CIVIL ENGINEERING DEPT.

M.Sc.- STRUCTURES

2024-2025

M.Sc. STUDY-STRUCTURAL ENGINEERING
FIRST SEMESTER

Item	code	Subjects	Units	HOURS	
				T	P
1	Eng.Civil 501	MATHEMATICS AND NUMERICAL ANALYSIS	3	3	--
2	Eng.Civil 502	THEORY OF ELASTICITY AND PLASTICITY	3	3	--
3	Eng.Civil 503	ADVANCED STRUCTURAL ANALYSIS	3	3	--
4	Eng.Civil 504	CONCRETE TECHNOLOGY	1.5	1	1
5	Eng. Civil 505	ENGLISH LANGUAGE	1	--	2
TOTAL			11.5	10	3

SECOND SEMESTER

Item	code	Subjects	Units	HOURS	
				T	P
1.	Eng.Civil 506	DYNAMICS OF STRUCTURES	2	2	--
2.	Eng.Civil 507	EXPERIMENTAL STRESS ANALYSIS	1.5	1	1
3.	Eng.Civil 508	ADVANCED REINFORCED CONCRETE	2.5	2	1
4.	Eng.Civil 509	THEORY OF PLATES	3	3	--
5.	Eng.Civil 510	FINITE ELEMENT METHOD	2.5	2	1
6.	Eng.Civil 511	ENGLISH LANGUAGE	1	--	2
TOTAL			12.5	10	5

Advanced Engineering Mathematics And Numirecal Analysis (3-1)\ Eng.Civil (501)

ADVANCED ENGINEERING MATHEMATICS

1. **Singularity Function**
    - Unit step, delta and double function.
    - Integration of singularity function.
    - Application
2. **Laplace Transformation**
    - Laplace transforms Inverse transform.
    - Laplace transform of derivative.
    - Shifting on the s & t axis
    - Laplace transform of singularity function.
    - Differentiation and integration of transform.
    - Convolution, Integral equation
    - Periodic function
    - Application
3. **Laplace transformation applied to buckling of slender columns.**

NUMERCAL ANALYSIS

- Active column solver and solution of tridiagonal system.
- Eigenvalues and eigenvectors.
- Solution of ordinary differential equation by weight residual method.
- Numerical integration.
- Solution of nonlinear system of equation.

Theory of Elasticity and Plasticity (3-0) \ Eng.Civil (502)

Theory of Elasticity

Introduction and definitions

1- Stress-Strain, Hooke's low ,Index relation, stress-strain Tensors, plane Stress and plane strain, strain measurement, Mohr's circle, quilibrium Equations, Boundary conditions and compatibility Equations, stress function.

2- Two-dimensional problems in rectangular coordinates (cantilever Beam, uniform loaded beam).

3- Two-dimensional problems in polar coordinates Stress and strain transformation at points.

4- Axi-symmetry problems

5- Torsion of straight bars, solution of torsional problems by strain energy.

Theory of Plasticity

1-Stress-strain in simple tension,

2-Stress analysis in elasticity and Plasticity, Theory of Plasticity, Equations to stress and strain curve, Max load in tension, strain rate in tension and compression.

3-Yield criteria (Tresca criteria, vone Mises, Parandtl - Reuss, Levy-Mises, Work hardening, Elastic –plastic bending of beam, rings and plates.

Advanced Structural Analysis (3-0)/ Eng. Civil (503)

1. Introduction.
2. Actions and displacements.
3. Work and Energy.
4. Strain Energy.
5. Flexibility Method;
   - (i) Plane Truss.
   - (ii) Beams.
   - (iii) Plane Frames.
6. Stiffness Method;
   - (i) Springs.
   - (ii) Plane Trusses.
   - (iii) Space Trusses.
   - (iv) Beams.

(v) Plane Frames.
(vi) Grillages.
(vii) Space Frames.

Concrete Technology (2-1) \ Eng.Civil (504)

- **Grading of aggregates as related to:**
- Particles size distribution
- Standard deviation.
- Average sieve size.
- Water demand of the mix.
- New and revised specifications.
- New concepts and applications.
- Related research published works**.**
- **Properties and strength of concrete**
- **Factors affecting quality of concrete.**
- **w/c rations and modes of failure.**
- **Maturity of concrete.**
- **Creep and shrinkage – application of F.I.P method – European code – Theory of linear creep – other approaches.**
- **Durability of concrete.**
- **Aggressive waters.**
- **Sulphate treatments**
- **Special concretes**
- **Light weight concretes- No fines concrete.**
- **Self compacting concrete.**
- **Sawdust concrete.**
- **Intrusion concrete.**
- **Mix Design**
- **Philosophy and principles of mix design**
- **Methods.**
- **Applications and comparison.**
- **Introduction to Rheology (Flow of materials) treatment of workability of fresh concrete.**

- **Quality control**

Dynamics of Structure (2-0) \ Eng.Civil (506)

Basic Concept

- Introduction to Structural Dynamic
- Types of Dynamic Loads
- Sources of Dynamic Loads
- Distinguishing Features of a Dynamic Problem
- Methodology for Dynamic Analysis
- Types of Structural Vibration
- Organization of the Text
- System of Units

Single-Dgree-of- Freedom (SDOF) System
Equation of Motion and Natural Frequency

- Fundamental Components of a Vibrating System
- D Alembert s Principle of dynamic Equilibrium
- The Energy Method
- The Principle of Virtual Displacements

Undamped Free Vibration

- Simple Harmonic Motion
- Interpretation of the Solution
- Equivalent Stiffness
- Rayleigh Method

Damped Free Vibration

- Free Vibration with Viscous Damping
- Logarithmic Decrement
- Hysteresis Damping
- Coulomb Damping

Response to Harmonic Excitation

- Forced Harmonic Response of Undamped System
- Beating and Resonance
- Forced Harmonic Vibration with Viscous Damping

- Effect of Damping Factor on Steady-state Response and Phase Angle
- Harmonic Excitation Caused by Rotating Unbalance
- Base Excitation
- Vibration Isolation and Transmissility

Response to Periodic and Arbitrary Dynamic Excitation

- Response to Periodic Excitation
- Response to Unit Impulse
- Duhamel Integral
- ResponsetoArbitraryDynamicExcitation
- Response Spectrum

Numerical Evaluation of Dynamic Response

- Interpolation of the Excitation
- Direct Integration of the Excitation of Motion
- Central Difference of the Equation of Motion
- Runge-kutta Methods
- Average Acceleration Method
- Linear Acceleration Method
- Response to Base Excitation
- Response Spectra by Numerical Integration

Advanced Reinforced Concrete (3-0) /Eng. Civil (508)

1. Shear-Friction.
2. Shear Strength of Corbels and Brackets.
3. Strut-and-Tie Model for the Design of Deep Beams and Brackets.
4. Design of R. C. Shear Walls for Shear and Moments.
5. Moment-Curvature Relationships for Beams and Columns.
6. Limit-Design Method for Beams.
7. Some aspects of Yield line theory.
8. Affinity Theory
9. Strip method for the design of slabs.
10. Serviceability of beams and one-way slabs.
11. Effect of creep and shrinkage on beams and columns.

Theory of Plates (3-0) /Eng. Civil (509)

1- Introduction, Type of plates (Thick and thin plate, linear and nonlinear plate , Isotropic and Anisotropic plate),Cylindrical Bending of pate, pure bending of plate, moment curvature relation in Rectangular plate, moments and curvature transformation, strain
Energy in pure bending

2- Small deflection of laterally load plates and boundary conditions
Membrane active of plates

3- Exact theory of plates

4- Simply supported of plates (method of solution)(Nauier solution, le'vy's solution)

5- Plate with different boundary conditions, plate on elastic foundation

6- Effect of transverse shear deformations on bending of plate

7- Plate of various shapes

8- Application of finite difference method

9- Bending of Anisotropic plate

10- Combined action of lateral load and in plane forces, large deflection of plates

FINITE ELEMENT METHOD (2-1)/ Eng.Civil (510)

1- Introduction to Finite element Method.
2- Finite element formulation for 1D bar element, shape function, element stiffness matrix, assembly, boundary conditions and solution.
3- Shape (displacement) function, properties and restrictions.
4- Potential method and constant strainTriangle element for plane stress-plane strain problems.
5- Rectangular 4 nodes isoparametric element. Issues on element quality for plane stress analysis, rigid body and zero energy modes.
6- Incompatible modified 4 nodes element

7- Formulation of constant strain triangular element based on four node isoparametric element.
8- Shape functions and formulation of higher order 2D and 3D elements.
9- Formulation of Mindlene plate element.
10- Formulation of shell elements.