31241- MECHANICS OF STRUCTURES
DETAIL SYLLABUS

UNIT I: 1.1 INTRODUCTION, STRESS AND STRAIN & ELASTIC CONSTANTS:

Importance of study of Engineering Mechanics/ Strength of Materials, Mechanical properties of materials – Elasticity, Plasticity, Hardness, Toughness, Brittleness, Ductility, Creep & Fatigue.

STRESS AND STRAIN:

Force-definition-Types of forces acting on a structural member- Definition of tension, compression, shear; Stress-strain-definition- Different types of stresses tensile, compressive and shear stresses - Different types of strains –Tensile, Compressive and Shear strains; Longitudinal and Lateral strains-Poisson's Ratio-Numerical problems on stress and strain.

MODULUS OF ELASTICITY / ELASTIC CONSTANTS

Elasticity –Elastic limit- Hooke's law – Young's modulus of Elasticity –Rigidity modulus-Volumetric strain – Bulk modulus – Definition- Relation between three Moduli-(no derivation)-Young's modulus for selected engineering materials- Numerical problems.

1.2 APPLICATION OF STRESS AND STRAIN IN ENGINEERING FIELD:

Deformation of prismatic bars subjected to uni-axial load – Deformation of stepped bars – deformation of prismatic bars due to self weight – Numerical problems.

BEHAVIOR OF DUCTILE AND BRITTLE MATERIAL

Load extension curve of Ductile and Brittle material – Limit of proportionality, Elastic limit, Yield stress, Ultimate stress, Breaking stress, Factor of safety – Significance of percentage of elongation and reduction in area – Numerical problems.

UNIT II 2. 1 SHEAR FORCE AND BENDING MOMENT

Definition of a beam– Support conditions and diagrammatic representation – Types of beams based on support conditions – Diagrammatic representation of beams – Static equilibrium equations – Determinate and indeterminate beams- Loads-Transverse loads-Types (Concentrated, uniformly distributed and varying loads)-Diagrammatic representation of beams with different loads - Shear force and Bending Moment - Definition – Conventional signs used for S.F. and B.M – S.F and B.M of determinate beams – Cantilever beam & Simply supported beams - simple problems only(Concentrated loads and udl only) – Overhanging beams(No Problems) – Point of contra flexure – Economical overhanging.

UNIT III GEOMETRICAL PROPERTIES

3.1 CENTROID: Geometrical properties -Definition of centroid and center of gravity – Centroid of regular geometrical figures - Centroid of symmetric, asymmetric, and anti symmetric practical sections-Numerical problems.

3.2. MOMENT OF INERTIA (MI):

Definition and notation of Moment of Inertia, Polar moment of inertia, Radius of gyration, Section modulus and Polar modulus, Parallel and perpendicular axis theorems; M.I. of regular geometrical plane sections (rectangular, triangular and circular sections) – M.I. about centroidal axis - MI about base, Radius of gyration- section modulus-Polar moment of inertia – Polar modulus- problems- MI of symmetric, asymmetric and anti symmetric practical sections - Problems.

UNIT IV 4.1 SLOPE AND DEFLECTION OF BEAMS (CANTILEVER & SIMPLY SUPPORTED

BEAMS:

Deflected shape of beams with different support conditions – Flexural rigidity and stiffness of beams – Definition of slope and deflection-Area moment method – Mohr's theorems for slope and deflection of beams – Derivation of expression for maximum slope and maximum deflection of simple standard cases by area moment method for cantilever and simply supported beams subjected to symmetrical udl and point loads – Numerical problems on slope and deflection at salient points of cantilever and simply supported beam from first principles..

4.2 THEOREM OF THREE MOMENTS:

Introduction to continuous beam – Definition of indeterminate structures- Degree of indeterminacy of continuous beams- General methods of analysis of indeterminate structures – Clapeyron's theorem of three moments – Statements – Application of Clapeyron's theorem of three moments and sketching of SFD & BMD for the following cases: problems on two span simply supported ends, one end fixed and the other simply supported, propped cantilever and fixed beams.

UNIT V 5.1 COLUMNS AND STRUTS:

Definition of columns and struts - Short and long columns – Equivalent length/Effective length- Slenderness ratio- Axially loaded and eccentrically loaded- End conditions – Euler's formula and Rankine's formula for buckling load (no derivation) - application of formula – columns subjected to axial loads – simple problems on simple single section

5.2 PIN JOINED FRAMES

Frame / Truss – definition – Determinate and Indeterminate frames – Classification of frames – Perfect and Imperfect frames – Deficient and Redundant frames - Formulation of a perfect frame – Common types of trusses – Methods of analysis – Graphical method only - Space diagram – Bow's notation – Resultant force– Vector diagram – Determination of forces in a cantilever / Simply supported determinate truss with vertical load only.

REFERENCES:

1. Strength of materials and Theory of structures- Vol I, B.C.Punmia, Lakshmi publications, Delhi
2. Strength of Materials S. Ramamrutham, Dhanpatrai & Sons, Delhi.
3. Engineering Mechanics & Strength of Materials R.K. Bansal, Lakshmi publications, Delhi.
4. Theory of Structures S. Ramamrutham
5. Analysis of Structures V.N. Vazirani & M.M. Ratwani.
6. Elementary Theory of Structures R.L. Jindal.