GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

MECHANICS OF SOLIDS

Course Code: GR15A2020 L:3 T:1 P:0 C:4
II Year I Semester

Prerequisites: Knowledge in Engineering Mechanics (statics)

Course Objectives
- To provide the basic concepts and principles of strength of materials.
- To give an ability to calculate stresses and deformations of objects under external loads.
- To give an ability to apply the knowledge of strength of materials on engineering applications and design problems.

Course Outcomes: Students will able to
- Analyse and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behaviour of materials.
- Utilize appropriate materials in design considering engineering properties, sustainability, cost and weight.
- Perform engineering work in accordance with ethical and economic constraints related to the design of structures and machine parts

Unit-I

Simple stresses & strains: Concept of stresses and strains (linear, lateral, shear, thermal and volumetric), Hooke's law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Bulk Modulus. Stress-strain diagrams for ductile & brittle materials, Proof stress, True stress & strain - True stress strain Curve Various strengths of material- Yield strength, Ultimate tensile strength, Factor of safety, Strain energy-Gradual, sudden and Impact Loads. Relation between elastic constants, Axial forces, stresses and strains in composite bars, bars under axial loads and self-weight.

Unit-II

Shear Force and Bending Moment Diagrams: Shear forces and bending moments of beams due to concentrated loads, uniformly distributed loads, uniformly varying loads and couples; Shear Force and Bending Moment diagrams for cantilevers, simply supported beams, and their construction- Maximum bending moment & point of contra flexure. Relation between shear force, bending moment and load intensity.

Unit-III

Slope and Deflection of Beams: Relation between Bending Moment and slope, slope & deflection of beams, double integration method (Macaulay's method), derivation of formula for maximum slope & deflection for standard cases like cantilever, simply supported carrying point loads and UDL loads.

Unit-IV

Principal Stresses and Strains: Normal and shear stresses on any oblique plane - Concept of principal planes, derivation for principal stresses and maximum shear stress, position of principal planes & planes of maximum shear, graphical solution using Mohr's circle of stresses, combined effect of axial force, bending moment & torsional moment on circular shafts (solid as well as hollow).

Torsional Stresses: Derivation of torsion equation, stresses, strain & deformations in solid & hollow Shafts, homogeneous & composite circular cross section subjected to twisting moment, stresses due to combined torsion, bending & axial force on shafts.

Unit-V

Stresses in Machine Elements. Bending stresses: Theory of simple bending, assumptions, derivation of flexural formula, Bending of common cross sections like rectangular, I,T,C with respective centroidal & parallel axes, bending stress distribution diagrams, moment of resistance and section modulus. Shear stresses:Concept, derivation of shear stress distribution formula, shear stress distribution diagrams for I, T and C symmetrical sections, maximum and average shears stresses.

Teaching Methodology

Power point Presentations, Working models, white board & marker

Text Books

1. Strength of Materials: Ramamrutham.
2. Strength of Materials R K Bansal, Laxmi Publications

Reference Books

1. Analysis of structures byVazirani and Ratwani.
2. Mechanics of StructuresVol-III,by S.B.Junnarkar.
3. Strength of Materials by S.Timshenko
4. Strength of Materials by Andrew Pyteland Ferdinond L.Singer Longman.
5. Solid Mechanics,by Popov