Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NMEC507	Theory of Elasticity	3	1	0	4

Course Objective

- To make students understand the analysis of linear elastic solids under mechanical and thermal loads
- To provide the foundation for pursuing other solid mechanics courses, such as the theory of plates and shells, elastic stability, composite structures, and fracture mechanics
- To expose students to two-dimensional problems in Cartesian and polar coordinates.
- To make students understand the principle of torsion of prismatic bars.

Learning Outcomes

Upon successful completion of this course, students will:

- Understand the basic concepts in continuum mechanics of solids, including strain, internal force, stress, and equilibrium in solids
- Characterize materials with elastic constitutive relations
- Use analytical techniques to predict deformation, internal force, and failure of simple solids and structural components
- Apply principles of continuum mechanics to design a structure or component to achieve desired performance under realistic constraints

Unit No.	Topics to be Covered	Lecture Hours (L+T)	Learning Outcome
1	Introduction of Cartesian tensor analysis, Continuum concept of stress and strain fields, Concept of the displacement field, Stress-strain-displacement relationship in polar coordinate system.	10+3	Gives a comprehensive idea of the basic mechanics of elastic response.
2	Generalized Hook's law, Stress equilibrium equation, Compatibility condition, 3-D Mohr's circle and plan stress & strain Problem, Hydrostatic and deviatoric stress tensor, Lame's elastic constant, concept of Airy's stress function approach.	10+3	Understanding the traction vector and stress tensor and developing the equilibrium equation
3	Formulation and Solution Strategies, Energy Methods	6+2	Understanding the general formulation of the boundary value problem
4	Bending analysis of a beam with shear effect, Effect of thickness ratio on the deflection of a beam due to shear, estimation of bending stresses, Plastic analysis of beams.	4+2	Understanding the stress and deflection of a general cross-section beam
5	Torsion of circular and non-circular bar (Saint Venant approach), Flexural rigidity in an elliptical and triangular bar under torsion.	4+1	Understanding the behaviour of the general cross-section bar under Torsion
6	Axi-symmetric Problem: Analysis of thick cylinder under internal, external and combined pressure, analysis of Rotating disk using Airy's stress function	5+2	Understanding the stress and deformation in Axi-symmetric structures

7	Introduction to thermal stresses.Thermal stresses for a radially symmetric problem	3+1	Understanding the effect of temperature on the deformation behavior of the material
Total		42 + 14	

Text Books:

1. Advanced Mechanics of Solids, L. S. Srinath, 2nd Ed. TMH, 2003.

Reference Books:

1. Theory of Elasticity, S. P. Timoshenko & J. N. Goodier, 2nd Ed. McGraw-Hill, 1951
2. Solid Mechanics, S M A Kazimi, TMH, 1st revised edition 2017