

Course syllabus

Department of Civil Engineering, Indian Institute of Technology Madras

CE5630 - Advanced theory and design of concrete structures Finite Element Analysis

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

Course Type: Theory

Description: To review basic concepts in structural concrete design (including basics of prestressed concrete), understand the background of various code formulations, and learn advanced theory and applications of design principles in reinforced concrete (RC).

Course Content: 1. Introduction, Basic Properties, Durability, Design Philosophy: Introduction to plain, reinforced & prestressed concrete. Behaviour of concrete under uniaxial and multi-axial states of stress. Effects of creep, shrinkage and temperature. Strength, stiffness and ductility of steel. Deterioration due to chemical attack of concrete, corrosion of steel, methods to check loss of durability in concrete. Limit states method, comparison with working stress and ultimate load methods. 2. Behaviour and Design of RC Flexural Members: Flexure, flexural shear, torsion combined with flexure and flexural shear, bond and development length, curtailment and splicing of bars. 3. Behaviour of Prestressed Concrete Flexural Members: Losses in prestress. Analysis of stresses at transfer and service loads. Assessment of ultimate capacity. Basic design requirements. 4. Behaviour and Design of RC Columns: Axial compression combined with flexure, eccentric tension, biaxial bending, slender columns, effect of confinement, detailing. 5. Serviceability Limit States: Estimation of deflections and crack-widths in RC members. 6. Limit analysis of RC members: Moment redistribution in continuous beams; yield line analysis of slabs. 7. Design of Footings: isolated and combined footings 8. Special Topics: Building systems; Beam-column joints; Deep beams and corbels; Strut-and-tie method of analysis; Structural walls.

Text Books :

- Pillai, S. U., and Menon, D., Reinforced Concrete Design, 3rd Ed., McGraw Hill Education Private Limited, 2011

Reference Books :

- IS 456 Plain and Reinforced Concrete " Code of Practice, Bureau of Indian Standards
- SP 16: 1980 Design Aids for Reinforced Concrete to IS 456 : 1978, Bureau of Indian Standards
- SP 24: 1983 Explanatory Handbook on Indian Standard Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards
- Varghese, P. C., Limit State Design of Reinforced Concrete, PHI Learning Pvt. Ltd., 2008.
- Subramanian, N. Design of Reinforced Concrete Structures. Oxford University Press, 2013.
- Wang, C-K, and Salmon, C.G., Reinforced Concrete Design, 7th Ed., John Wiley, 2006.
- Lin, T.Y. and Burns, N.H., Design of Prestressed Concrete Structures, John Wiley and Sons, 1981.

- Rajagopalan, N. Prestressed Concrete. Tata McGraw-Hill Publishing Company Ltd, 2002.
- Wight, J. and MacGregor, J.G., Reinforced Concrete: Mechanics and Design. 6th Ed., Pearson Education, 2016

Prerequisite: NIL