Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
M. Tech. in Design Engg.	Theory of Elasticity	MED 512	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
II	3	3-0-0	3 Hours

Unit – I

Plane Stress and Plain Strain: Analysis of stress; Analysis of strain; Compatibility conditions; Generalized Hooke's law; Stress-strain relations; Theories of failure; Factor of Safety in design; Ideally plastic solid Differential equation of equilibrium; Boundary conditions; Compatibility; Stress function and Biharmonic equation; Two dimensional problems in rectangular co-ordinates; Applications to polynomials in rectangular co-ordinates saint Venant's principle.

(08 Hours)

Unit – II

Two Dimensional Problems in Polar Co-ordinates: General equation in polar coordinators; Pure bending of curved bars; Strain components in polar co-ordinates; Rotating disks; stresses in a circular disks; Shear centre shear stress distribution and shear centre for thin walled open section. Asymmetric bending of beams; Shear Centre; Bending of curved beams and thick curved bars.

(08 Hours)

Unit – III

Torsion: Torsion of non prismatic bars; Membrane analogy. Hydrodynamic analogy. Torsion of hollow & thin tubes. Membrane stresses in shell and storage vessels; shells and vessels of uniform strength. Contact stresses problems of determining contact stresses; Assumptions expression for principal stresses; Yield surfaces of Tresca and Von-Mises; Prandtl-Reuss and Saint Venant von-Mises equations. **(09 Hours)**

Unit – IV

Energy Methods: First and second theorems of Castigliano; Engesser's Theorem; Maxwell-Mohr integrals; Bending of a plate; Bending of a uniformly loaded rectangular plate; Deflection of a Rectangular plate with initial curvature; Bending of a circular plate with various loading conditions. **(07 Hours)**

Unit – V

Thermal Stresses: In thin circular disc; Long circular cylinder; Sphere and straight and curved beams. Elastic stability; Beam-columns with concentrated load; With several concerned loads; With end couple buckling problem as eigen value problem; Orthogonality relations; Energy methods for buckling problem.

(06 Hours)

Unit – VI

Concepts of Plasticity: Plastic material behavior; Plastic structural behavior; Plasticity field equations; Example; Thick ring; Limit load by a "work" calculation ; Theorems of limit analysis; The lower bound theorem; The upper bound theorem; Example; The bearing capacity (indentation) Problem; Circular mechanisms sliding block mechanisms; Problems. **(07 Hours)**

Recommended Books:

1. Advanced Mechanics of Solids; L. S. Srinath; Tata McGraw Hill; 2002.
2. Strength of Materials Part-II Advanced Theory and Problems; S. Timoshenko; Third Ed. First Indian; Ed. CBS 1986.
3. Engineering Mechanics of Solids; Egor P Popov; Second Ed.; Pearson 1998.
4. Applied Elasticity; Xu; Zhilun; New Age; 1997.
5. Mechanics of Materials; Craig; second Ed.; Joh Wiley; 1999.
6. Advanced Mechanics of Solids and Structures; Raju; N Krishan and Gururaje; Narosa; 1997.
7. Principles of Solid Mechanics; R. Richards; CRC Press.; 2001.