

II Year II Semester

L T P C

Code: 20ME4642

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ADVANCED STRENGTH OF MATERIALS

Course Objectives:

The Students will acquire the knowledge

1. To interpret the concepts of strain energy and various theories of failure.
2. To discuss the utility of various springs.
3. To outline the strength considerations of thin and thick cylinders.
4. To discuss the calculation procedures for stresses in curved beams.
5. To outline the effects of shearing stresses, bending stresses and rotational stresses.

UNIT-I STRAIN ENERGY

Strain energy, energy of dilation and distortion, resilience stress due to suddenly applied loads, Castigliano's theorem, Maxwell's theorem of reciprocal deflection

THEORIES OF FAILURE :Maximum principal stress theory, maximum shear stress theory, Total strain energy theory, shear strain energy theory, graphical representation and derivation of equation for each and their application to problems relating to two dimensional stress systems only.

UNIT-II SPRINGS

Leaf spring, deflection and bending stresses; open coiled helical springs; derivation of formula and application for deflection and rotation of free end under the action of axial load and/or axial couple; flat spiral springs – derivation of formula for strain energy, maximum stress and rotation.

UNIT-III THICK CYLINDERS:

Derivation of Lamé's equations, calculation of radial longitudinal and hoop stresses and strains due to internal pressure in thick cylinders, compound cylinders, hub shrunk on solid shafts.

UNIT-IV BENDING OF CURVED BEAMS:

Calculation of stresses in crane or chain hooks, rings of circular section and trapezoidal section and chain links with straight sided.

UNIT-V SHEAR STRESSES

Shear stress distribution in rectangular, circular, I,T and channel section and the compression with bending stresses, Importance of shear centre. Rotational stresses in discs and rims of uniform thickness; discs of uniform Strength.

REFERENCE BOOKS:

1. Elements of Strength of Materials by Timoshenko and Gere
2. Advanced Solid Mechanics by LS Srinath
3. Advanced Mechanics of Materials by Seely and Smith
4. Strength of Materials by GH Ryder
5. Mechanics of Materials-I by EJ Hern; Paragaman, New York
6. Introduction to Mechanics of Solids by Crandell, Dahl and Lardner, McGraw Hill

7. Strength of Materials DS Bedi
8. Mechanics of Materials by Dr. Kirpal Singh, Standard Publishers & Distributors.
9. Strength of Materials by R.S. Lehri, S.K Kataria and Sons.

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. Illustrate the concepts of strain energy and various theories of failure.
2. Explain the utility of various springs.
3. Summarize the concepts of the strength considerations of thin and thick cylinders.
4. Describe the theory of calculation procedures for stresses in curved beams.
5. Outline the concepts of the effects of shearing stresses, bending stresses and rotational stresses.