

Course syllabus

Department of Civil Engineering, Indian Institute of Technology Madras

CE7640 - ELASTIC AND PLASTIC STRESS ANALYSIS

Credit Distribution: C:9 L:3 T:0 P:0 E:0 O:6 TH:0

Course Type: Theory

Description: 1. To understand the mathematical framework used to describe the mechanical response of solids, with specific application in civil engineering such as steel, concrete, composites. 2. To solve initial boundary value problems for various classes of material models.

CourseContent:1. Review of Continuum Mechanics: Mathematical preliminaries, Kinematics, Balance laws, Constitutive theory; 2. Elasticity: Finite and Linearized elasticity, General representation for stress, Experimental issues in determining the stored energy with applications to elastomers and polymers, Universal relations, Micromechanics with applications to concrete and composites; 3. Plasticity: Yield and failure criteria, classical theory of plasticity, application to steel, soil and concrete, cyclic loading of metals, endochronic theory; 4. Boundary Value Problems: Bending, stretching and shearing of beams and plates; Inflation, extension, torsion and shearing of cylinders; Inflation of shells; Torsion of closed and open sections

TextBooks:

1. Holzapfel, G.A., Nonlinear Solid Mechanics, Wiley, 2001
2. Atkin, R.J., and Fox, N., An introduction to the Theory of Elasticity, Longman, 1980
3. Khan, A.S., and Huang, S., Continuum Theory of Plasticity, John Wiley, 1995.

Reference Books:

1. Truesdell, C., and Noll, W., Nonlinear Field Theories, Springer, 2004.
2. Armenakas, A.E., Advanced Mechanics of Materials and Applied Elasticity, CRC Press, 2016.

Prerequisite: CE6780, ID6010 or COT

Prepared in January 2021