SMPE104 FINITE ELEMENT METHOD AND APPLICATIONS

UNIT I   BASIC CONCEPTS
Basic concepts - Discretization of continuum, typical elements, the element characteristic matrix, element assembly and solution for unknowns - Applications.

UNIT II   VARIATIONAL PRINCIPLES
Variational principles, variational formulation of boundary value problems, variational methods approximation such as Ritz and weighted residual (Galerkin) methods, Applications.

UNIT III   DISPLACEMENTS BASED ELEMENTS
Displacements based elements, finite elements for axial symmetry. One-dimensional problems of stress, deformation and flow, assembly, convergence requirements, Finite elements analysis of two-dimensional problems. The linear and quadratic triangle, Natural coordinates.

UNIT IV   ISOPARAMETRIC FORMULATION
Isoparametric formulation – Isoparametric bar element – plane bilinear isoparametric element – refined elements – Numerical integration techniques.

UNIT V   APPLICATIONS IN GEOTECHNICAL ENGINEERING
Use of FEM to Problems in soils and rocks, Introduction to non-linearity. Description and application to consolidation, seepage and soil – structure interaction problems.

REFERENCES:
1.   Cook, R.D., Malkus, D.S., and Plesha, M.E., Concepts and Applications of Finite Element Analysis, John Wiley, 1989.
2.   Reddy, J.N., An Introduction to the Finite Element Method, McGraw Hill, 1984.
3.   Chadrupatla, R.T., and Belegundu. A.D, Introduction to Finite Elements in Engineering, Third Edition, Prentice- Hall, 2006.
4.   Rockey, K.C., Erans, H.R., Griffiths, D.W., and Nethercot, D.A., The Finite Element method, Grostry Lockwood Staples, London, 1975.
5.   Rajasekaran, S., Finite Element Analysis in Engg Design, Wheller Publishing, Allahabad, 1993.
6.   Smith, I.M., Programming the Finite Element Method with Application to Geomechanics, John Wiley and sons, New Delhi, 2000.
7.   Gupta, O.P. Finite and Boundary Element Methods in Engineering, Oxford & IBH Publishing Co., Pvt. Ltd., New Delhi, 2000.
8.   Rao, S.S. The finite element method in Engg, Butterworth - Heinemann., 1998.
9.   Potts, D.M. and Zdramcovic, L., Finite Element analysis in Geotechnical Engineering - Application, Thomas Telford, 2001.
10.   Shen, J. and Kushwaha. R.L., Soil-Machine Interaction - A finite element perspective, Moral Dikker, Inc. 1998.