SYLLABUS

For

Master of Engineering Programmes
(M.Tech. Structural Engineering and Construction)

(For admission in 2022-23 and onwards)
**Proposed Scheme of Examination of M.Tech. 2 Year Programme for Specialization:**

**Structural Engineering and Construction**

<table>
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<tr>
<th>Sr.No.</th>
<th>Course Type</th>
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<th>Course Name</th>
<th>Teaching Scheme</th>
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**Semester II**

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| Semester III Total | 3     | 0    | 22   | 16   | 550   | 250   | 800          |

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| Semester IV Total | 0     | 0    | 28   | 14   | 250   | 450   | 700          |
Course objectives:

From this course, students will be able to:
1. learn distinct methods of solving simultaneous equations.
2. well-versed with partial differential equations and their solutions and applications.
3. acquire the knowledge of transformation to ease the complex problems.
4. acquaint with basics of random variables and their distribution for dealing with events by chance.
5. study different mathematical domains to deal with real-time engineering problems.

Learning outcomes:

1. Comprehend with engineering problems in different mathematical realm.
2. Learn analytical and numerical methods to deal with mathematical problems.
3. Understand how to model the engineering problems and their solutions.
4. Implement the solutions to real-time complex engineering problems.
5. Apprehend with mathematical methodology.

Course content:

Unit I: Solution of linear simultaneous equations: (8 hours)

Consistency, Iterative method, Convergence, Cholesky’s (Crout’s) method, Gauss-Jordan method, Gauss-Seidel iteration and relaxation methods, Solution of Eigenvalue problems, Smallest, largest, and intermediate Eigen values.

Computer based algorithm and programme for these methods (non-evaluative)

Unit II: Partial differential equation and its applications: (10 hours)

Introduction and classification of partial differential equation, Four standard forms of non-linear partial differential equations and their solutions, linear equations with constant coefficients. Applications of partial differential equations one and two-dimensional wave equation, one and two-dimensional heat equation, Two-dimensional Laplace’s equation.
Syllabus
Advanced Mathematics (AHT-301)

L:T:P:: 3:1:0

Credits-4

Unit III: Transform calculus-I: (8 hours)
Laplace transform, Properties of Laplace transform, Inverse Laplace transform, Applications of Laplace transform, Fourier integral theorem, Fourier transforms, Application of Fourier transform

Unit IV: Transform calculus-II: (8 hours)
Z-transform, Properties of Z-transform, Shifting theorems, Initial and final value theorem, Convolution theorems, Inverse Z-transform, Application of Z-transform

Unit V: Basic probability theory: (8 hours)
Concept and laws of probability, Discrete and continuous random variable and their distributions; Some special distributions such as Binomial, Poisson, Negative Binomial, Geometric, Continuous uniform, Normal, Exponential, Weibull, Moments, Moment generating functions, Expectation and variance

Practical demo with statistical software like R, SPSS, SAS, etc. (non-evaluative)

Text Books / References:
Syllabus

Advanced Structural Analysis (CET-301)

3L:1T:0P Credit: 4

Course Objectives:
1. To impart the principles of elastic structural analysis and behavior of indeterminate structures.
2. To impart knowledge about various methods involved in the analysis of indeterminate structures.
3. To apply these methods for analyzing the indeterminate structures to evaluate the response of structures.
4. To enable the student get a feeling of how real-life structures behave.
5. To make the student familiar with latest computational techniques and software used for structural analysis.

Course outcomes:
At the end of the course, students will be able
1. to analyze the skeleton structures using stiffness analysis code.
2. Use direct stiffness method understanding its limitations.

Syllabus:

UNIT – I (6 Hours)

Influence Coefficients: Physical Significance, Effects of Settlements, Temperature Change and Lack of Fit, Member Approach and Structure Approach.
UNIT – II  (10 Hours)

**Stiffness Method applied to Large Frames:** Local Coordinates and Global Coordinates.

**Stiffness Matrix Assembly of Structures:** Stiffness Matrix in Global Coordinates, Boundary Conditions, Solution of Stiffness Matrix Equations, Calculation of Reactions and Member Forces.

UNIT – III  (08 Hours)

**Applications to Simple Problems:** Beams, Plane Trusses, Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach.

UNIT – IV  (08 Hours)

**Boundary Value Problems (BVP):** Approximate Solution of Boundary Value Problems, Modified Galerkin ‘s Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin’s Method.

UNIT – V  (08 Hours)

**Linear Element:** Shape Functions, Solution for Poisson’s Equation, General One-Dimensional Equilibrium Problem.

**References:**

1. Matrix Analysis of Framed Structures, Weaver and Gere.
Course Objectives:
This course will enable students to understand the various types of equipment used for construction and understand the various methods of construction techniques.
- To give an experience in the implementation of new technology concepts which are applied in the field of advanced construction.
- To study different methods of construction to successfully achieve the structural design with recommended specifications.
- To involve the application of scientific and technological principles of planning, analysis, design and management to construction technology.
- To study construction equipment and temporary works required to facilitate the construction process.

Course Outcomes: On completion of this course, students are able to decide which type and capacity of construction equipment can be used for a particular job on site and to know the methods of drilling and blasting. The students will gain an experience in the implementation of new construction technology on engineering concepts which are applied in field advanced construction technology.
- The students will get a diverse knowledge of advanced technology practices applied to real-life problems.
- The students will learn to understand the theoretical and practical aspects of new technology in civil engineering along with the design and management applications.

Syllabus:

UNIT – I (08 Hours)

UNIT – II (10 Hours)
Mechanization in rebar fabrication, Mechanization in concrete production and placement. Mechanization through construction: formwork and scaffolding types, materials and design principles. Mechanization through construction Methods/technologies: segmental construction of bridges/flyovers, box pushing technology for tunneling, trench-less technology. Pile Driving Equipment: Pile hammers, selecting a pile hammer, loss of energy due to impact, Energy losses due to causes other than impact.

UNIT – III (06 Hours)
Mechanization through construction methods of Drilling, Blasting and Tunneling Equipment: Definition of terms, bits, Jackhammers, Drifters, wagon drills, chisel drills, piston drills, blast hole drills,
shot drills, diamond drills, tunneling equipment, selecting the drilling method equipment; electing drilling pattern. Safety and Environmental issues in mechanization

UNIT – IV  
**Coffer Dams:** Definition, uses, selection of coffer dams, types of coffer dams, design features of coffer dams; leakage prevention, economic height.

**Control of Ground Water in Excavations:** Methods- pumping, well points, bored wells, electro-osmosis, injections with cement, clays and chemical, freezing process, vibro-flotation.

UNIT – V  
**Construction of Earthquake Resistant Buildings:** Planning of earthquake resistant building, Construction of walls – provision of corner reinforcement, Construction of beams and columns. Base isolation.

**Special Structures:** Tall structures, Spatial structures, Pre-stressed structures.


**Text Books:**

**Reference Books:**

1. “Construction Machinery and Equipment in India”. (A compilation of articles Published in Civil Engineering )

Course Objectives: To impart knowledge on common form work and special form works, and design of form work with different materials for various structural elements.

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

1. Select proper formwork, accessories and material.
2. Design the form work for Beams, Slabs, columns, Walls and Foundations.
3. Design the form work for Special Structures.
4. Understand the working of flying formwork.
5. Judge the formwork failures through case studies.

Syllabus:

UNIT – I (10 Hours)
Introduction: Requirements and Selection of Formwork.
Formwork and false work – Temporary work systems, construction planning and site constraints.
Temporary Works: Form work for R.C.C. wall, slab, beam and column, Centering for arches of large spans and dams, design features for temporary works, Slip formwork, False work for bridges, Specialty form work.

UNIT – II (06 Hours)
Materials and construction of the common formwork and false work systems; Timber, Plywood, Steel, Aluminum, Plastic, and Accessories. Horizontal and Vertical Formwork Supports Special, and proprietary forms. Concrete pressure on forms.

UNIT – III (10 Hours)
Formwork Design for Special Structures: Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Bridges. Types of beams, decking and column formwork; Design of decking; False work design;

UNIT – IV (08 Hours)
Flying Formwork: Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues –Pre- and Post-Award. Foundation and soil on false work design; The use and applications of special forms; Sequence of construction; Safety use of formwork and false work.
UNIT – V  (06 Hours)

**Formwork Failures:** Causes and Case studies in Formwork Failure, Formwork Issues in Multi-Story Building Construction.

**Text Books:**

2. Formwork for Concrete Structures, Peurify, Mc Graw Hill India, 2015

**Reference Books:**

2. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS
Syllabus

Advanced Solid Mechanics (CET – 302)

L:T:P:: 3:0:0 Credits-3

Course Objectives: To introduce the Advanced concepts of equilibrium and deformation in components, and structures for engineering design.

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

1. Solve advanced problems of elasticity and plasticity understanding the basic concepts.
2. Apply numerical methods to solve continuum problems

Syllabus:

UNIT – I (10 Hours)

Introduction to Elasticity: Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.

Strain and Stress Field: Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.

Stress-Strain Relationships: Hooke’s law and its application to isotropic materials, elastic constants and their relationships, plane stress and plain strain conditions.

UNIT – II (08 Hours)

Equations of Elasticity: Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.


UNIT – III (08 Hours)

Members in Uniaxial State of Stress: Uniform cross-section and tapered bars subjected to uniaxial tension and compression, composite bars and statically indeterminate bars, thermal stresses; Introduction to plasticity; S.E. under axial loading.

Members Subjected to Axi-Symmetric Loads: Stresses and strains in thin cylindrical shells and spheres under internal pressure, stresses in thin rotating rings

UNIT – IV (08 Hours)

Members Subjected to Torsional Loads: Torsion of solid and hollow circular shafts, stepped and composting shafts, close-coiled helical springs subjected to axial loads, S.E. in torsion.
**Torsion of Prismatic Bars:** Saint Venant’s Method, Prandtl’s Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes.

**Members Subjected to Combined Loads:** Short struts subjected to eccentric loads, shafts subjected to combined bending, torsion and axial thrust, concept of theory of failure.

**UNIT – V (06 Hours)**

**Plastic Deformation:** Strain Hardening, Idealized Stress-Strain curve, Yield Criteria, vonMises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening

**Elastic Stability of Columns:** Euler’s theory of initially straight columns, critical loads for different end condition of columns, eccentric loading, columns with small initial curvature, empirical formulae

**Text Books:**


**Reference Books:**


**Open Electives (Optional)**

- Infrastructure Planning and management
- Hydropower Engineering
Syllabus

Structural Health Monitoring( CET-304)

3L:0T:0P                                                                                                                 Credit: 3

Course Objective: To understand the structural health monitoring for structures and to understand the conditional assessment & techniques for strengthening and retrofitting of structures.

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

1. Diagnosis the distress in the structure understanding the causes and factors.
2. Assess the health of structure using static field methods.
3. Assess the health of structure using dynamic field tests. Suggest repairs and rehabilitation measures of the structure

Syllabus:

UNIT – I (08 Hours)
Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.

UNIT – II (08 Hours)

UNIT – III (08 Hours)
Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

UNIT – IV (08 Hours)
Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.


UNIT – V (08 Hours)
Introduction to Repairs and Rehabilitation of Structures: Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

Reference Books:

Syllabus

Structural Health Monitoring (CET-304)

3L:0T:0P Credit: 3


Syllabus

Theory of Thin Plates and Shells (CET-306)

3L:0T:0P                                                                                                                 Credit: 3

Course Objectives: To introduce the concept of plate theory and to study the behavior and analysis of thin plates and rectangular plates and classification of shell surfaces.

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

1. Use analytical methods for the solution of thin plates and shells. Use analytical methods for the solution of shells.
2. Apply the numerical techniques and tools for the complex problems in thin plates. Apply the numerical techniques and tools for the complex problems in shells.

Syllabus:

UNIT – I (08 Hours)

UNIT – II (08 Hours)
Static Analysis of Plates: Governing Equation for a Rectangular Plate, Navier Solution for Simply-Supported Rectangular Plate under Various Loadings, Levy solution for Rectangular Plate with other Boundary Conditions.

UNIT – III (08 Hours)

UNIT – IV (08 Hours)
Syllabus

Theory of Thin Plates and Shells (CET-306)

3L:0T:0P                                                                                                                  Credit: 3

UNIT – V (08 Hours)

Thermal Stresses in Plate/Shell. Case Studies

References:
2. Stresses in Plates and Shells, Ugural Ansel C., McGraw Hill.
3. Thin Elastic Shells, Kraus H., John Wiley and Sons.
5. Design and Construction of Concrete Shells, Ramaswamy G.S.
Syllabus

Theory and application of cement composites (CET -307)

3L:0T:0P

Credit: 3

Course Objectives: The Student shall learn about composite materials, stress strain relations of orthotropic and anisotropic materials, Mechanical behavior of materials. The student shall also learn about types of cement composites, Mechanical properties of Cement composites and application of cement composites.

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

1. Formulate constitutive behavior of composite materials – Ferro cement, SIFCON and FibreReinforced Concrete - by understanding their strain- stress behavior.
2. Classify the materials as per orthotropic and anisotropic behavior.
3. Estimate strain constants using theories applicable to composite materials.
4. Analyze and design structural elements made of cement composites.

Syllabus Content:

UNIT – I (08 Hours)


UNIT – II (08 Hours)


UNIT – III (08 Hours)


UNIT – IV (08 Hours)

Mechanical Properties of Cement Composites: Behavior of Ferro cement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion. Application of Cement Composites: FRC and Ferro cement- Housing, Water Storage, Boats and
Syllabus
Theory and application of cement composites (CET -307)

3L:0T:0P Credit: 3


UNIT – V (08 Hours)

Analysis and Design of Cement Composite Structural Elements - Ferro cement, SIFCON and Fiber Reinforced Concrete.

Reference Books:
Syllabus

Theory of Structural Stability (CET-308)

3L:0T:0P Credit: 3

Course Objectives: To achieve fundamental understanding of the subject of stability of structures and apply it to diverse problems in civil, mechanical, and Aerospace engineering.

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

1. Determine stability of columns and frames
2. Determine stability of beams and plates
3. Use stability criteria and concepts for analysing discrete and continuous systems,

Syllabus:

UNIT – I (08 Hours)

UNIT – II (08 Hours)

UNIT – III (08 Hours)
Stability of Frames: Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members.

UNIT – IV (08 Hours)
Stability of Beams: lateral torsion buckling.
Stability of Plates: axial flexural buckling, shear flexural buckling, buckling under combined loads.

UNIT – V (08 Hours)
Introduction to Inelastic Buckling and Dynamic Stability.

Reference Books:
Syllabus
CEP-301 Structural Design Lab (CEP-301)

Course Objectives: To execute the methods of Design and detail drawing of a building.

Course Outcomes: At the end of the course, students will be able to
1. Design and Detail all the Structural Components of Frame Buildings.
2. Design and Detail complete Multi-Storey Frame Buildings.

Syllabus Content:
Design and detailed drawing of complete G+ 3 structures by individual student using latest relevant IS codes.
Syllabus

Advanced Concrete Lab (CEP-302)

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

- Design high grade concrete and study the parameters affecting its performance.
- Conduct Non Destructive Tests on existing concrete structures.
- Apply engineering principles to understand behavior of structural/elements.

List of Experiments/Assignments:

1. Study of stress-strain curve of high strength concrete,
2. Determination of Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
3. Study the Effect of cyclic loading on steel.
4. Non-Destructive testing of existing concrete members.
5. Behavior of Beams under flexure, Shear and Torsion.

Reference Books:

Open Elective 1 (Optional)

Infrastructure Planning and management (CET-323)

3L:0T:0P  Credit: 3

COURSE OBJECTIVES: To study the necessity of infrastructure and its management and the infrastructural planning. To study the theoretical concepts which are applied to real problems encountered in the planning, management and operation of infrastructure and the finance management Fundamentals & Evaluation and managerial economics.

COURSE OUTCOMES:
1. Understand infrastructure organizations.
2. Achieve Knowledge of Planning and development of problem solving skills in management.
3. Understand the principles of financial fundamentals.
4. Prepare tender documents for infrastructure project contract.

SYLLABUS:

UNIT – I (10 Hours)
Infrastructure: Definitions of infrastructure, Governing Features, Historical overview of Infrastructure development in India, Infrastructure Organizations & Systems.

UNIT – II (10 Hours)
Infrastructure Planning: Typical infrastructure planning steps, Planning and appraisal of major infrastructure projects, Screening of project ideas, Life cycle analysis, Multi-criteria analysis for comparison of infrastructure alternatives, Procurement strategies, Scheduling and management of planning activities, Infrastructure Project Budgeting and Funding, Regulatory Framework, Sources of Funding.

UNIT – III (10 Hours)
Project Management in Construction: Introduction to project management processes - Initiating, Planning, Executing, Controlling, and Closing processes; Project Integration Management - Project plan development, Project plan execution, and Overall change control; Project Scope Management - Initiation, Scope planning, Scope definition, Scope verification, and Scope change control.
UNIT – IV

(10 Hours)

Contracts and Management of Contracts: Engineering contracts and its formulation, Definition and
Open Elective 1 (Optional)

Infrastructure Planning and management (CET-323)

3L:0T:0P Credit: 3


References books:

Technical Writing and Presentation Skills (AHT-303)

L:T:P::2:0:0 Non-credits

Course Objectives:
- To develop effective writing and presentation skills in students.
- To develop textual, linguistic and presentation competencies in students appropriate for their professional careers.

Course Outcomes:
After the successful completion of course, the students will be able to:
CO1: Write clearly and fluently to produce effective technical documents.
CO2: Demonstrate an appropriate communication style to different types of audiences both orally and written as per demand of their professional careers.
CO3: Communicate in an ethically responsible manner.

Course Contents:

**WRITING SKILLS**

Unit-I (4 hours)
Technical Writing—Basic Principles: Words—Phrases—Sentences, Construction of Cohesive Paragraphs, Elements of Style.

Unit-II (4 hours)
Principles of Summarizing: Abstract, Summary, Synopsis

Unit-III (6 hours)
Technical Reports: Salient Features, Types of Reports, Structure of Reports, Data Collection, Use of Graphic Aids, Drafting and Writing

**PRESENTATION SKILLS**

Unit-IV (6 hours)

Unit-V (8 hours)

References:

Syllabus

Finite Element Method in Structural Engineering (CET-309)

3L:0T:0P  Credit: 3

**Course Objective:** To introduce importance and applications of Finite Element Method. Simple one dimensional problem, analysis of beams and simplified modeling of two dimensional problems were discussed. The analysis of one dimensional steady state heat transfer is elaborate.

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

1. Use Finite Element Method for structural analysis.
2. Execute the Finite Element Program/Software.
3. Solve continuum problems using finite element analysis.

**Syllabus:**

**UNIT – I**  (08 Hours)


**UNIT – II**  (06 Hours)

*Beam Elements:* Flexure Element, Element Stiffness Matrix, Element Load Vector.

**UNIT – III**  (12 Hours)


**UNIT – IV**  (08 Hours)

*Application to Solid Mechanics:* Plane Stress, CST Element, Plane Strain Rectangular Element, Iso-parametric Formulation of the Plane Quadrilateral Element, Axi-Symmetric Stress Analysis, Strain and Stress Computations.

**UNIT – V**  (06 Hours)

*Computer Implementation of FEM procedure,* Pre-Processing, Solution, Post-Processing, Use of Commercial FEA Software.
Reference Books:
Syllabus

Structural Dynamics (CET-310)

3L:0T:0P Credit: 3

Course Objective: The objective is to provide the fundamental understanding of the structural dynamics and the problem solving ability for dynamic response in civil engineering design, analysis and research. Introduce students to analytical and numerical methods in structural dynamics with emphasis on vibration and to opportunities to optimize system for desired dynamic response.

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

1. Analyze and study dynamics response of single degree freedom system using fundamental theory and equation of motion.
2. Analyze and study dynamics response of multiple degree freedom system using fundamental theory and equation of motion.
3. Use the available software for dynamic analysis.

Syllabus:

UNIT – I (08 Hours)

UNIT – II (08 Hours)

UNIT – III (08 Hours)

UNIT – IV (10 Hours)
Multiple Degree of Freedom System (Lumped parameter): Two Degree of Freedom System, Multiple Degree of Freedom System, Inverse Iteration Method for Determination of Natural Frequencies and Mode Shapes, Dynamic Response by Modal Superposition Method, Direct Integration of Equation of Motion.

UNIT – V


Reference Books:
2. Structural Dynamics and Introduction to Earthquake Engineering, Chopra A. K.
**Course Objective:** To recognize limit states and failure modes in structural steel members and systems; To become familiar with design specification and codes for steel structures, and understand their basis in mechanics, testing, and analysis; To design steel and composite members and connections with an understanding of their limit states / failure modes and current design specifications / codes

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

1. Design steel structures/components by different design processes.
2. Analyze and design beams and columns for stability and strength, and drift.
3. Design welded and bolted connections.

**Syllabus:**

**UNIT – I**

(08 Hours)

**Properties of Steel:** Mechanical Properties, Hysteresis, Ductility.

**Hot Rolled Sections:** Compactness and non-compactness, slenderness, residual stresses.

**UNIT – II**

(08 Hours)

**Design of Steel Structures:**

Inelastic Bending Curvature, Plastic Moments, Design Criteria Stability, Strength, Drift.

**UNIT – III**

(08 Hours)

**Stability of Beams:** Local Buckling of Compression Flange & Web, Lateral Torsional Buckling.

**Stability of Columns:** Slenderness Ratio, Local Buckling of Flanges and Web, Bracing of Column about Weak Axis.

**UNIT – IV**

(08 Hours)

**Method of Designs:** Allowable Stress Design, Plastic Design, Load and Resistance Factor Design;

**Strength Criteria:** Beams - Flexure, Shear, Torsion, Columns - Moment Magnification Factor, Effective Length, PM Interaction, Biaxial Bending, Joint Panel Zones.
UNIT – V  (08 Hours)

**Drift Criteria**: PEff ect, Deformation Based Design;
**Connections**: Welded, Bolted, Location Beam Column, Column Foundation, Splices.

**Reference Books**:

2. Design of Steel Structures - Arya A.S., Ajmani J.L., Nemchandand Bros., Roorkee.
Syllabus

Design of High-Rise Structures (CET-312)

3L:0T:0P Credit: 3

Course Objectives: To study the behaviour and design criteria of tall structures and various structural systems under wind loads. To learn analysis and design of buildings for wind loads. To familiarize the students about stability analysis of tall structures.

Course Outcomes: At the end of the course, students will be able to
1. Analyse, design and detail Transmission/TV tower, MastLight and Trestles with different loading conditions.
2. Analyse, design and detail the RC and Steel Chimney.
3. Analyse, design and detail the tall buildings subjected to different loading conditions using relevant codes.

Syllabus:

UNIT – I (12 Hours)
Design of transmission/TV tower, Mast and trestles: Configuration, bracing system, analysis and design for vertical transverse and longitudinal loads.

UNIT – II (12 Hours)
Analysis and Design of RC and Steel Chimney, Foundation design for varied soil strata.

UNIT – III (10 Hours)
Tall Buildings: Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach, structural design considerations and IS code provisions. Firefighting design provisions.

UNIT – IV (06 Hours)
Application of software in analysis and design.

Reference Books:


5. Tall Building Structures, Smith Byran S. and Coull Alex, Wiley India. 1991.


Course Objective: To develop an understanding for implementation of Masonry structures. To present fundamental principles and methodologies of design of Masonry structures. To categorize, classify and understand the masonry building component. To have the ability to analyze and design of masonry structure.

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

1. Understand the masonry design approaches.
2. Analyzereinforcedmasonry members and determine interactions between members.
3. Determine shear strength and ductility of Reinforced Masonry members.
4. Check the stability of walls
5. Perform elastic and inelastic analysis of masonry walls.

Syllabus:

UNIT – I (10 Hours)

Introduction: Historical Perspective, Masonry Materials, Masonry Design Approaches, Overview of Load Conditions, Compression behaviour of Masonry, Masonry Wall Configurations, Distribution of Lateral Forces.

UNIT – II (08 Hours)

Flexural Strength of Reinforced Masonry Members: In plane and Out-of-plane Loading.

UNIT – III (10 Hours)

Interactions: Structural Wall, Columns and Pilasters, Retaining Wall, Pier and Foundation. Shear Strength and Ductility of Reinforced Masonry Members.

UNIT – IV (06 Hours)

Prestressed Masonry - Stability of Walls, Coupling of Masonry Walls, Openings, Columns, Beams.

UNIT – V (06 Hours)

**Reference Books:**

1. Design of Reinforced Masonry Structures, Narendra Taly, ICC, 2nd Edn,
Syllabus

Design of Advanced Concrete Structures (CET-314)  

3L:0T:0P  

Credit: 3

Course Objective: The main objective of the course is to provide students with a rational basis of the design of reinforced concrete members and structures through advanced understanding of material and structural behavior.

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

1. Analyze the special structures by understanding their behavior.
2. Design and prepare detail structural drawings for execution citing relevant IS codes.

Syllabus:

UNIT – I  
Design philosophy, Modeling of Loads, Material Characteristics.  
(08 Hours)

UNIT – II  
(16 Hours)

UNIT – III  
(16 Hours)

References Books:

6. Steel Structures Design and Behavior Emphasizing Load and Resistance Factor Design, Salm
on
Syllabus

Advanced Design of Foundations (CET-315)

3L:0T:0P Credit: 3

COURSE OBJECTIVES: To Study the advanced design methods of foundations. Impart knowledge on earth pressure theories in design of gravity and cantilever retaining wall. Narrate the importance of apparent earth pressure diagrams in design of sheet piles & braced cuts. Design of foundations in Expansive soils.

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

1. Decide the suitability of soil strata for different projects.
2. Design shallow foundations deciding the bearing capacity of soil.
3. Analyze and design the pile foundation. Understand analysis methods for well foundation.

Syllabus Contents:

UNIT – I (08 Hours)
Planning of Soil Exploration for Different Projects, Methods of Subsurface Exploration, Methods of Borings along with Various Penetration Tests.

UNIT – II (08 Hours)

UNIT – III (08 Hours)

UNIT – IV (08 Hours)
**Tunnels** and Arching in Soils, Pressure Computations around Tunnels.

**UNIT – V**

(08 Hours)

**Coffer Dams**, Various Types, Analysis and Design, Foundations under uplifting loads, Soil-structure interaction

**Reference Books:**
1. Design of foundation system, N.P. Kurian, Narosa Publishing House
Syllabus

Design of Industrial Structures (CET-316)

3L:0T:0P                                                                                                            Credit: 3

**Course Objectives:** To understand the numerical methods for solving simultaneous equations. The students are introduced to the analysis of trusses, beams, and simple portal frames using flexibility and stiffness methods by element approach. The students are introduced to the concepts of direct stiffness method involving formulation and assembly of stiffness matrices, and analyzing beams and trusses.

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

1. Design Steel Gantry Girders.
2. Design Steel Portal, Gable Frames. Design Steel Bunkers and Silos.
3. Design Chimneys and Water Tanks.

**Syllabus Contents:**

**UNIT – I**

*Steel Gantry Girders* – Introduction, loads acting on gantry girder, permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, construction detail, design procedure.

**UNIT – II**

*Portal Frames* – Design of portal frame with hinge base, design of portal frame with fixed base - Gable Structures – Lightweight Structures

**UNIT – III**


**UNIT – IV**

*Chimneys* – Introduction, dimensions of steel stacks, chimney lining, breech openings and access ladder, loading and load combinations, design considerations, stability consideration, design of baseplate, design of foundation bolts, design of foundation.
UNIT – V  (08 Hours)


Reference Books:
3. Design of Steel Structures, Subramaniyam.
Syllabus

Risk management in construction (CET 317)

Course Objectives: to find out the various risk which affect the construction Project

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

1. To recognize various risks that can delay the construction of any project.
2. Various mitigation measure to minimize risks

Syllabus:

UNIT – I (08 Hours)
Risk analysis


UNIT – II (08 Hours)

Use of risk prompts, use of Risk Assessment tables, details of RAMP process, utility of Grading of construction entities for reliable risk assessment. Risk Mitigation – by elimination, reducing, transferring, avoiding, absorbing or pooling. Residual risk, mitigation of un-quantified risk. Coverage of risk through CIDC’s MOU with the Actuarial Society of India

UNIT – III (08 Hours)

Safety Risk: safety hazards, dangerous tasks, Accidents, Case Studies
UNIT – IV

Financial Risk and Legal Risk: requirement of cash, cash flow, increase in cost, legal constraints, violations of code and contracts terms, disputes with clients and vendors

UNIT – I

Project Risk and Environmental Risk: risks associated with managing the projects, management of the resources, missing deadlines, acts of GOD, natural disasters

Reference Books:

2. Industrial Engineering And Management Of Manufacturing Systems.- Dr. Surendra Kumar Satya Prakashan
3. RAMP Handbook By Institution Of Civil Engineers And The Faculty And Institute Of Actuaries, Thomas Telford Publishing, London.
7. Construction Management Practice, Dr. V. K. Raina, Shroff Publ.
9. Project Management, K. Nagarajan, New Age International
Course objective: The objectives of the course are to define and classify Environmental Impacts and the terminology. Understands the environmental Impact assessment (EIA) procedures and methodology and List and describe environmental audit.

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

1. Identify the environmental attributes to be considered for the EIA study
2. Formulate objectives of the EIA studies
3. Identify the methodology to prepare rapid EIA
4. Prepare EIA reports and environmental management plans

Syllabus:

UNIT – I (08 Hours)

UNIT – II (08 Hours)
EIA Methodologies: Environmental attributes-Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods. EIA review- Baseline Conditions -Construction Stage Impacts, post project impacts.

UNIT – III (08 Hours)
Environmental Management Plan: EMP preparation, Monitoring Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre-Appraisal and Appraisal.

UNIT – IV (08 Hours)

UNIT – V

Case Studies: Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Air ports.

Reference Books:
3. World Bank – Source book on EIA.
Course Objectives: 1. To study about Industrial safety programs and toxicology, Industrial laws, regulations and source models. To understand about fire and explosion, preventive methods, relief and its sizing methods and To analyze industrial hazards and its risk assessment.

Course Outcomes: By the end of the course the students will be able to
1. Analyze the effect of release of toxic substances
2. Understand the industrial laws, regulations and source models.
3. Apply the methods of prevention of fire and explosions.
4. Understand the relief and its sizing methods.
5. Understand the methods of hazard identification and preventive measures

Syllabus:

UNIT – I  
Industrial Safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT – II  
Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Servicelife of equipment.

UNIT – III  

UNIT – IV  
Fault tracing: Fault tracing concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show was decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal, and electrical equipment like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.
UNIT – IV

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:
Course Objectives: To study the models of various elements of building under field conditions

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

1. Understand the response of structures.
2. Prepare the models.
3. Conduct model testing for static loading.
4. Conduct model testing for free and forced vibrations.

Experiments:

1) Experiment on a 2 hinged arch for horizontal thrust and influence line for horizontal thrust.
2) Experimental and analytical study of a 3 bar pin jointed truss.
3) Experimental and analytical study of deflection and unsymmetrical bending of a cantilever beam.
4) Beggdefometer- verification of Muller Breslau principle.
5) Experimental and analytical study of an elastically coupled beam.
6) Sway in portal frames- demonstration.
7) To study the cable geometry and statics for different loading condition.
8) To plot stress–strain curve for concrete.
9) Use of mechanical and electrical strain and stress gauge.
**Course Objectives:** To determine the solution of various equations for data fitting

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

1. Find roots of non-linear equations by Bisection method and Newton’s method. Do curve fitting by least square approximations.
2. Solve the system of linear equations using Gauss-Elimination/Gauss-Seidai Iteration/Gauss-Jorden Method.
3. To integrate numerically using Trapezoidal and Simpson’s Rules.
4. To find the numerical solution of Ordinary Differential Equations by Euler’s Method, Runge-Kutta Method.

**Experiments:**

1. Find the Roots of Non-Linear Equation Using Bisection Method.
3. Curve Fitting by Least Square Approximations.
5. Solve the System of Linear Equations Using Gauss-Seidai Iteration Method.
8. Integrate numerically using Simpson’s Rules.
Syllabus
Open Elective 2 (Optional)
Hydro power Engineering(CET-324)

3L:0T:P Credit:3

COURSE OBJECTIVES: To understand the concept of Hydropower. To understand the various methods and procedure to plan and design a hydropower schemes. To have the knowledge of different types of Hydropower Schemes and their purposes. To learn to design and planning of different components of Hydropower plants

COURSE OUTCOMES: On completion of the course, the student will be able to:
1. Determine the need, requirements and constraints of hydropower development
2. Analyze the stream flow data to determine the hydropower potential
3. Classify the different types of hydropower plants and the different parts of a typical hydroelectric power structure
4. Determine the requirements of power generation as well as the water conveyance system.
5. Analyze the hydraulic transients and model the water hammer effects using HAMMER and EPANET software

Syllabus:

UNIT – I (08 Hours)
Introduction: Prospects of hydropower, sources of energy, hydropower potential, distribution and development, basin-wise development of hydropower, constraints in hydro power development.

UNIT – II (08 Hours)

UNIT – III (08 Hours)
Types of Hydro Power Plants: Base and peak load Hydro-power plants, run-ofriver plants, valley damplants, diversion canal plants, high head diversion plants, pumped-storage power plants. Intake Structures:Functions of intake structures, its location types, trash rack dimensions, design, spacing of bars, methods of cleaning; design of transition.
UNIT – IV

**Conveyance System:** Power canal-location, site, surges in canals, pen stocks types, design and layout, economical diameter of penstock, hydraulic losses, branches, air vent, forebay. Hydraulic Turbines: Types of turbines, characteristics and efficiency of turbines, selection of turbines, selection of turbines, cavitation, casing, draft tubes, tail trace and their hydraulic design.

UNIT – V

**Hydraulic Transients:** Basic equations of Unsteady flow through conduits, method of characteristics

**TEXT/REFERENCE BOOKS:**
Course Objectives: Students will be able to:

1. To understand the fundamentals of research in today’s world controlled by technology, ideas, concept, and creativity.
2. To understand different methods of research designing and data collections.
3. To understand the methods of report writing and its different methods of interpretations.
4. To understand research ethics and methods of research publications.
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Course Outcomes:

1. To understand research problem formulation.
2. To study research design and method of data collections.
3. To study methods of report writing.
4. To follow research ethics.
5. To enhance student’s competence to discover new inventions.

Syllabus Contents:

UNIT 1: FUNDAMENTAL OF RESEARCH

Meaning of research; objectives of research; basic steps of research; criteria of good research; Research methods vs. Methodology. Types of research — criteria of good research; Meaning of research problem; selection of research problem; Approaches of investigation of solutions for research problem, Errors in selecting a research problem, Scope and objectives of research problem, Review of related literature- Meaning, necessity and sources.

UNIT 2: RESEARCH DESIGN AND DATA COLLECTION

Research design: Types of research design- exploratory, descriptive, diagnostic and experimental; Variables- Meaning and types; Hypothesis- Meaning, function and types of hypothesis; Null/Alternative hypothesis; Sampling- Meaning and types of sampling; Probability and Non-Probability; Tools and techniques of data collection- questionnaire, schedule, interview, observation, case study, survey etc.

UNIT 3: REPORT WRITING AND ITS INTERPRETATION

Syllabus
Research Methodology and IPR (AHT-302)

Unit 4: RESEARCH ETHICS AND SCHOLARY PUBLISHING

Ethics—ethical issues, ethical committees (human & animal); scholarly publishing—IMRAD concept and design of research paper, citation and acknowledgement, plagiarism and its concept and importance for scholar.

Unit 5: INTELLECTUAL PROPERTY RIGHT (IPR)


Reference Books:

2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”