CEOE-004: Finite Element Method

L	T	P	Credit
3	0	0	3

Course Outcomes: At the end of the course, the student will be able to:

CEOE-004.1	apply the procedure involved to solve a problem using Finite Element Methods, develop the element stiffness matrices using different approach.
CEOE-004.2	Analyze a 2D problem using line, triangular, ax symmetric and quadrilateral element.
CEOE-004.3	Analyze a 3D problem using tetrahedral and hexahedral elements.

Mapping of course outcomes with Program Outcomes

CO	PO1: Engineering knowledge	PO2 Problem analysis	PO3:Design/development of solutions	PO4:Conduct investigations of complex problems	PO5:Modern tool usage	PO6: The engineer and society	PO7:Environment and sustainability	PO8:Ethics	PO9:Individual and team work	PO10:Communication	PO11:Project management and finance	PO12:Life-long learning
CEOE-004.1	3	3							3			3
CEOE-004.2	3	3							3			3
CEOE-004.3	3	3							3			3

Unit-I: Introduction to Finite Element Method:

1.1 General Applicability and Description of Finite Element Method

1.2 History of Finite Element Method

General Procedure of Finite Element Method:

1.3 Boundary Value Problems and Discretization of the domain,

1.4 Selection of Shapes, Types and Number of elements, node numbering technique,

1.5 Interpolation Polynomials, their selection and derivation in terms of global and local coordinates,

1.6 Convergence requirements.

1.7 Formulation of Element Characteristic, Matrices and Vectors,

1.8 Variational approach. Assembly of Element matrices and Vectors and Derivation system equations,
1.9 Computation of Element Resultants

Unit-II: Solution of Finite Element Method:

2.1 Weighed Residual Methods- Galerkin Method, One, two and three dimensional problems
2.2 Variation Methods- General Principles, Rayleigh Ritz Method, Least Square Method, Use of Lagrange's Multipliers
2.3 Eigen Value Problems,
2.4 Propagation Problems,
2.5 Computer Implementation of Gaussian Eliminations,

Unit-III: Iso-parametric Formulation:

3.1 Lagrange interpolation functions,
3.2 Isoparametric Elements and formulation
3.3 Numerical Integration, mapping and its use in mesh generation

Static Analysis:

3.4 Formulation of Equilibrium and Compatibility Equation- application to truss and beam.
3.5 Analysis of truss, Frames,
3.6 Plane Stress and Plane Strain Problems Plates and Shells.

Text / Reference Books:

1. Weaver, Johnson, Finite Element and Structural Analysis
2. HC Martin, Matrix Structural Analysis
3. CF Abel, CS Desai, Finite Element Methods
4. Buchanan, Finite element Analysis (Schaum Outline S), TMH
5. Krishnamurthy, Finite element analysis, TMH