



MANIPAL UNIVERSITY JAIPUR

School of Automobile Mechanical and Mechatronics Engineering

Department of Mechanical Engineering

Course Hand-out

Strength of Materials | ME 1304 | 3 Credits | 3 0 0 3

Session: July 18 – Dec 18 | Faculty: Prof Sasanka Sekhar Ghosh, Dr. Dharmesh Misra, Mr. Ravinder Jhorar | Class: B. Tech. II Year

COURSE OUTCOMES: At the end of the course, students will be able to

[ME 1304.1]. Understand the concepts of stress and strain at a point as well as the stress-strain relationships.

[ME 1304.2]. Compute shear force, bending moment, slope and deflection of a beam.

[ME 1304.3]. Determine the torsion in circular members.

[ME 1304.4]. Understand the concept of stability and buckling of column.

[ME 1304.5]. Calculate the stresses and strains associated with thin-wall spherical and cylindrical pressure vessels.

[ME 1304.6]. Determine and illustrate principal stresses, maximum shearing stress, and the stresses acting on a plane by FEM to improve design skills.

A. SYLLABUS

Introduction: Rigid and Deformable bodies, Strength, Stiffness and Stability, Stresses, Tensile, Compressive and Shear, Elastic constants, Strain energy and unit strain energy, Strain energy in uniaxial loads. Beams-Loads and Stresses: Types of beams, Supports and Loads, Shear force and Bending Moment in beams, Cantilever, Simply supported and Overhanging beams, Stresses in beams, Theory of simple bending, Stress variation along the length and in the beam section, Effect of shape of beam section on stress induced, Shear stresses in beams, Shear flow. Torsion: Analysis of torsion of circular bars, Shear stress distribution, Bars of Solid and hollow circular section, Stepped shaft, Twist and torsion stiffness, Fixed and simply supported shafts. Beam deflection: Elastic curve of Neutral axis of the beam under normal loads, Evaluation of beam deflection and slope, Columns, End condition, Equivalent length of a column, Euler equation, Slenderness ratio, Rankine formula for columns; Analysis of stresses in two dimensions: Biaxial state of stresses, Thick & Thin cylindrical shells and spherical shells, Deformation in thick and spherical shells, Biaxial stresses at a point, Stresses on inclined plane, Principal planes and stresses, Mohr's circle for biaxial stresses, Maximum shear stress.

B. TEXT BOOK:

- I. *Timoshenko S P and Young D H, "Elements of Strength of Materials", East West Press, New Delhi.*
- II. *Beer & Johnston, "Vector Mechanics for Engineers", Tata McGraw Hill, 2004.*

