

## ADVANCED MECHANICS OF SOLIDS

(Professional Elective – I)

**Course Code: 15ME1114**

L	T	P	C
3	0	0	3

### Pre requisites:

Engineering Mechanics and Mechanics of Solids.

### Course Outcomes:

At the end of the course, the student will be able to

- CO 1** Determine stress and strain transformations
- CO 2** Calculate shear force and bending moments in fixed and continuous beams
- CO 3** Compute stresses in curved beams and rotating discs
- CO 4** Discuss concept of torsion in non-circular shafts
- CO 5** Estimate stresses and deflection on beams with elastic foundation.

### UNIT-I (10 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 (10 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

(10 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's theorems 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

(10 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

(10 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*", 6<sup>th</sup> Edition Pearson education 2007.
2. B.C.Punmia, Ashok Jain, Arun kumar Jain, "*Mechanics of Materials*", Laxmi publications, New Delhi.2001.

3. P Haupt, “*Continuum Mechanics and Theory of Materials*”, 2<sup>nd</sup> Edition 2002, Springer publications (UNIT –V)

### REFERENCES:

1. Beer, F.P and Johnston,E.R, “*Mechanics of Materials*”, 6<sup>th</sup> Edition, McGraw Hill Inc,2013
2. B.C.Punmia,Ashok jain, Arun kumar jain, “*Strength of materials and Theory of Structures*”, Vol-II, 9<sup>th</sup> 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*”, 3<sup>rd</sup> Edition, Prentice Hall, New Delhi, 2009.