

Course syllabus

Department of Civil Engineering, Indian Institute of Technology Madras

CE5340 – FEM & Constitutive Modelling in Geomech

Credit Distribution: C:12 L:4 T:0 P:0 E:0 O:8 TH:0

Course Type: Theory

Description: Introduction of the finite element and constitutive modeling in geomechanics

Course Content:

Introduction to Matrix algebra and preliminaries – 1-d & 2-d discrete systems – bar and beam elements, matrix methods – Introduction to Raleigh-Ritz and Weighted residual methods – Continuum Analysis – definition of strain and stress tensors, concept of shape functions & equilibrium equations, derivation of finite element stiffness matrices – Numerical Integration and Isoparametric elements – Modelling of joints and interfaces – Modelling techniques for semi-infinite media – Modelling of construction and excavation sequences – Constitutive Modelling of soils – determination of material parameters, linear, nonlinear and elastic-plastic constitutive models – Nonlinear analysis techniques.

Text Books : Nil

Reference Books:

1. Bathe, K.J. (1996) Finite Element Procedures in Engineering Analysis, Prentice Hall, Prentice-Hall of India Pvt. Ltd., New Delhi. (topics – 2, 3, 6, 11 & 12)
2. Bhatti, M. A. (2005) Fundamental Finite Element Analysis and Applications, John Wiley & Sons, Inc., Hoboken, NJ, USA.
3. Cook, R.D., Malkus, D.S. and Plesha, M.E. (2000) Concepts and Applications of Finite Element Analysis, 4th Edition, Prentice Hall-India, New Delhi. (all topics)
4. Desai, C.S. and Zaman, M. (2014) Advanced Geotechnical Engineering: Soil-Structure Interaction Using Computer and Material Models, CRC press, Boca Raton, FL, USA.
5. Hinton, E. and Owen, D.R.J. (1977) Finite Element Programming, Academic Press.
6. Hinton, E. and Owen, D.R.J. (1979) An Introduction to Finite Element Computations, Pineridge Press, Swansea.
7. Krishnamoorthy, C.S. (1994) Finite Element Analysis: Theory and Programming, Tata McGraw Hill, New Delhi.
8. Potts D.M. and Zdravkovic, L. (2001) Finite element analysis in geotechnical engineering: Theory and application, Vols. 1 & 2, Thomas Telford, London, UK
9. Rao, S.S. (2001) The Finite Element Method in Engineering, Butterworth Heinemann, New Delhi.
10. Zienkiewicz, O.C. and Taylor, R.L. (1989) Finite Element Method (4th edn) McGraw Hill, London, U.K.

Prerequisite: NIL