human impacts on environmental systems.<br>CO3: Investigate ecological engineering processes, study energy concepts, and apply ecological engineering in agro ecosystems and disaster scenarios.<br>CO4: Comprehend the soil infiltration, wetlands, source separation, aqua cultural, and detritus-based systems, and their applications in ecological engineering for marine environments. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Ecology: Definition and scope of ecology, types of ecosystem, abiotic and biotic environments, biotic – abiotic interactions, Population ecology, Community structure, two-species interactions, food webs, succession, disturbance and succession, negative and positive feedbacks in succession. Energy flows, nutrient cycling | | | | | | CO1 |
| Unit 2 | Classification of eco technology – Principles and components of Systems and Modeling –Structural and functional interactions in environmental systems – Human modifications of environmental systems. | | | | | | CO2 |
| Unit 3 | Ecological Engineering Processes: Self-organizing processes – Multiple seeded microcosms – Interface coupling in ecological systems. Concepts of energy – Adapting ecological engineering systems to potentially catastrophic events – Agro ecosystems – Determination of sustainable loading of ecosystems | | | | | | CO3 |
| Unit 4 | Principles and operation of soil infiltration systems – wetlands and ponds – source separation systems – aqua cultural systems – detritus based treatment for solid wastes – Applications of ecological engineering marine systems. | | | | | | CO4 |
| Text Book/s | 1.Mitsch, J.W & Jorgensen, S.E., Ecological Engineering – An Introduction to Eco technology, John Wiley & Sons, New York, 1989.<br>2. White, I.D, Mottershed, D.N and Harrison, S.L., Environmental Systems – An Introductory Text, Chapman Hall, London, 1994<br>3. Basic Ecology, E .P. Odum, H.S Publication.<br>4. Energy and Ecological Modelling, W.J Mitch, R. W. Bosserman and Klopatek JN, Elsevier Publication | | | | | | |
| Reference Book/s | 1.Mitsch, J.W & Jorgensen, S.E., Ecological Engineering – An Introduction to Eco technology, John Wiley & Sons, New York, 1989.<br>2. White, I.D, Mottershed, D.N and Harrison, S.L., Environmental Systems – An Introductory Text, Chapman Hall, London, 1994<br>3. Basic Ecology, E .P. Odum, H.S Publication. | | | | | | |

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| | 4. Energy and Ecological Modelling, W.J Mitch, R. W. Bosserman and Klopatek JN, Elsevier Publication | |

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| Course Code | **CED455** | | | | | | |
| Course Title | **AIR AND NOISE POLLUTION CONTROL** | | | | | | |
| Course Outcomes | CO1: Analyze air pollution's global significance, effects, and atmospheric composition for informed environmental engineering decisions.<br>CO2: Apply meteorological concepts, dispersion modeling, and plume behavior to assess air quality and make effective engineering choices.<br>CO3: Evaluate air pollution through stack monitoring, indoor models, and control measures for stationary and mobile sources.<br>CO4: Examine noise pollution's impact, prediction, control, and health effects, considering criteria, factors, and monitoring techniques. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Introduction to air pollution– environmental engineering significance – global issues – units, Effects of air pollution– visibility – basic calculations Atmospheric composition – temperature profile | | | | | | CO1 |
| Unit 2 | Meteorology- lapse rate – stability conditions, Maximum mixing depth– plume behavior, Dispersion– modeling – engineering decisions – maxi ground level concentration - effective stack height. | | | | | | CO2 |
| Unit 3 | Air pollution sampling– Stack monitoring, control measures, Indoor air quality models, Air pollution control of stationary & mobile sources. | | | | | | CO3 |
| Unit 4 | Introduction, Rating Systems, Sources & Criteria, Noise prediction and Control. Noise pollution in India, Factors Affecting Noise Pollution, Road Traffic Noise Monitoring, Ambient Noise Monitoring, Occupational Noise Monitoring, traffic noise data analysis, health effects of noise. | | | | | | CO4 |
| Text Book/s | 1. Air Pollution, Perkins H C ,McGraw Hill Book Company, New York<br>2. Environmental Pollution Control Engineering, Rao, C S, New Age Pub. New Delhi,2nded<br>3. S.K. Agarwal (2009). Noise Pollution. ISBN No. 817648833X<br>4. S.P. Singal .Noise Pollution and Control Strategy. ISBN No. 81-7319-645-1. | | | | | | |
| Reference Book/s | 1. Air Pollution, Perkins H C ,McGraw Hill Book Company, New York<br>2. Environmental Pollution Control Engineering, Rao, C S, New Age Pub. New Delhi,2nded<br>3. S.K. Agarwal (2009). Noise Pollution. ISBN No. 817648833X<br>4. S.P. Singal .Noise Pollution and Control Strategy. ISBN No. 81-7319-645-1. | | | | | | |

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| Course Code | **CED456** | | | | | | |
| Course Title | **SOLID WASTE MANAGEMENT** | | | | | | |
| Course Outcomes | CO1: Identify solid waste types, sources, and related laws, integrated waste management concepts.<br>CO2: Analyze waste characteristics, reduction strategies, recycling, and waste handling systems. Evaluate hazardous waste management practices.<br>CO3: Examine waste processing technologies: composting, thermal conversion, energy recovery, and hazardous waste treatment. Assess biomedical waste treatment methods.<br>CO4: Evaluate landfill disposal processes: site selection, design, operation, leachate management, and landfill closure, environmental monitoring and remediation techniques. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Introduction to solid waste: Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management, Legislations on management and handling of municipal solid wastes, hazardous wastes, and biomedical wastes, Elements of integrated waste management. | | | | | | CO1 |
| Unit 2 | Waste characterization and analysis Waste generation rates, Composition, Hazardous Characteristics, waste sampling, Source reduction of wastes, Recycling and reuse. Management of solid waste Handling and segregation of wastes at source, storage and collection of municipal solid wastes, Analysis of Collection systems, need for transfer and transport – Transfer stations - labeling and handling of hazardous wastes. | | | | | | CO2 |
| Unit 3 | Waste processing – processing technologies, biological and chemical conversion technologies, Composting, thermal conversion technologies, energy recovery, incineration, solidification and stabilization of hazardous wastes, treatment of biomedical wastes. | | | | | | CO3 |
| Unit 4 | Disposal on landfill Disposal in landfills - site selection, design and operation of sanitary landfills, secure landfills and landfill bioreactors, leachate and landfill gas management, landfill closure and environmental monitoring, landfill remediation. | | | | | | CO4 |
| Text Book/s | 1. George Tchobanoglous, Hilary Theisen, Samuel A. Viquel, “Integrated Solid Waste Management: Engineering, Principles & Management issues”, McGraw-Hill- International Edition.<br>2. CPHEEO Manual on Municipal Solid Waste Management.<br>3. Michael D. LaGrea, Phillip L. Buckingham, Jeffrey C. Evans, “Hazardous Waste Management and Environmental Resource Management”, McGraw-Hill- International Edition.<br>4. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, “Environmental Engineering”, McGraw-Hill- International Edition.<br>5. Mackenzige L. Davis, David A. Cornwell, “Introduction to environmental | | | | | | |

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| | engineering", McGraw-Hill- International Edition | |
| Reference Book/s | 1. George Tchobanoglous, Hilary Theisen, Samuel A. Viquel, "Integrated Solid Waste Management: Engineering, Principles & Management issues", McGraw-Hill- International Edition.<br>2. CPHEEO Manual on Municipal Solid Waste Management.<br>3. Michael D. LaGrea, Phillip L. Buckingham, Jeffrey C. Evans, "Hazardous Waste Management and Environmental Resource Management", McGraw-Hill- International Edition.<br>4. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, "Environmental Engineering", McGraw-Hill- International Edition.<br>5. Mackenzige L. Davis, David A. Cornwell, "Introduction to environmental engineering", McGraw-Hill- International Edition | |

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| Course Code | **CED457** | | | | | | |
| Course Title | **DESIGN OF CONCRETE STRUCTURES-II** | | | | | | |
| Course Outcomes | CO1: Analyze moment redistribution in RC beams, apply limit analysis, and interpret moment-curvature relationships in structural elements. Design of staircases.<br>CO2: Apply RCC footing theories to design isolated, combined, and raft footings, considering various geometric configurations and loadings.<br>CO3: Design curved plan beams, including semi-circular and circular beams, and analyze building frames for critical loads using SP16 guidelines.<br>CO4: Design different types of retaining walls (cantilever and counterfort), water tanks, and staging structures, applying relevant design criteria and principles. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Redistribution of moments: Introduction; limit analysis applied to RC beam fixed at ends, Moment curvature relationship, Continuous beam and one-way continuous slab<br>Design of staircases: - Introduction, Types of stair case, Design considerations, design of Dog-legged and open- well staircase. | | | | | | CO1 |
| Unit 2 | RCC Footings - Theory and Design: Isolated Footing (Square, Rectangular), Combined Footing (Rectangular, Trapezoidal, Strap), Raft Footing | | | | | | CO2 |
| Unit 3 | Beams curved in plan: Design of semi-circular beams supported on three supports. Design of circular beam supported on symmetrically placed columns. Building Frames: Load patterns for critical conditions, design of continuous beams, slabs, columns, detailing of reinforcement in the same. (Use of SP16) | | | | | | CO3 |
| Unit 4 | Retaining walls: Cantilever type retaining wall, Counter fort type retaining wall. Water tank and staging; Introduction, Design criteria, Design of rectangular and circular water tank, Design of Intze tank, Staging for overhead tank; | | | | | | CO4 |
| Text Book/s | 1. Pillai&Menon ;"Reinforced Concrete Design";; Tata McGraw-Hill Education, 2006.<br>2. Varghese P C "Limit state Design of Reinforced Concrete" Prentice-Hall of India Pvt. Ltd. 2009.<br>3. Mallick and Rangasamy ;"Reinforced Cement Concrete" Oxford-IBH, 2010.<br>4. Syal I.C "Behaviour, Analysis and Design of Reinforced Concrete Structural Elements" S. Chand & company, New Delhi, 2003.<br>5. James, G. Mac Gregor, "Reinforced Concrete- Mechanics and Design", Prentice Hall, N.J., New York, 1997<br>6. Design of Reinforced Concrete Structure by P Dayaratnam P Sarah<br>7. Design of Reinforced Concrete by Jack C. McCormac, Russell H. Brown wiley publications.<br>8. Reinforced concrete design by Abi O. Aghayere | | | | | | |

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| Reference Book/s | 1. Pillai&Menon ;"Reinforced Concrete Design";; Tata McGraw-Hill Education, 2006.<br>2. Varghese P C "Limit state Design of Reinforced Concrete" Prentice-Hall of India Pvt. Ltd. 2009.<br>3. Mallick and Rangasamy ;"Reinforced Cement Concrete" Oxford-IBH, 2010.<br>4. Syal I.C "Behaviour, Analysis and Design of Reinforced Concrete Structural Elements" S. Chand & company, New Delhi, 2003.<br>5. James, G. Mac Gregor, "Reinforced Concrete- Mechanics and Design", Prentice Hall, N.J., New York, 1997<br>6. Design of Reinforced Concrete Structure by P Dayaratnam P Sarah<br>7. Design of Reinforced Concrete by Jack C. McCormac, Russell H. Brown wiley publications.<br>8. Reinforced concrete design by Abi O. Aghayere | |

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| Course Code | **CED458** | | | | | | |
| Course Title | **MATRIX METHODS FOR STRUCTURAL ANALYSIS** | | | | | | |
| Course Outcomes | CO1: Develop comprehending of matrices, determinants, and their applications in solving linear equations and systems.<br>CO2: Analyze pin-jointed frames using the flexibility method, considering temperature effects and displacements in indeterminate structures.<br>CO3: Master the stiffness method for structural analysis, handling relative displacements, and analyzing indeterminate pin-jointed frames.<br>CO4: Apply computer tools like MS Excel to perform matrix-based structural analysis on various types of beams, trusses, and frames. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | **Fundamentals of Matrices and Determinants** | | | | | | CO1 |
| • | Review of Determinants and Matrices: Introduction, summation convention, determinants and their properties, Cramer's rule, matrices and their properties, solution of non-homogeneous equations by matrix methods, differentiation and integration of a matrix. | | | | | | CO1 |
| Unit 2 | **Flexibility Method for Structures** | | | | | | CO2 |
| • | Flexibility method of Analysis: Introduction, method of consistent deformation, application to pin-jointed frames, effect of temperature and pre-strain. | | | | | | CO2 |
| • | displacements and forces in members of indeterminate structures, flexibility matrix of a plane member. | | | | | | CO2 |
| Unit 3 | **Stiffness Method for Analysis** | | | | | | CO3 |
| • | Stiffness Method of Analysis: Introduction, relation between slope deflection method and stiffness method, choice between flexibility and stiffness method | | | | | | CO3 |
| • | stiffness method for members with relative displacement of supports, analysis of indeterminate structures, analysis of pin-Jointed frames. | | | | | | CO3 |
| Unit 4 | **Matrix Analysis in Engineering** | | | | | | CO4 |
| • | Computer Applications: Matrix structural analysis using spreadsheets, MS Excel Matrix Commands, MS Excel procedure for stiffness method of analysis, analysis of single span beams, continuous beams, plane trusses and plane frames. | | | | | | CO4 |
| Text Book/s | 1. Gere W and Weaver J M; "Matrix Analysis of Structures" CBS Publishers, New Delhi, 1986.<br>2. Kanchi M B; "Matrix Methods of Structural Analysis" Wiley Eastern Limited, New Delhi, 2002.<br>3. Ganju T N; "Matrix Structural Analysis using Spreadsheets" TMH | | | | | | |

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| | Publishing Co. Ltd. New Delhi,2002. | |
| Reference Book/s | 1. Vazirani V N and Ratwani M M; "Advanced Theory of Structures and Matrix Methods" Khanna Publishers, New Delhi, 1995.<br>2. Pandit G S and Gupta S P; "Structural Analysis A Matrix Approach" Tata McGraw Hill, New Delhi, 1994. | |

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| Course Code | **CED459** | | | | | | |
| Course Title | **ENVIRONMENTAL GEOTECHNOLOGY** | | | | | | |
| Course Outcomes | CO1: Comprehend soil formation, composition, and structure's influence on engineering behavior for effective geotechnical applications.<br>CO2: Grasp mechanisms of subsurface contamination, its detection, monitoring, and the impact of contaminants on soil properties.<br>CO3: Gain proficiency in comprehensive site investigation techniques, including geophysical and hydro-geological methods for environmental assessment.<br>CO4: Develop knowledge of waste containment concepts, remediation strategies, and real-world case studies related to geo-environmental challenges. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | **Soil Formation and Structure** | | | | | | CO1 |
| • | Introduction and soil mineralogy: Scope of environmental geotechnology and its applications, Soil Formation, Composition and Structure: Introduction, Soil formation, Solids composition and characterization. | | | | | | CO1 |
| • | Mineral composition, Different scales of soil structure, Structural variations due to consolidation and compaction, Role of Composition and soil structure in the engineering behavior of soils. | | | | | | CO1 |
| Unit 2 | **Subsurface Contamination Mechanisms** | | | | | | CO2 |
| • | Contamination in soils: Subsurface contamination, Mass transport mechanisms, Mass transfer mechanisms, Governing equation for mass transport, Soil as a geotechnical trap, effects of subsurface contamination its detection and monitoring. | | | | | | CO2 |
| • | Mechanisms of soil-water interaction: Diffuse double layer and simple DDL models; Force of attraction and repulsion; Soil-water-contaminant interaction; Effect of contaminants on engineering properties of soil. | | | | | | CO2 |
| Unit 3 | **Comprehensive Site Investigation** | | | | | | CO3 |
| • | Site investigation: Introduction, Site investigation approach, phase investigations, Geophysical techniques | | | | | | CO3 |
| • | Hydro-geological investigations, Hydro-geochemical investigations, Geochemical data collection and analysis. | | | | | | CO3 |
| Unit 4 | **Waste Containment and Remediation** | | | | | | CO4 |
| • | Concepts of waste containment facilities: Desirable properties of soil; contaminant transport and retention; containment of solid waste in landfills, environmental impact of slurry waste and containment of slurry wastes, contaminated site remediation. | | | | | | CO4 |
| • | Case histories: Case histories on geo-environmental problems pertaining to use | | | | | | CO4 |

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| | of readily available local soils, bio-remediation of spills etc. | |
| Text Book/s | 1. Mitchell, J.K. and Soga, K., Fundamentals of Soil Behaviour, John Wiley & Sons, Inc., New Jersey., 2005<br>2. Reddy, L.N. and Inyang. H. I., Geoenvironmental Engineering –Principles and Applications, Marcel Dekker, Inc., New York., 2000<br>3. Mohamed, A.M.O. and Antia, H.E., Geoenvironmental Engineering, Elsevier, Netherlands., 1998<br>4. Hsai_Yang Fang and Daniels, J.L. Introductory Geotechnical Engineering an Environmental Perspective, Taylor & Francis, Oxon., 2006 | |
| Reference Book/s | 1. Yong, R. N., Geoenvironmental Engineering: Contaminated Soils, Pollutant Fate and Mitigation", CRC press LLC, Florida., 2001.<br>2. Fang, H.Y, Introduction to Environmental Geotechnology, CRC Press, 1997. 7. " Proceedings of the International symposium of Environmental Geotechnology (Vol. I and Vol. II) ",4. Environmental Publishing Co., 1986 and 1989.<br>3. CDEEP, IITB video lectures on course CE 488 and CE 641 by Prof. D. N. Singh | |

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| Course Code | **CED460** | | | | | | |
| Course Title | **PORT AND HARBOUR ENGINEERING** | | | | | | |
| Course Outcomes | CO1: Comprehend the principles and significance of water transportation and its various components, including inland waterways, harbours, and ports.<br>CO2: Analyze the impact of natural phenomena such as wind, tides, waves, and sediment transport on harbour design, structure, and coastal protection.<br>CO3: Comprehend the design, construction, and functionality of different harbour infrastructures, including breakwaters, docks, piers, and navigational aids.<br>CO4: Develop the skills to plan and evaluate port facilities for efficient cargo and passenger handling, considering regional connectivity, economic viability, and environmental impacts. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | **Water Transportation Scope** | | | | | | CO1 |
| • | Water Transportation: Scope, Merits, Developments of Water Transportation in India, Inland waterways, River, Canal, Inland water transportation | | | | | | CO1 |
| • | Development of ports & Harbours, Harbour classification, Site selection, Harbour dimensioning. | | | | | | CO1 |
| Unit 2 | **Natural Phenomena Effects** | | | | | | CO2 |
| • | Natural Phenomena: Wind, Tides, Water waves, Wave decay & port, wave diffraction, breaking, reflection, | | | | | | CO2 |
| • | Littoral drift, sediment transport, Effects on Harbour and structure design. | | | | | | CO2 |
| Unit 3 | **Harbour Infrastructure Types** | | | | | | CO3 |
| • | Harbour Infrastructures: Types of breakwaters, jetty, dock fenders, piers, wharves, dolphin, mooring accessories, | | | | | | CO3 |
| • | Repair facilities, wet docks, lift docks, dry docks, gates for graving docks, floating docks, slipways, locks and gates | | | | | | CO3 |
| Unit 4 | **Port Facility Planning** | | | | | | CO4 |
| • | Port facility: Transit shed, warehouses, cargo handling, container handling, Inland port facility, Navigational aids, types, requirements of signals, lighthouses, beacon light, buoys. Dredging & coastal protection: | | | | | | CO4 |
| • | Types of dredgers, choices, usage of dredged material, sea wall protection-sea wall revetment, bulkhead, Planning of ports: For regional and intercontinental transportation development, forecasting cargo & passenger demand, regional connectivity, cargo handling capacity of port, economic evaluation of port project, impacts of port activities. | | | | | | CO4 |
| Text Book/s | Port and Harbour Engineering: 6 (Studies in the History of Civil Engineering) by | | | | | | |

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| | Adrian Jarvis<br>Handbook of Port and Harbor Engineering: Geotechnical and Structural Aspects by Gregory Tsinker<br>Port Engineering by Per Bruun<br>Ocean engineering by NPTEL<br>Port Engineering: Planning, Construction, Maintenance, and Security by Gregory P. Tsinker | |
| Reference Book/s | 1. Port Engineering, Volume 1: Harbor Planning, Breakwaters, and Marine Terminals by Dr. Per Bruun<br>2. Port Engineering, Volume 2: Harbor Transportation, Fishing Ports, Sediment Transport, Geomorphology, Inlets, and Dredging by Dr. Per Bruun | |

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| Course Code | **CED461** | | | | | | |
| Course Title | **DESIGN OF HYDRAULIC STRUCTURES** | | | | | | |
| Course Outcomes | CO1: Comprehend head work components, seepage theories, and silt control mechanisms in hydraulic engineering projects.<br>CO2: Gain expertise in designing weirs, barrages, and energy dissipation structures for effective water flow management.<br>CO3: Develop skills in regulating canal flows through cross-drainage works, falls, and escape mechanisms for optimized water distribution.<br>CO4: Master the design principles of canal outlets, aqueducts, and siphons, focusing on efficiency, modularity, and hydraulic behavior. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | | | | | | | CO1 |
| • | **Head Works**: Types of head works, Functions and investigations of a diversion head Work: component parts of a diversion head work and their design considerations, silt control devices. | | | | | | CO1 |
| • | **Theories of Seepage**: Seepage force and exit gradient, assumptions and salient features of Bligh's Creep theory, Limitations of Bligh's Creep theory, salient features of Lane's weighted Creep theory and Khosla's theory, Comparison of Bligh's Creep theory and Khosla's theory, Determination of uplift pressures and floor thickness. | | | | | | CO1 |
| Unit 2 | | | | | | | CO2 |
| • | **Design of Weirs**: Weirs versus barrage, types of weirs, main components of weir, causes of failure of weir and design considerations with respect to surface flow, hydraulic jump and seepage flow. Design of barrage or weir. | | | | | | CO2 |
| • | **Energy Dissipation Devices**: Use of hydraulic jump in energy dissipation, Factors affecting design, Types of energy dissipaters and their hydraulic design. | | | | | | CO2 |
| Unit 3 | | | | | | | CO3 |
| • | **Canal Regulators**: Off take alignment, cross-regulators–their functions and design, Distributory head regulators, their design, canal escape. | | | | | | CO3 |
| • | **Canal Falls**: Necessity and location, types of falls and their description, selection of type of falls, Principles of design, Design of Sarda type, straight glacis and Inglis or baffle wall falls. | | | | | | CO3 |
| Unit 4 | | | | | | | CO4 |
| • | **Cross-Drainage works**: Definitions, choice of type, Hydraulic design consideration, Aqueducts their types and design, siphon aqueducts – their types | | | | | | CO4 |

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| | and design considerations, super passages, canal siphons and level crossing. | |
| • | **Canal Out-lets:** Essential requirements, classifications, criteria for outlet behaviours, flexibility, proportionality, sensitivity, sensitiveness, etc. Details and design of non-modular, semi-modular and modular outlets. | CO4 |
| Text Book/s | 1. Garg S.K.; "Irrigation Engg. & Hydraulic Structure", Khanna Publishers, 2007.<br>2. Sharma R.K.; "Design of Irrigation Structures", Oxford IBH Pub, 2006.<br>3. Sahasrabudhe S.R.; "Irrigation Engg. and Hydraulics Structures", Katson publishing, 1996. | |
| Reference Book/s | 1. Khushlani K.B.; "Irrigation Practice and Design Vol. I to VII", Oxford IBH Pub, 1995.<br>2. Modi P.N.; "Irrigation with Resources and with Power Engineering", Standard Book House, 1995.<br>3. Ivan E. Houk; "Irrigation Engg. Vol. I & II", John Wiley and sons, 2010 | |

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| Course Code | **CED462** | | | | | | |
| Course Title | **REPAIR AND REHABLITATION OF STRUCTURES** | | | | | | |
| Course Outcomes | CO1: Comprehend maintenance, repair, and rehabilitation strategies for structures, including inspection, assessment, and causes of deterioration.<br>CO2: Comprehend concrete strength, durability, cracks, and effects of environmental factors, corrosion, and cover thickness.<br>CO3: Familiarize with special concretes, repair techniques, and protection methods using NDT, epoxy injection, corrosion inhibitors, and innovative materials.<br>CO4: Gain insight into reinforcement coatings, cathodic protection, structural rehabilitation, strengthening methods, and demolition techniques through case studies. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | | | | | | | CO1 |
| • | Maintenance and Repair Strategies Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection | | | | | | CO1 |
| • | Assessment procedure for evaluating a damaged structure, causes of deterioration | | | | | | CO1 |
| Unit 2 | | | | | | | CO2 |
| • | Strength and Durability of Concrete- Quality assurance for concrete –Strength, Durability and Thermal properties, of concrete – Cracks, | | | | | | CO2 |
| • | different types, causes –Effects due to climate, temperature, Sustained elevated temperature, Corrosion – Effects of cover thickness | | | | | | CO2 |
| Unit 3 | | | | | | | CO3 |
| • | Special Concretes- Polymer concrete, Sulphur infiltrated concrete, Fibre-reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self-compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes | | | | | | CO3 |
| • | Techniques for Repair and Protection Methods- Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels | | | | | | CO3 |
| Unit 4 | | | | | | | CO4 |
| • | Coatings to reinforcement, cathodic protection; Repair, Rehabilitation and Retrofitting of Structures- Evaluation of root causes; Underpinning & shoring; some simple systems of rehabilitation of structures; Guniting, shotcreting; Non-Destructive testing systems; Use of external plates, carbon fibre wrapping and carbon composites in repairs. | | | | | | CO4 |
| • | Strengthening of Structural elements, Repair of structures distressed due to | | | | | | |

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| | corrosion, fire, Leakage, earthquake – Demolition Techniques –Engineered demolition methods – Case studies | |
| Text Book/s | 1. Denison Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical UK, (1991).<br>2. R.T. Allen and S.C. Edwards, Repair of Concrete structures, Blakie and Sons, UK, (1987)<br>3. M. S. Shetty, Concrete Technology – Theory and Practice, S. Chand and Company, New Delhi, (1992). | |
| Reference Book/s | 4. Santhakumar, A.R., Training Course notes on Damage Assessment and repairs in Low Cost<br>Housing, "RHDC – NBO" Anna University, July (1992).<br>5. Raikar, R.., Learning from failures – Deficiencies in Design, Construction and Service – R & D centre (SDCPL), RaikarBhavan, Bombay, (1987).<br>6. N. Palaniappan, Estate Management, Anna Institute of Management, Chennai, (1992).PCI, *PCI Design Handbook: Precast and Prestressed Concrete*, Precast/Prestressed Concrete Institute, IL, 1992. | |

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| **L** | **T** | **P** | **Credit** |
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|---|---|---|---|---|---|---|---|
| Course Code | **CED463** | | | | | | |
| Course Title | **MATERIAL CHARACTERIZATION** | | | | | | |
| Course Outcomes | (CO1): Introduce fundamental techniques (calorimetry, X-ray diffraction) for comprehending construction materials' properties and structures.<br>(CO2): Develop proficiency in analyzing construction materials through thermal, surface area measurement, optical, and electron microscopy techniques.<br>(CO3): Enhance skills in image analysis and spectroscopic techniques for advanced characterization of construction materials.<br>(CO4): Gain expertise in utilizing methods like mercury intrusion porosimetry and impedance analysis for assessing porosity and material behavior. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | | | | | | | |
| • | Introduction to course; Structure of Construction Materials – An Overview : Calorimetry , X-ray diffraction | | | | | | CO1 |
| Unit 2 | | | | | | | |
| • | Thermal analysis, Surface area measurement , Optical microscopy , Scanning electron microscopy | | | | | | CO2 |
| Unit 3 | | | | | | | |
| • | Image analysis, Spectroscopic techniques | | | | | | CO3 |
| Unit 4 | | | | | | | |
| • | Mercury intrusion porosimetry, Impedance analysis and ultrasonic methods | | | | | | CO4 |
| Text Book/s | 1. Materials Characterization: Introduction to Microscopic and Spectroscopic Methods by Yang Leng<br>2. N. Subramanian, "Concrete Technology: Theory and Practice," Oxford University Press.<br>3. S. V. Deodhar, "Engineering Materials: Properties and Applications," Tata McGraw-Hill Education.<br>4. M. S. Shetty, "Concrete Technology: Theory and Practice," S. Chand Publishing. | | | | | | |
| Reference Book/s | 5. William D. Callister Jr. and David G. Rethwisch, "Materials Science and Engineering: An Introduction," John Wiley & Sons.<br>6. F. P. Beer, E. R. Johnston Jr., and John T. DeWolf, "Mechanics of Materials," McGraw-Hill Education.<br>7. Michael F. Ashby and Hugh Shercliff, "Materials: Engineering, Science, Processing and Design," Butterworth-Heinemann. | | | | | | |

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| Course Code | **CED464** | | | | | | |
| Course Title | **STRUCTURAL ENGINEERING-II** | | | | | | |
| Course Outcomes | CO1: Comprehend classical methods (Slope Deflection, Moment Distribution) for analyzing statically indeterminate structures and their applications.<br>CO2: Gain proficiency in matrix methods (stiffness and flexibility) to analyze skeletal structures including beams, trusses, and plane frames.<br>CO3: Apply energy principles (Castigliano's theorems) to analyze framed structures, both statically determinate and indeterminate, under various loads.<br>CO4: Develop skills in creating influence line diagrams (ILD) for determinate and indeterminate structures to evaluate support reactions and internal forces. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | | | | | | | CO1 |
| • | Statically Indeterminate structure – Classical methods Slope Deflection Method: Analysis of continuous beams for various loading including settlement/ rotation of support, analysis of simple portal frame with sway. Moment Distribution Method: Analysis of plane frames including sway, use of symmetry of structure up to two storeyed / two bay frames. | | | | | | CO1 |
| Unit 2 | | | | | | | CO2 |
| • | Matrix Methods: Types of skeletal structures, Internal forces and deformations. Introduction and applications of stiffness method to analyze beams, Trusses and plane frames by system approach. Introduction and applications of Flexibility method to analyze beams, Trusses and plane frames by system approach. | | | | | | CO2 |
| Unit 3 | | | | | | | CO3 |
| • | Energy Principles: Castigliano's theorems, Application of castigliano's 1 st and 2ndtheorm to statically determinate and indeterminate framed, structure – beams, plane truss & plane frames. Approximate methods: Forces in the framed structure subjected to Vertical and lateral loads.. | | | | | | CO3 |
| Unit 4 | | | | | | | CO4 |
| • | Influence line diagrams ILD for statically determinate beams- I.L.D of support reaction, shear force and moment bending moment for beams subjected to u.d.l and several point loads, criteria for maximum effects, ILD for statically determinate trusses, forces in members for u.d.l and point loads ILD for statically indeterminate beams: Muller-Breslau's principle, steps for obtaining I.L for reaction and internal forces in propped cantilever and continuous beams, qualitative I.L diagram for rigid jointed structures having higher degree of statically indeterminacy. | | | | | | CO4 |
| Text Book/s | 1. Junarkar S. B. & Shah H. J.; Mechanics of Structures Vol-II; Charotar publishing | | | | | | |

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| | house,Anand<br>2. Wang C. K.; Intermediate Structural Analysis; Tata McGraw Hill book Company, NewDelhi | |
| Reference Book/s | 3. Gere & Weaver; Matrix Analysis of framed structures, CBS Publications<br>4. Ryder G.H.; Strength of Materials; Mcmillan<br>5. Gere & Timoshenko; Mechanics of Materials; CBS Publishers & Distributors, Delhi | |

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| Course Code | **CED465** | | | | | | |
| Course Title | **FLUID MECHANICS** | | | | | | |
| Course Outcomes | CO1: Comprehend fundamental principles of fluid mechanics, including laminar and porous media flow, boundary layer theory, and transition to turbulent flow.<br>CO2: Comprehend the characteristics of turbulent flow, velocity distribution, drag and lift forces on immersed bodies, and resistance diagrams.<br>CO3: Gain knowledge of open channel flow principles, including resistance equations, flow classifications, velocity distribution, Energy and Momentum principles and critical flow, and efficient flow sections.<br>CO4: Develop expertise in gradually varied flow analysis, water surface profiles, hydraulic jumps, and surge phenomena in open channels. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | | | | | | | CO1 |
| • | 1. Laminar Flow: Navier-stokes equations in Cartesian coordinates (no derivation), meaning of terms, flow between parallel plates, stokes law. Flow through porous media,. Transition from laminar to turbulent flow. 2. Boundary Layer Analysis: Assumption and concept of boundary layer theory. Boundarylayer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control. | | | | | | CO1 |
| • | 2. Boundary Layer Analysis: Assumption and concept of boundary layer theory. Boundarylayer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control. | | | | | | CO1 |
| Unit 2 | | | | | | | CO2 |
| • | Turbulent Flow: Definition of turbulence, scale and intensity, Effects of turbulent flow in pipes. Equation for velocity distribution in smooth and rough pipes (no derivation). Resistance diagram. | | | | | | CO2 |
| • | Flow Past immersed bodies: Drag and lift deformation Drag and pressure drag. Drag on a sphere, cylinder and Airfoil: lift-Magnus Effect and circulation, lift on a circular cylinder. | | | | | | CO2 |
| Unit 3 | | | | | | | CO3 |
| • | Uniform flow in open Channels: Flow classifications, basic resistance Equation for open channel flow. Chezy, Manning, Bazin and Kutter formulae. Variation of roughness coefficient, conveyance and normal depth. Velocity Distribution. Most efficient flow sections; rectangular, trapezoidal and circular. | | | | | | CO3 |

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| • | Energy and Momentum principles and critical flow: Energy and specific Energy in an open channel; critical depth for rectangular and trapezoidal channels. Alternate depths, applications of specific energy to transitions and Broads crested weirs. Momentum and specific force in open channel flow, sequent depths. | CO3 |
| Unit 4 | | CO4 |
| • | Gradually varied Flow: Different Equation of water surface profile; limitation, properties and classification of water and surface profiles with examples, computation of water surface profile by graphical, numerical and analytical approaches. | CO4 |
| • | Hydraulic Jump and Surges: Theory of Jump, Elements of jump in a rectangular Channel, length and height of jump, location of jump, Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges | |
| Text Book/s | 1. Dr. R.K. Bansal, "Fluid Mechanics", Laxmi Publications.<br>2. Dr. Pijush K. Kundu, Dr. Ira M. Cohen, and Dr. David R. Dowling, "Fluid Mechanics", Academic Press.<br>3. Dr. Pijush K. Kundu, Dr. Ira M. Cohen, and Dr. David R. Dowling, "Fluid Mechanics Fundamentals and Applications", McGraw-Hill Education.<br>4. Foreign Authors: | |
| Reference Book/s | 1. Frank M. White, "Fluid Mechanics", McGraw-Hill Education.<br>2. John F. Douglas, John M. Gasiorek, and John A. Swaffield, "Fluid Mechanics", Pearson Education.<br>3. Yunus A. Çengel and John M. Cimbala, "Fluid Mechanics: Fundamentals and Applications", McGraw-Hill Education. | |

## OPEN ELECTIVES

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|---|---|---|---|---|---|---|---|
| Course Code | **CIV801** | | | | | | |
| Course Title | **CONSTRUCTION MATERIALS AND TECHNIQUES** | | | | | | |
| Course Outcomes | CO1: Analyze building materials' properties, selection, and deterioration mechanisms for informed construction decision-making.<br>CO2: Comprehend cement and concrete production, characteristics, workability, and factors influencing concrete strength.<br>CO3: Learn masonry techniques, damp proofing methods, and their importance in building durability and structural integrity.<br>CO4: Gain insights into plastering, pointing, foundation types, and their roles in creating functional and stable structures. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | | | | | | | CO1 |
| • | **Building Stones**: General, Uses of stones, natural bed of stones, qualities of a good building stone, deterioration of stones, artificial stones, common building stones of India and their uses. Bricks: General, Composition of good brick earth, Harmful ingredients in brick earth, qualities of good bricks, tests for bricks, classification of bricks. Timber: Definition, classification of trees, structure of a tree, felling of trees, seasoning of timber, storage of timber, market forms of timber. | | | | | | CO1 |
| Unit 2 | | | | | | | CO2 |
| • | **Cement**: Constituents of Cement, Manufacture of Portland cement Concrete: Introduction, Constituents of concrete, batching of materials, Manufacturing process of cement concrete, workability and factors affecting it, Methods to determine workability, segregation and bleeding of concrete, Strength of concrete and factors affecting it. | | | | | | CO2 |
| Unit 3 | | | | | | | CO3 |
| • | **Brick and stone masonry**: Terms used, Types of bonds & their merits and demerits, rubble and ashlars joints in stone masonry, cement concrete hollow blocks and their advantages and disadvantage. Damp Proofing: Sources, causes and bad effects of dampness, preventive measures for dampness in buildings. | | | | | | CO3 |
| Unit 4 | | | | | | | CO4 |
| • | **Plastering and pointing**: Objects, Methods of plastering, Materials and types, Defects in plastering, special material for plastered surface, distempering white washing and colour washing. Foundation: Definition, types of foundations | | | | | | CO4 |
| Text Book/s | 1. Rangwala S.C. “Engineering Materials” Charotar Publishing House Anand India, 1989. | | | | | | |

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| | 2. Bindra SP, Arora KR “Building construction” Dhanpat Rai Publications, Delhi 1970. | |
| Reference Book/s | 3. Shetty MS , “Concrete Technology” S. Chand & Co. N. Delhi, 2005<br>4. Punmia BC, “Building construction” Laxmi Publications Pvt. Ltd. 2008.<br>5. KumarSushil , “Building Construction” Standard Publishers Distributors, 2006 | |

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|---|---|---|---|---|---|---|---|
| Course Code | **CIV802** | | | | | | |
| Course Title | **RAILWAY AND TUNNEL ENGINEERING** | | | | | | |
| Course Outcomes | CO1: Comprehend the historical evolution of railways, permanent way construction, and basic points and crossing layouts.<br>CO2: Comprehend station and yard site selection, track laying, signaling principles, and interlocking systems for safe railway operations.<br>CO3: Gain insights into tunnel construction necessities, design for highways and railways, and ventilation/drainage methods for tunnels.<br>CO4: Grasp the significance of tunnel ventilation, drainage, and lighting systems for operational safety and efficiency in underground transportation infrastructure. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | | | | | | | CO1 |
| • | **Railways**: History of development of Railways, Permanent Way, Requirement of ideal permanent way, cross-sections of single and double tracks in embankment and cutting. Points and Crossing: Simple types currently in use: points and crossing terminology, layout plans of simple cross over, turnouts, diamond crossing, | | | | | | CO1 |
| Unit 2 | | | | | | | CO2 |
| • | **Stations and yards**: Selection of site for station and yards, different types of stations and yards and their layouts-way side station.] Permanent way Construction and Maintenance: Laying of track, relaying and dismantling, maintenance of track. Signalling and Interlocking: Objects of signalling, types of signals, Interlocking and devices used in interlocking. | | | | | | CO2 |
| Unit 3 | | | | | | | CO3 |
| • | Tunnels: Definition and necessity of tunnels, Typical section of tunnels for a national highway and single and double broad gauge railway track. | | | | | | CO3 |
| Unit 4 | | | | | | | CO4 |
| • | Ventilation: necessity and methods of ventilation, by blowing, exhaust and combination of blowing and exhaust. Drainage method of draining water in tunnels. Lighting of tunnels | | | | | | CO4 |
| Text Book/s | 1. Rangawal S C "Railway Engineering" Charotar Publishers, Anand, 2002.<br>2. Arora S P and Saxena (2001), "Railway Engineering", DhanpatRai Publishers, New Delhi, 2001 | | | | | | |
| Reference Book/s | 3. Vaswani, NK, "Railway Engineering", Publishing House, Roorkee<br>4.Deshpande, R,"A Text Book of Railway Engineering", Poonam united Book Corporation | | | | | | |

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| Course Code | **CIV803** | | | | | | |
| Course Title | **METRO SYSTEMS AND ENGINEERING** | | | | | | |
| Course Outcomes | CO1: Comprehend the fundamental concepts of metro systems, their necessity, routing considerations, planning, and financial aspects.<br>CO2: Gain insights into the construction of metro stations, elevated structures, tunnels, depots, ventilation, safety systems, and building infrastructure.<br>CO3: Learn about the preliminary surveys, construction management, quality, safety, environmental and social aspects, track systems, and facilities management in metro projects.<br>CO4: Acquire knowledge about signaling, fare collection, control centers, SCADA systems, and platform screen doors for efficient metro operation and management. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | | | | | | | CO1 |
| • | Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financials<br>Civil Engineerig-Overview and construction methods for metro systems. | | | | | | CO1 |
| Unit 2 | | | | | | | CO2 |
| • | Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems | | | | | | CO2 |
| Unit 3 | | | | | | | CO3 |
| • | Initial Surveys & Investigations; Basics of Construction Planning & Management, Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management | | | | | | CO3 |
| Unit 4 | | | | | | | CO4 |
| • | Signaling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors. | | | | | | CO4 |
| Text Book/s | 1. David Bennett METRO: The Story of the Underground Railway Mitchell Beazley Publ., ISBN 1840008385<br>2. Stan Fischler: SUBWAYS OF THE WORLD - Motorbooks International, 2000. Introduction to 10 of the world's most important metro systems. | | | | | | |
| Reference Book/s | 3. William D. Middleton: Metropolitan Railways: Rapid Transit in America (Railroads Past and Present). - January 2003, 400 pages, Indiana University Press, ISBN 0253341795 | | | | | | |

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| Course Code | **CIV804** | | | | | | |
| Course Title | **DISASTER PREPAPREDNESS AND PLANNING** | | | | | | |
| Course Outcomes | After completing this course the student must demonstrate the knowledge and ability to:<br>CO1: Identify various types of disasters, their causes, effects & mitigation measures.<br>CO2: Demonstrate the understanding of various phases of disaster management cycle and create vulnerability and risk maps. Understand the use of emergency management system to tackle the problems<br>CO3: Discuss the role of media, various agencies and organizations for effective disaster management. Design early warning system and understand the utilization of advanced technologies in disaster management<br>CO4: Compare different models for disaster management and plan & design of infrastructure for effective disaster management | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Introduction to Disaster Management: Define and describe disaster, hazard, vulnerability, risk-severity, frequency and details, capacity, impact, prevention, mitigation.<br>Disasters: Identify and describe the types of natural and manmade disasters, hazard and vulnerability profile of India, mountain and coastal areas, Factors affecting vulnerability such as impact of development projects and environment modifications (including dams, land-use changes, urbanization etc.), Disaster impacts (environmental, physical, social, ecological, economic etc.); health, psycho-social issues; demographic aspects (gender, age, special needs), Lessons and experiences from important disasters with specific reference to civil engineering. | | | | | | CO1&2 |
| Unit 2 | Disaster Mitigation and Preparedness: Disaster Management Cycle-its phases; prevention, mitigation, preparedness, relief and recovery; structural and nonstructural measures; Preparedness for natural disasters in urban areas.<br>Risk Assessment: Assessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems; Use of Remote Sensing Systems (RSS) and GIS in disaster Management, early warning systems. | | | | | | CO2&3 |
| Unit 3 | Post disaster response: Emergency medical and public health services; Environmental post disaster response (water, sanitation, food safety, waste management, disease control, security, communications); reconstruction and rehabilitation; Roles and responsibilities of government, community, local institutions, role of agencies like NDMA, SDMA and other International agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines. | | | | | | CO3 |

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| Unit 4 | Integration of public policy: Planning and design of infrastructure for disaster management, Community based approach in disaster management, methods for effective dissemination of information, ecological and sustainable development models for disaster management. | CO4 |
| Text Book/s | 1. www.http//ndma.gov.in<br>2. http://www.ndmindia.nic.in<br>3. Natural Hazardsin the Urban Habitat by Iyengar, C.B.R.I., Tata McGraw Hill, Publisher<br>4. Natural Disaster management, Jon Ingleton (Ed), Published by Tudor Rose, Leicester92<br>5. Singh B.K., 2008, Handbook of disaster management: Techniques & Guidelines, Rajat Publications.<br>6. Disaster Management, R.B. Singh (Ed), Rawat Publications<br>7. ESCAP: Asian and the Pacific Report on Natural Hazards and Natural Disaster Reduction | |
| Reference Book/s | 1. www.http//ndma.gov.in<br>2. http://www.ndmindia.nic.in<br>3. Natural Hazardsin the Urban Habitat by Iyengar, C.B.R.I., Tata McGraw Hill, Publisher<br>4. Natural Disaster management, Jon Ingleton (Ed), Published by Tudor Rose, Leicester92<br>5. Singh B.K., 2008, Handbook of disaster management: Techniques & Guidelines, Rajat Publications.<br>6. Disaster Management, R.B. Singh (Ed), Rawat Publications<br>7. ESCAP: Asian and the Pacific Report on Natural Hazards and Natural Disaster Reduction | |

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| Course Code | **CIV805** | | | | | | |
| Course Title | **ROAD SAFETY** | | | | | | |
| Course Outcomes | After completing this course:<br>CO1: Student will be able to learn causes of road accidents with various influence on traffic safety.<br>CO2: Student will gain insight on various road safety measure to decrease road crash frequency.<br>CO3: Students will become familiarize with road safety audit and its procedure, ITS importance in implementation of road safety.<br>CO4: Student will be able to acknowledge various parameters to ensure traffic safety in road operation. | | | | | | |
| Examination Mode | Theory | | | | | | |
| Assessment Tools | Written Quiz | Assignment/ Project Work | MSE | MTP | ESE | EPR | ABL/PBL |
| Weightage | 10% | 10% | 25% | - | 50% | - | 5% |
| **Syllabus** | | | | | | | **CO Mapping** |
| Unit 1 | Road Accidents: Causes of road accidents, Vehicle design factors & Driver characteristic's influencing road safety, Road condition, Parking and its influence on traffic safety | | | | | | CO1 |
| Unit 2 | Road safety measures : Accident data collection methods; Representation of accident data: Collision and condition diagram; Methods to Identify and Prioritize ,Black spots ,Road safety, 3„E"measures | | | | | | CO2 |
| Unit 3 | Road Safety Audits: Key elements in Road safety audit, Road safety audit procedure and investigations, Role of ITS in Road safety | | | | | | CO3 |
| Unit 4 | Ensuring Traffic Safety in Road Operation:-Ensuring Traffic Safety during Repair and Maintenance, Prevention of Slipperiness and Influence of Pavement Smoothness, Restriction speeds on Roads, Safety of Pedestrians, Cycle Paths, and Informing Drivers on Road Conditions with Aid of Signs, Traffic Control Lines & Guide Posts, Guardrails & Barriers and Road Lighting. | | | | | | CO4 |
| Text Book/s | 1. BABKOV, V.F. `Road conditions and Traffic Safety', MIR, publications,Mascow - 1975.<br>2. K.W. Ogden, `Safer Roads – A Guide to Road Safety Engg.' Averbury Technical, Ashgate Publishing Ltd., Aldershot, England, 1996.<br>3. Kadiyali, L.R., `Traffic Engineering and Transport Planning', Khanna Publications, New Delhi, 2009.<br>4. C. JotinKishty& B. Kent Lall, "Transportation Engineering-An Introduction" , Thrid Edition, Prentice Hall of India Private Limited, New Delhi, 2006<br>5. Latest Editions of Relevant Indian Roads Congress (IRC) Publications for Design of Roads and Road Safety.<br>6. Khanna and Justo, 'Text book of Highway Engineering', Nemchand Brothers, | | | | | | |

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| | Roorkee,2001 | |
| Reference Book/s | 1. BABKOV, V.F. `Road conditions and Traffic Safety', MIR, publications,Mascow - 1975.<br>2. K.W. Ogden, `Safer Roads – A Guide to Road Safety Engg.' Averbury Technical, Ashgate Publishing Ltd., Aldershot, England, 1996.<br>3. Kadiyali, L.R., `Traffic Engineering and Transport Planning', Khanna Publications, New Delhi, 2009. 4. C. JotinKishty& B. Kent Lall, "Transportation Engineering-An Introduction" , Thrid Edition, Prentice Hall of India Private Limited, New Delhi, 2006<br>5. Latest Editions of Relevant Indian Roads Congress (IRC) Publications for Design of Roads and Road Safety.<br>6. Khanna and Justo, 'Text book of Highway Engineering', Nemchand Brothers, Roorkee,2001 | |