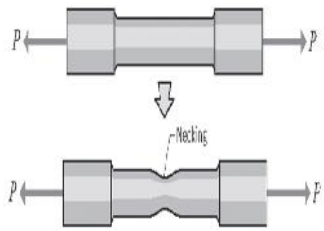
19ME212 SOLID MECHANICS



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Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P
45	-	30

WA/RA	SSH/HSH	CS	SA	S	BS
5	40	-	8	5	-

PRE-REQUISITE COURSE: Engineering Mechanics

COURSE DESCRIPTION AND OBJECTIVES:

This course deals with the fundamental concepts of mechanics of deformable solids, static equilibrium, stress analysis of pressure vessels and geometry of deformation. The objective of this course is to gain knowledge in mechanics of solids and design various types of structural members like beams, pressure vessels subjected to different types of loads.

COURSE OUTCOMES:

Upon completion of the course the student will be able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Understand the basics of mechanics of solids.	1
2	Calculate and Plot variation of shear forces, bending moment, slope and deflection for beams subjected to different boundary and loading conditions.	2,5
3	Estimate bending and shear stresses for a given beam, torsional shear stress for circular shafts.	2,5
4	Design spherical and cylindrical pressure vessels.	3,5

SKILLS:

- ✓ *Draw stress-strain curves for various engineering materials.*
- ✓ *Estimate transverse deflection of beams for various loading and boundary conditions.*
- ✓ *Analyze thermal stresses for statically determinate and indeterminate structures.*
- ✓ *Plot shear stress distribution for different cross sections.*
- ✓ *Calculate rigidity modulus of circular shafts.*

UNIT- I **L-9**

INTRODUCTION: Mechanical properties of the material, Types of Stresses and Strains, Hooke's law, Stress strain diagram for ductile and brittle materials, Elastic Constants and relations between them, Stress analysis of simple and compound bars, Thermal Stresses, Stress on an inclined plane, Principal stresses - Mohr circle.

UNIT- II **L-9**

BEAMS: Types of loads and beams, Shear force and bending moment diagrams of cantilever, simply supported and over-hanging beam subjected to point load, uniformly distributed load; Point of contraflexure.

DEFLECTION OF BEAMS: Deflection equation for elastic beam, Deflection and slope for cantilever and simply supported beams subjected to point load, UDL using double integration and Macaulay's methods.

UNIT- III **L-9**

BENDING STRESSES: Assumptions in theory of simple bending, Derivation of flexural formula, Bending stresses for rectangular, circular, triangular, I, T cross-sections of beams.

SHEAR STRESSES: Shear stress formula, Variation of shear stress for rectangular, circular, triangular, I, T cross section beams.

UNIT- IV **L-9**

TORSION OF CIRCULAR SHAFTS: Assumption and derivation of torsion equation, Shear stress distribution for solid and hollow circular shafts, Power transmission capacity of a shaft, Percentage of weight reduction (solid and hollow).

UNIT- V **L-9**

THIN AND THICK PRESSURE VESSELS: Longitudinal stresses in cylinders and Hoop stresses in cylinders and spheres subjected to internal pressure, Changes in length, diameter and volume of thick and thin cylinders and spheres.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS **TOTAL HOURS: 30**

1. Estimate the young's modulus, yield strength and ultimate strength for a given specimen using tensile test.
2. Compare the hardness value of the given specimen using Brinell and Rockwell hardness test.
3. Determine the impact strength and toughness values of the given specimen using Izod and Charpy Tests.
4. Estimate the shear strength of the given specimen using double shear test.
5. Estimate the young's modulus of the beam material through deflection test for given end supports.
6. Plot the Shear force and Bending Moment diagram using C/MATLAB for a beam under given load and end conditions.
7. Calculation of slope and deflection of beam using C/MATLAB at given location of beam.
8. Estimate the flexural strength of the beam material using 3 point bending test.
9. Plot the bending stress and shear stress variation using C/MATLAB for a given beam.
10. Estimate the rigidity modulus of a given circular shaft using torsion test.
11. Plot the stress variation developed in a thin pressure vessel with respect to the change in input parameters using C/MATLAB.
12. Plot the stress variation developed in a thick pressure vessel with respect to the change in input parameters using C/MATLAB.

TEXT BOOKS:

1. Timoshenko & Gere, "Mechanics of Materials", 2nd edition, CBS Publishers and Distributors Pvt Ltd, 2006.
2. R. K. Rajput, "Essentials of Strength of materials", Paperback, S.Chand Publications, 2016.

REFERENCE BOOKS :

1. Dr. Sadhu Singh, "Strength of Materials", 11th edition, Khanna Publishers, 2013.
2. Egor P. Popov, "Engineering Mechanics of Solids", 2nd edition, Prentice Hall of India, 2002.
3. R.S.Khurmi & N.Khurmi, "Strength of Materials". Revised edition, S Chand Publications, 2013.