

## 17MD003ADVANCED MECHANICS OF SOLIDS

### **Course Description and Objectives:**

To analyze and predict the mechanical behavior of deformable solid bodies like beams; columns; plates and non circular shafts using techniques of engineering mechanics and applied mathematics.

### **Course Outcomes:**

Upon successful completion of this course student should be able to:

- understand the concept of unsymmetrical bending and find the deflection of beams undergoing unsymmetrical bending and location of the shear centre of given cross section.
- understand the shear stress distribution of non circular shaft and determination of torque transmitted of a solid or hollow thin walled shaft of any cross section
- understand the concept of elastic foundation; long; and short beams in order to design the structures of rail roads etc.
- acquire knowledge about the centrifugal stresses of rotating discs.
- understand the concept of curved beam; its stress distribution due to external loads and design the C Clamps holding devices and Crane hook applications.

### **SKILLS ACQUIRED: Students are able to**

- unsymmetrical bending and Shear Centre
- torsion of non-circular shafts.
- design of Rotating Discs
- beams on Elastic foundation
- design of Rotating Discs
- curved Beam Theory

**UNIT-I****L-13****UNSYMMETRICAL BENDING AND SHEAR CENTRE**

Introduction; product of inertia – parallel axes theorem for product of inertia – principal axes and principal moments of inertia; bending stresses in beams due to unsymmetrical bending; deflection of straight beams due to unsymmetrical bending. Concept of shear center; determination of shear center for symmetrical and unsymmetrical sections.

**UNIT-II****L-13****TORSION OF NON CIRCULAR SHAFTS**

Introduction; Membrane Analogy; torsion of non-circular solidsections; thin wall tubular sections; thin-walled multi-cell sections.

**UNIT-III****L-13****BEAMS ON ELASTIC FOUNDATION**

General theory; infinite beam subjected to concentrated load at its end boundary conditions; infinite beam subjected to a distributed load; semi-infinite beam with point load near its end; short beams.

**UNIT-IV****L-****13****DESIGN OF ROTATING DISCS**

Introduction to Centrifugal stresses- Rotating ring; flat discs-Disc of uniform thickness and Disc of uniform strength.

**UNIT-V****L-12****CURVED BEAM THEORY**

Winkler bach formula for circumferential stresses – Limitations; corrections factors – Radial stress in curved beams – closed rings subjected to concentrated and uniform loads.

**TEXTBOOKS:**

1. Boresi, "Advanced Mechanics of Materials", 6th Edition, John Wiley and Sons, 2003.
2. Timoshenko and S. Woinowsky - Krieger, "Theory of Plates and Shells", 2nd Edition, Tata Mc Graw Hill, 2010.

**REFERENCE BOOKS:**

1. J.P. Den Hartog, "Advanced Strength of Materials", 1st Edition, Dover Publications, 1987.
2. L.S. Srinath, "Advanced Solid Mechanics", 3rd Edition, Tata Mc Graw Hill, 2009.
3. R.K. Rajput, "Strength of Materials", 3rd Edition, S. Chand Publications, 2007.
4. B.C. Punmia, "Strength of Materials and Theory of Structures", 12th Edition, Lakshmi Publications, 2004.