THEORY OF ELASTICITY

(Professional Elective-I)

Course Code: **19CE2252**

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Course Outcomes: At the end of the course the student will be able to

CO1 : Discuss plane stress and plane strain in a given situation.

CO2 : Analyse the two dimensional problems using Airy's stress function.

CO3 : Solve linearly elastic bodies using Hooke's law.

CO4 : Calculate torsional stresses developed in thin walled sections.

CO5 : Apply the concepts of elasticity and plasticity to analyse the engineering problems.

UNIT-I (10-Lectures)

Elasticity: Analysis of stress and strain, Definition of stress and strain at a point, Equilibrium and compatibility equations, Transformation of stress and strain at a point Principal stresses and strains: Stress and strain invariants, hydrostatic and deviator stress strains.

LO1 : Understand the Equilibrium and compatibility equations.
LO2 : Understand types of stresses and its transformation.

UNIT-II (10-Lectures)

Plane stress and plane strain: - Simple two dimensional problems in Cartesian and polar co-ordinates, Airy's stress function in rectangular and polar coordinates.

LO1 : Explain 2D stress and strain.
LO2 : Explain Airy's stress formulation.

UNIT-III (10-Lectures)

Stress-strain relations for linearly elastic solids: Generalized Hooke's law. Solution of axi-symmetric problems, stress concentration due to presence of a circular hole, Elementary problems of elasticity in three dimensions.

LO1 : Solve problem using generalized Hooke's law.
LO2 : Solve stress concentration problems.

UNIT-IV (10-Lectures)

Torsion: St.Venant's approach-Prandtl's approach – Membrane analogy – Torsion of thin walled open and closed sections

LO1 : Understand various approaches for torsion in member.
LO2 : Behaviour of thin walled section subjected to torsion.

UNIT-V (10-Lectures)

Plasticity: Physical Assumptions – Yield criteria – Tresca and VonMises criterion of yielding, plastic stress strain relationship, Elastic plastic problems in bending. Some engineering applications of elasticity and plasticity.

LO1 : Explain various yield criteria.
LO2 : Explain plastic stress strain relations.

TEXT BOOKS

1. Timoshenko, S. and Goodier J.N. –Theory of Elasticity‖, 2nd Edition, McGraw Hill Book Co, 2001.
2. Sadhu Singh, –Theory of Elasticity‖, 3rd Edition, Khanna Publishers, 2003.

REFERENCES

1. Chen W.F. and Han D.J. –Plasticity for structural Engineers‖, 1 st Edition,. Springer-Verlag, 2000.
2. Irving H.Shames and James, M.Pitarresi. –Introduction to Solid Mechanics‖, 4 th Edition, Prentice Hall of India Pvt. Ltd., 2000.