Subject Code	:	**06ME63**
IA Marks	:	25
No. of Lecture Hrs./ Week	:	04
Exam Hours		

:

03

Total No. of Lecture Hrs.

:

52

Exam Marks

:

100

PART - A

Unit - 1

Introduction: Equilibrium equations in elasticity subjected to body force, traction forces, stress strain relations for plane stress and plane strain, Boundary conditions, Initial conditions, Euler's Lagrange's equations of bar, beams, Principal of a minimum potential energy, principle of virtual work, Rayleigh-Ritz method, Galerkins method., Guass elimination Numerical integration.

7 Hours

Unit - 2

Basic Procedure: General description of Finite Element Method, Engineering applications of finite element method, Discretization process; types of elements 1D, 2D and 3D elements, size of the elements, location of nodes, node numbering scheme, half Bandwidth, Stiffness matrix of bar element by direct method, Properties of stiffness matrix, Preprocessing, post processing.

6 Hours

Unit - 3

Interpolation Models: Polynomial form of interpolation functions- linear, quadratic and cubic, Simplex, Complex, Multiplex elements, Selection of the order of the interpolation polynomial,

Convergence requirements, 2D Pascal triangle, Linear interpolation polynomials in terms of global coordinates of bar, triangular (2D simplex) elements, Linear interpolation polynomials in terms of local coordinates of bar, triangular (2D simplex) elements, CST element.

6 Hours

Unit - 4

Higher Order and Isoparametric Elements: Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Truss element, Shape functions of 2D quadratic triangular element in natural coordinates, 2D quadrilateral element shape functions – linear, quadratic, Biquadric rectangular element (Noded quadrilateral element), Shape function of beam element. Hermite shape function of beam element.

7 Hours

PART - B

Unit - 5

Derivation of element stiffness Matrices and load Vectors: Direct method for bar element under axial loading, trusses, beam element with concentrated and distributed loads, matrices, Jacobian, Jacobian of 2D triangular element, quadrilateral, Consistent load vector, Numerical integration.

7 Hours

Unit - 6

Heat Transfer Problems: Steady state heat transfer, 1D heat conduction governing equation, boundary conditions, One dimensional element, Functional approach for heat conduction, Galerkin approach for heat conduction, heat flux boundary condition, 1D heat transfer in thin fins.

6 Hours

Unit - 7

Applications I: Solution of bars, stepped bars, plane trusses by direct stiffness method. Solution for displacements, reactions and stresses by using elimination approach, penalty approach.

6 Hours

Unit - 8

Applications II: Solution of beam problems, heat transfer 1D problems with conduction and convection.

7 Hours

Text Books:

1. **Finite Elements in engineering,** Chandrupatla T.R., 3rd Pearson Edition.
2. **The Finite Element Method in Engineering**, S.S. Rao, 4th Edition, Elsevier, 2006.

Reference Books:

1. **The FEM its basics and fundamentals:** O.C.Zienkiewicz, Elsevier, 6e.
2. **Finite Element Method,** J.N.Reddy, McGraw –Hill International Edition.
3. **Finite Element Methods,** by Daryl. L. Logon, Thomson Learning 3rd edition, 2001.
4. **Finite Element Analysis,** C.S.Krishnamurthy,–Tata McGraw Hill Publishing Co. Ltd, New Delhi, 1995.