

## Course syllabus

Department of Civil Engineering, Indian Institute of Technology Madras

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### CE6780 - Advanced mechanics of structures

**Credit Distribution:** C:10 L:3 T:1 P:0 E:0 O:6 TH:0

**Course Type:** Theory

**Description:** To find the stress and displacement of deformable bodies subjected to various spatial and temporal distributions of boundary loads. To find whether the body would fail for a given boundary load.

**Course Content:** 1. Theory of Elasticity: Analysis of stress and strain; equilibrium equations, compatibility equations; Constitutive equations; Elasticity, Hooke's law. 2. Yield and Failure theories: Ductile and brittle failure; Yield condition, Rankine's failure theory, Mohr's failure theory; Fracture mechanics; Fatigue failure, S-N curve. 3. Theory of Inelasticity: Classical plasticity, flow rule, hardening law; Classical viscoelasticity, creep and stress relaxation. 4. Boundary Value Problems: Stresses and stress resultants in beams; 2D Elasticity solution for bending of beams; Deep beams; Unsymmetrical bending of beams; Torsion, linear elastic solution including warping, thin walled sections; Shear center, Bending and twisting of thin walled beams; Stress Concentration, effective stress concentration factors and applications. 5. Structural Instability: General principles; Buckling of columns, beam-columns, Effect of initial imperfections. 6. Analysis of Thin Plates and Shells: Analysis of thin plates, plate equilibrium equations, derivation of classical plate equation; Classification of shells; Equilibrium equations for thin cylindrical shells; Analysis of shells with and without bending; Instability in plates and shell, Local buckling.

#### Text Books

- Srinath, L.S., Advanced Mechanics of Solids, Tata McGraw Hill, 2007.
- Boresi, A.P. and Sidebottom, O.M., Advanced Mechanics of Materials, John Wiley and Sons, 1985.

#### Reference Books:

- Ragab, A.R.A. and Bayoumi, S.E.A., Engineering Solid Mechanics: Fundamentals and Applications, Taylor & Francis, 1998.
- Armenakas, A.E., Advanced Mechanics of Materials and Applied Elasticity, CRC Press, 2016
- Timoshenko, S.P., and Goodier, J.N., Theory of Elasticity, McGraw Hill, 1988
- Timoshenko, S.P., and Kreiger, W. Theory of Plates and Shells, McGraw Hill, 1989.

**Prerequisite:** NIL