ADVANCED MECHANICS OF SOLIDS
(Elective – I)

Course Code: 13ME1130

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Pre requisites:
Engineering Mechanics and Mechanics of Solids.

Course Educational Objectives:
To make the student

- Acquire knowledge in stress and strain transformation
- Understand the concepts of fixed and continuous beams
- Learn application of Castigliano theorem to beams and trusses
- Calculate the bending stresses for various cross sections of curved bars
- Acquire knowledge of torsional behavior of non circular shafts
- Understand stresses due to rotation

Course Outcomes:
The student will be able to

- Calculate in-plane principal stresses and strains
- Draw and analyze shear force and bending moment diagrams for fixed and continuous beams
- Estimate torsional stresses of non-circular shafts
- Calculate stresses due to rotation in wheel rims and discs

UNIT-I (12 Lectures)

STRESS AND STRAIN TRANSFORMATION:

Plane stress transformation, general equations of plane stress transformation, plane strain transformation, general equation of plane strain transformation, strain rosettes.

THEORY OF ELASTICITY:

compatibility equations, generalized Hooke's law, stress function, equilibrium and compatibility equations in polar coordinates.

UNIT-II (12 Lectures)

FIXED BEAMS:

Fixing moments for a fixed beam of uniform and variable sections, effect of Sinking support, slope and deflection.

Continuous beams: Analysis of continuous beams, reaction at the supports, and theorem of three moments, Propped cantilevers.

UNIT-III (12 Lectures)

ENERGY METHODS:

External work and strain energy, elastic strain energy for various types of loading, conservation of energy, impact loading, principle of virtual work, trusses, method of, Applications of Castigliano theorem I and II.

TORSION OF NONCIRCULAR SHAFTS:

Torsion of noncircular prismatic bars, Saint Venant's Theory, open and closed sections and shear flow,

Unsymmetrical loading of thin walled members: Shear Centre

UNIT-IV (12 Lectures)

STRESSES IN CURVED BARS:

Determination of factor m in bars of circular, rectangular and trapezoidal sections, stresses in hooks.

STRESSES DUE TO ROTATION:

Wheel rim, rotating disc of uniform thickness and disc of uniform strength, permissible speed of a solid disc

UNIT-V (12 Lectures)

VISCO ELASTICITY:

Representation by means of functional, representation by means of internal variables.

VISCO PLASTICITY:

Visco plasticity with elastic domain, plasticity as a limit case of visco plasticity, a concept of general visco plasticity.

TEXT BOOKS:

1. R.C.Hibbeler, *"Mechanics of materials"*, 6th Edition Pearson education2007.
2. B.C.Punmia, Ashok Jain, Arun kumar jain, *"Mechanics of materials"*, Laxmi publications, New Delhi.2001
3. P Haupt, *"Continum Mechanics and Theory of Materials"*, 2nd Edition 2002, Springer publications (UNIT –V)

REFERENCES:

1. Beer,P.F and Johnston,E.R, *"Mechanics of Materials"*, 6th Edition, McGraw Hill Inc,2013
2. B.C.Punmia,Ashok jain, Arun kumar jain, *"Strength of materials and Theory of Structures"*,Vol-II,9th Edition, Laxmi publications, New Delhi.
3. Timoshenko S.P. and Goodier J N, *"Theory of Elasticity"*, McGraw Hill, New Delhi, 2010.
4. Irving H. Shames and James M. Pitaressi, *"Introduction to Solid Mechanics"*, 3rd Edition, Prentice Hall, New Delhi, 2009.