

10 ME 422 FINITE ELEMENTS METHODS

IV B.Tech II Semester

(with effect from the academic year 2013-2014)

Lectures/week: 4 Hrs.
University Exam: 3 Hrs

Credits : 4
Sessional Marks : 40
End Examination Marks : 60

UNIT-I

Basic Concepts of the Finite Element Method – Introduction, How does the FEM work – Comparison of Finite Element and Exact Solutions and Comparison of Finite Element and Finite Difference Methods. A General Procedure for Finite Element Analysis with simple examples: determination of circumference of a circle & centre of mass of an irregular body. Concepts of formulation, Boundary and Initial value problems, Brief History of Finite Element Methods, Finite Element softwares, Typical applications of FEM.

UNIT-II

Finite Element Formulations starting from Governing Differential Equations: Weighted Residual Methods – simple continuous trial functions, collocation and Galerkin methods, The General weighted Residual, weak (variational) Forms, Piece – wise continuous trial function solutions of the weak form, one- dimensional bar elements, one-dimensional Heat Transfer element.

UNIT-III

Finite Element Formulation based on the stationarity of a Functional – Functional and differential equation forms, Principle of Stationary Total Potential (PSTP) – Rayleigh– Ritz Method, Piece-wise Trial Functions – Finite Element Method – bar element and one dimensional heat transfer based on the stationarity of a functional. Meaning of Finite Element equations.

UNIT-IV

One Dimensional Finite Element Analysis – General form of the total potential for 1-d, Generic form of FEM equations. Linear Bar Element, Quadratic bar element – determination of shape functions, Element Matrices; beam element – Selection of nodal d.o.f., determination of shape functions, Element matrices. One dimensional heat transfer.

UNIT-V

Two Dimensional Finite Element Analysis : Dimensionality of a problem, Approximation of Geometry and field variable – Simple three noded Triangular element, Four-noded rectangular Element. Natural coordinates for 4-Quadrilateral Element and Triangular element. 2-D elements for structural mechanics – Generic relations for Three-noded triangular element, Four-noded rectangular element, Numerical integration- Gauss quadrature in two dimensions, Computer implementation.

TEXT BOOKS:

1. An Introduction to Finite Element Method : J.N.Reddy (Mc Graw Hill book company – Chapters 1 & 6)
2. Text Book of Finite Element Analysis : P.Seshu(PHI pvt.Ltd.,New Delhi 2003-Complete syllabus)

REFERENCES:

1. Introduction to Finite Elements in Engineering : Chandrupatla T.R. & Belegundu A.D
2. Fundamentals of Finite Element Analysis : David V Hutton.
3. Introduction to the Finite Element Method : Abel & Desai