



GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRENGTH OF MATERIALS-I

Course Code: GR15A2005
II Year I Semester

L:3 T:1 P:0 C:4

Prerequisites

- Fundamentals of Engineering Mathematics
- Knowledge of Engineering Mechanics

Course Objectives

- To study the stresses, strains and elastic constants of different material and to know the concept of strain energy.
- To gain knowledge about the shear force and bending moment for different types of beams such as cantilever, simple supports and fixed beams etc.
- To understand the flexural and shear stress concepts for the different materials and shapes of the structure.

Course Outcomes: Students should be able to:

- Determine the stresses, strains, elastic constants such as modulus of elasticity, modulus of rigidity, Poisson's ratio and bulk density. And also to determine the strain energy for various types of loading.
- Generate the shear force, bending moment diagrams and identify the point of contra flexure for different types of beams such as cantilever, simple supports and fixed beams etc. with different loading.
- Understand the bending equation and shear equation to calculate the bending stresses and shear stresses for the different sections of the structural members.

Unit-I

Simple Stresses and Strains: Elasticity and plasticity-Types of stresses and strains-Hooke's law-Elastic constant and the relationship between them. Stress-strain diagram for mild steel-Lateral strain, poisson's ratio and volumetric strain- Bars of varying section-composite bars-Temperature stresses, Working stress, factor of safety.

Strain Energy: Resilience-Gradual, sudden, impact and shock loadings-simple applications.

Unit-II

Shear Force and Bending Moment: Definition of beam-Types of beams, loading and support conditions-concept of shear force and bending moment-S.F



and B.M diagrams for various types of statically determinate beams like cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed load, uniformly varying loads and applied moments 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

Stresses in Beams Flexural Stresses: Theory of simple bending-Assumptions-Derivation of pure bending equation: $M/I=f/y=E/R$ -Neutral axis-Determination of bending stresses-section modulus of rectangular and circular sections (solid and hollow), I-Section, T-Section, Angle and Channel sections-Design of simple beam sections & flitched beams.

Shear Stresses: Derivation of formula-Shear stress distribution across various beam sections like rectangular, circular, triangular, I-Section, T-Section and angle 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, Uniformly varying loads-Mohr's theorems-moment area method-application to simple cases including overhanging beams.

Unit-V

Principal Stresses and Strains: Introduction-stresses on an inclined section of a bar under axial loading-compound stresses-Normal and Tangential stresses on an inclined plane for biaxial stresses-two perpendicular normal stresses accompanied by a state of simple shear- Mohr's circle of stresses-principal stresses and strains-Analytical and graphical solutions-Various theories of failures like Maximum Principal stress theory-Maximum shear stress theory-Maximum strain energy theory-Maximum shear strain energy theory.

Teaching Methodologies

1. White board and markers

Text Books

1. Dr. B. C. Punmia, Mechanics of Materials, Laxmi publications, 10th Edition, 2013.
2. B. S. Basavarajaiah, Strength of Materials, University Press, Hyderabad, 3rd Edition, 2010.
3. Dr. R. K. Bansal, Strength of material, Laxmi Pulications, New Delhi, 5th Edition, 2012.



Reference Books

1. Ferdinand Beer and others, Mechanics of Solid, Tata Mc. Graw Hill publications, 6th Edition, 2000.
2. Schaum's out line series, Strength of materials, Mc. Graw Hill International Editions, 6th Edition, 2011.
3. R. K. Rajput, Strength of materials, S. Chand & Co, New Delhi, 5th Edition, 2010.
4. A.R.Basu, Dhanpat Rai & Co, Strength of materials, Nai Sarah, New Delhi, 2nd Edition, 2010.
5. Bhavi Katti, Strength of materials, New Age Publications, 3rd Edition, 2008, Re-print 2009.
6. Strength of materials by R. Subramanian, Oxford University Press, New Delhi, 2nd Edition, 2010.
7. Strength of material- S. Ramamrutham, Dhanpat Rai Publishing Company, New Delhi, 15th Edition, 2007.
8. Strength of material- R.S. Khurmi, S. Chand & Company Ltd., New Delhi, 2010 Re-print.