

ME 532 Finite Element Methods in Engineering (3-0-0-6)

Introduction: Historical background, basic concept of the finite element method, comparison with finite difference method; Variational methods: calculus of variation, the Rayleigh-Ritz and Galerkin methods; Finite element analysis of 1-D problems: formulation by different approaches (direct, potential energy and Galerkin); Derivation of elemental equations and their assembly, solution and its postprocessing. Applications in heat transfer, fluid mechanics and solid mechanics. Bending of beams, analysis of truss and frame. Finite element analysis of 2-D problems: finite element modelling of single variable problems, triangular and rectangular elements; Applications in heat transfer, fluid mechanics and solid mechanics; Numerical considerations: numerical integration, error analysis, mesh refinement. Plane stress and plane strain problems; Bending of plates; Eigen value and time dependent problems; Discussion about preprocessors, postprocessors and finite element packages.

Texts/References:

1. J. N. Reddy, An introduction to the Finite Element Method, 3rd edition, McGraw-Hill, 2006.
2. R. D. Cook, D. S. Malkus and M. E. Plesha, Concepts and Applications of Finite Element Analysis, 4th edition, John Wiley, 2007.
3. K. J. Bathe, Finite Element Procedures in Engineering Analysis, 2nd edition (reprint), Prentice-Hall, 2009.
4. T. J. R. Hughes, The Finite Element Method, Prentice-Hall, 1986.
5. O. C. Zienkiewicz and R. L. Taylor, The Finite Element Method, 7th edition, Butterworth-Heinemann, 2013.