

CE/BOS/ CE 502/0412

K L UNIVERSITY
THEORY OF ELASTICITY (11 – CE 502)

SYLLABUS

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Two-dimensional problems in rectangular coordinates

Plane stress ; Plane strain; Differential equations of equilibrium; Boundary conditions; Compatibility equations; Stress function; Governing differential equation; Solution by Polynomials; End effects – Saint-Venant’s Principle; Determination of displacements; Bending of a cantilever loaded at the end; Bending of a beam by uniform load

Two-dimensional problems in polar coordinates

General equations in polar coordinates; Stress distribution symmetrical about an axis; Effect of circular holes on stress distribution in plates; Concentrated force at a point of a straight boundary; Concentrated force acting on a beam; Stresses in a circular disc, general solutions of the two dimensional problem in polar coordinates, applications of the general solutions in polar coordinates.

Strain energy methods

Total strain energy; Principle of virtual work; Griffith’s theory of rupture; Castigliano’s theorem; Principle of least work (Stationary potential energy), applications of the principle of least work rectangular plates, shear lag

Analysis of stress and strain in three dimensions

Stress at a point – components of stress; Principal stresses; Stress ellipsoid and stress director surface; Determination of principal stresses; Stress invariants; Determination of maximum shear stresses; Octahedral shear stress; strain at a point – Components of strain; differential equations of equilibrium, the principle of superposition

Torsion

Torsion of straight bars – Saint Venant’s theory; Elliptic cross section; Membrane analogy; Torsion of a bar of narrow rectangular cross-section; Torsion of rolled profile sections; Torsion of thin tubes

Text Books:

1. Theory of Elasticity by Timoshenko, S. and Goodier J.N., McGraw Hill Book Co., Newyork, 1988.

Reference Books

1. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, New Delhi 1988.
2. Hearn , E.J. “Mechanics of Materials”, Vol.2, Pergamon Press, Oxford, 1985
3. Irving H.Shames and James, M.Pitarresi, “Introduction to Solid Mechanics”, Prentice Hall of India Pvt. Ltd., Newl Delhi -2002.