2/4 B.Tech. THIRD SEMESTER

ME3T1 **MECHANICS OF SOLIDS-I** **Credits: 4**

Lecture: 4 periods/week **Internal assessment: 30marks**
Tutorial: 1 periods/week **Semester end examination: 70 marks**

Objectives:

1. The student will acquire the fundamental concepts of deformable bodies.
2. The student will describe force-deformation, and stress-strain relationships for isotropic materials.
3. The student will be able to analyze axially loaded members, beams, plane trusses, thin and thick cylinder for induced stresses, strains and deformations under static loads

Learning outcomes:

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

1. Apply the formal theory of mechanics of solids to calculate forces, deflections, moments, stresses, and strains in a wide variety of structural members subjected to tension, compression, and torsion, both individually and in combination, including axially loaded bars, circular shafts in torsion and thin-walled pressure vessels.
2. Use the method of superposition as applied to problems involving statically determinate and indeterminate axially loaded members.
3. Utilize basic properties of materials such as elastic modulii and Poisson's ratio appropriately to solve problems related to isotropic elasticity.
4. Draw shear force and bending moment diagrams of simple members subject to combination of loads.
5. Solve problems relating to pure bending of beams and other simple structures.

Prerequisites: Engineering Mechanics I,II

UNIT - I

TENSION, COMPRESSION AND SHEAR:

Introduction, Normal Stress and Strain, Stress-Strain Diagrams, Elasticity and Plasticity, Linear Elasticity and Hooke's Law, Shear Stress and Strain, Allowable Stresses and Loads. Analysis of bars for varying sections, analysis of uniformly tapering circular rod and rectangular bar. Elongation of a bar due to its self weight.

UNIT - II

STATICALLY INDETERMINATE STRUCTURES:

Analysis of bars of composite sections, thermal stresses in composite bars, Strain Energy of Axially Loaded Members subjected to static load.

UNIT - III

ELASTIC CONSTANTS:

Lateral strain, Poisson's Ratio, volumetric strain, relation between E and G, relation between E and K, relation between E, G and K,

UNIT - IV

SHEAR FORCE AND BENDING MOMENT:

Types of Beams, Shear Force and Bending Moment, Relationships between Load, Shear Force and Bending Moment, Shear Force and Bending Moment Diagrams for cantilever, simply supported and overhang beams with different loads.

UNIT - V

THEORY OF SIMPLE BENDING:

Introduction, pure or simple bending, bending stresses in symmetrical sections, section modulus, composite/flitched beams.

UNIT - VI

SHEAR STRESSES IN BEAMS:

Introduction, Shear Stress at a section, Shear Stresses distribution for different sections.

UNIT – VII

TORSION:

Introduction, Torsion of Circular shafts, Transmission of power by circular shafts, Strain Energy in pure Shear and uniform Torsion for Statically determinate Members.

UNIT - VIII

THIN PRESSURE VESSELS:

Introduction, Thin Spherical and Cylindrical Pressure Vessels subjected to internal pressure, efficiency of boiler joints, changes in dimensions of pressure vessel when subjected to internal pressure. Wire Wound Cylinders

Learning resource

Text Books:

1. Mechanics of Materials, (2nd edition) by Stephen P. Timoshenko , James M. Gere, C B S Publishers, 2011.
2. Mechanics of Materials, (7th edition) by James M. Gere, Cengage learning India, 2010.

Reference books:

1. Strength of Materials, (Revised 4th edition) by R. K. Bansal, Laxmi Publishers, New Delhi, 2010.
2. Strength of Materials, (2nd edition) by S.S. Rattan, Tata Mc-Graw Hill Private Limited, New Delhi, 2012
3. Mechanics of Materials, (1st edition) by Adarsh Swaroop, New Age International Pvt. Ltd, 2012