2/4 B.Tech. FOURTH SEMESTER

ME4T1 **MECHANICS OF SOLIDS-II** **Credits: 4**

Lecture:- -4 periods/week **Internal assessment: 30marks**
Tutorial: - 1 periods/week **Semester end examination: 70 marks**

Objectives:

1. The student will compute beam deflections under transverse loads using various methods.
2. The student will describe State of stress at a point and compute principal stresses under bi-axial loading conditions
3. The student will be able to analyze curved beams, thick cylinders and rotating discs for induced stresses, strains and deformations under static loads

Learning Outcomes:

At the end of course the students will be able to:

1. calculate deflections of statically determined and indeterminate beams
2. Determine the state of stress, principal stresses and maximum in-plane shear stresses at any given point on a deformable body which is subjected to combined loading.
3. Analyze and evaluate critical buckling loads of columns under various boundary conditions
4. apply the formal theory of mechanics of solids to thick-walled pressure vessels and rotating discs to evaluate stresses and strains.
5. solve problems relating to bending of curved beams.

Pre-Requisites: Engineering Mechanics

UNIT - I

DEFLECTIONS OF BEAMS:

Introduction, Differential Equations of the Deflection Curve, Deflections by Integration of the Bending Moment Equation, integration of the Shear Force and Load equations, Deflections by Moment Area Method and Macaulay's Method.

UNIT - II

STATICALLY INDETERMINATE BEAMS:

Statically indeterminate Beams, Analysis by the differential equations of the Deflection curve, Moment Area Method.

UNIT - III

CONTINUOUS BEAMS:

Clapeyron's theorem of three moments, Beams with constant and varying moments of inertia.

UNIT – IV

COLUMNS:

Buckling and Stability, Columns with Pinned ends, Columns with other support conditions, effective length of a column, Limitations of Euler's Formula, Rankine's Formula, Columns with eccentric Axial Loads, Secant formula

UNIT – V

ANALYSIS OF PLANE STRESS:

Stresses on inclined Sections, Plane Stress, Principal Stresses and Maximum Shear Stress. Mohr's Circle for Plane Stress, Hooke's Law for Plane Stress. Strain Rosettes

UNIT - VI

THICK PRESSURE VESSELS:

Thick Cylinders: Lame's theory, Radial Deflection, Compound Cylinder.

UNIT – VII

CENTRIFUGAL STRESSES:

Introduction, Rotating Ring, Rotating Disc, Rotating Disc of uniform strength.

UNIT - VIII

CURVED BEAMS:

Stresses in Beams of small and large initial curvature, The Winkler-Bach theory, Stresses in Crane Hook and C-Clamp with Rectangular, Circular and Trapezoidal cross sections.

Learning resources

Text books:

1. Mechanics of Materials, (2^{nd} edition), by Stephen P. Timoshenko , James M. Gere, C B S Publishers, 2011.
2. Mechanics of Materials, (7^{th} edition) by James M. Gere, Cengage learning India,2010.

Reference books:

1. Strength of Materials, (4th edition) by R. K. Bansal, revised, Laxmi Publishers, New Delhi.2010.
2. Strength of Materials (2nd edition) by S.S. Rattan, Tata Mc-Graw Hill Private Limited, New Delhi, 2012.
3. Mechanics of Materials, (1st edition) by Adarsh Swaroop, New Age International Pvt. Ltd, 2012 .