

II YEAR-I Semester

ME3T5

MECHANICS OF SOLIDS-I

Credits: 3

Lecture: 3 periods/week

Internal assessment: 30marks

Tutorial: 1 period/week

Semester end examination: 70 marks

Course Objectives:

- The student will acquire the fundamental concepts of deformable bodies.
- The student will describe force-deformation, and stress-strain relationships for isotropic materials.
- 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

Course Outcomes:

Upon completion of this course the student will be able to:

1. Calculate stresses, strains and deflections in structural members subjected to various types of loadings.
2. Determine the principal stresses and maximum shear stresses subjected to combined loading.
3. Analyze the stresses in statically indeterminate structures and relate the elastic constants.
4. Draws shear force and bending moment diagrams of simple beams subject to combination of loads.
5. Plot the stress distribution in section of the beam subjected to bending and shear loads.

Pre-Requisites: Engineering Mathematics-1, Engineering Mathematics-2, Engineering Mechanics,

UNIT - I

TYPES OF STRESSES:

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

UNIT - II

PRINCIPAL STRESSES:

Stresses on inclined Sections, Plane Stress, Principal Stresses and Maximum Shear Stress. Mohr's Circle for Plane Stress, Hooke's Law for Plane Stress.

UNIT - III

STATICALLY INDETERMINATE STRUCTURES & ELASTIC CONSTANTS:

Analysis of bars of composite sections, thermal stresses in composite bars, Strain Energy of Axially Loaded Members subjected to static load. Strain energy in members due to impact loads, 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 various combination of loads.

UNIT – V

SIMPLE BENDING & SHEAR STRESSES IN BEAMS:

Introduction, pure or simple bending, bending stresses in symmetrical sections, section modulus, composite/flitched beams. Shear Stress at a section, Shear Stresses distribution for different sections.

Learning Resources

Text Books:

1. Stephen P. Timoshenko, James M. Gere "Mechanics of Materials", 2nd edition, C B S Publishers, 2011.
2. S.S. Rattan, "Strength of Materials", 2nd edition, Tata Mc-Graw Hill Private Limited, New Delhi, 2012

Reference books:

1. James M. Gere, "Mechanics of Materials", 7th edition, Cengage learning India, 2010
2. Adarsh Swaroop, "Mechanics of Materials" 1st edition, New Age International Pvt. Ltd, 2012.
3. Abdul Mubeen, "Mechanics of Solids" 2nd Edition, Pearson Education, Noida, 2011
4. R. K. Bansal, "Strength of Materials", Revised 4th edition, Laxmi Publishers, New Delhi. 2010