

II Year I Semester

L T P C

Code: 20ME3002

3 0 0 3

MECHANICS OF SOLIDS

Course Objectives:

1. The students completing this course are expected to understand the basic terms like stress, strain, Poisson's ratio...etc. and different stresses and deflections induced in beams, thin cylinders, thick cylinders, and columns.
2. The student shall be able to understand the shear stresses due to torsion in circular shafts.

UNIT – I

Simple stresses & strains: Elasticity and plasticity – Types of stresses & strains–Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – composite bars – Temperature stresses- Complex Stresses- Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle - Relation between elastic constants-Strain Energy.

UNIT – II

Shear force and bending moment: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported subjected to point loads, U.D.L, U.V.L and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

Flexural stresses: Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T sections – Design of simple beam sections.

Shear stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T sections.

UNIT – IV

Deflection of beams: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L, U.V.L. Mohr's theorems – Moment area method.

Torsion: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

UNIT – V

Thin and thick cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in diameter and volume of thin cylinders – Riveted boiler shells – Thin spherical shells. Lamé's equation – cylinders subjected to inside & outside pressures – compound cylinders.

Columns:

Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula.

Text Books:

1. A text book of Strength of Materials –Dr. R.K. Bansal, Laxmi Publications.
2. Strength of materials /GH Ryder/ Mc Millan publishers India Ltd

References:

1. Strength of Materials -By Jindal, Umesh Publications.
2. Analysis of structures by Vazirani and Ratwani.
3. Mechanics of Structures Vol-III, by S.B.Junnarkar.
4. Strength of Materials by S.Timoshenko
5. Strength of Materials by Andrew Pytel and Ferdinand L. Singer Longman.

Weblinks/ Online Resources:

- http://www.engineersedge.com/strength_of_materials.htm
- <https://www.slideshare.net/mobile/shijuthomas007/strength-of-materials>
- <https://www.scribd.com/mobile/doc/28738576/Basic-Concepts-of-strength-of-materials>

Course Outcomes:

On the completion of the course the student will be able to

- CO1: Model & Analyze the behaviour of basic structural members subjected to various loading and support conditions based on principles of equilibrium.
- CO2: Analyze beams and draw correct and complete shear and bending moment diagrams for beams.
- CO3: Understand the application of the concept of stress and strain to analyze and design structural members and machine parts under shear and bending loads, moment and torsional moment.
- CO4: Attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behaviour.
- CO5: Design and analysis of Industrial components like pressure vessels.