Course Code	Course Title	L	T	P	C
17CE001	THEORY OF ELASTICITY	3	1	0	4

Course Objectives:

1. To make students understand the principles of elasticity.
2. To familiarize students with basic equations of elasticity.
3. To expose students to two dimensional problems in Cartesian and polar coordinates.
4. To make students understand the principle of torsion of prismatic bars.

Course Outcomes:

At the end of the course student will be able

1. To apply elastic analysis to study the fracture mechanics.
2. To apply linear elasticity in the design and analysis of structures such as beams, plates, shells and sandwich composites.
3. To apply hyper elasticity to determine the response of elastomer-based objects.
4. To analyze the structural sections subjected to torsion.

Activities:

1. Determination of Plane stress and plain strain for any 2D element using Excel and Mat-lab.
2. Determination of principle stress on 2D element by using Mat Lab.
3. Determination of Torsion in straight bars by using Mat Lab.

Skills:

1. Ability to analyze the elasticity problems using Mat Lab coding.
2. Developing the capability to use Mat Lab coding in elasticity problems

UNIT-I: Plane Stress and Plane Strain

Elasticity – Notation for forces and stresses – components of stresses and strains – Hooke's Law - Plane Stress – Plane strain – Differential Equations of equilibrium – Boundary conditions –Compatibility equations - Stress function – Boundary Conditions.

UNIT –II: Two Dimensional problems in Rectangular co-ordinates

Solution by polynomials – Saint Venant's principle – Determination of displacements – Bending of simple beams – cantilever and simply supported

UNIT-III: Two Dimensional problems in Polar co-ordinates

General equations in polar co-ordinates – Stress function and equation of compatibility with zero body forces – Analysis of thick cylindrical shells with symmetrical loading about the axis – Pure bending of curved bars – Strain components in Polar coordinates – rotating disk

UNIT-IV: Three Dimensional State of Stress

Analysis of stress and strain in three dimension - Principal stresses – Determination of principal stresses - Maximum shear stress – Homogeneous Deformation – General Theorems - Differential equations of equilibrium – Conditions of compatibility – Equations of equilibrium in terms of displacements – Principle of superposition – Uniqueness of solution –Reciprocal theorem.

UNIT-V: Torsion

Torsion of prismatic bars –St.Venant solution, stress function, Warp function - Bars with elliptical cross section – Other elementary solution – Membrane analogy – Torsion of rectangular bars

TEXT BOOKS:

1. Timoshenko & Goodier, "Theory of Elasticity" , McGraw Hill Company, 2006.

2. Martin H. Sadd, "Elasticity: Theory, Applications and Numeric", Academic Press, 2010

REFERENCES

1.C.T. Wang, "Applied Elasticity", McGraw Hill, 1953.

2.L.S. Srinadh, "Advanced Mechanics of Solids", TMH Publishing Company Limited, 1992.

3.Sadhu Singh, "Theory of Elasticity", Khanna Publishers, 1997.