B. E. CIVIL ENGINEERING
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
SEMESTER - VII

FINITE ELEMENT METHOD

Course Code	**18CV751**	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

Course Learning Objectives: This course will enable students to;

1. Develop analytical skills.
2. Learn principles of analysis of stress and strain.
3. Develop problem solving skills.
4. Understand the principles of FEM for one and two dimensional problems.

Module -1

Theory of elasticity concepts, Energy principles, Rayleigh - Ritz Method, Galerkin method and finite element method, steps in finite element analysis, displacement approach, stiffness matrix and boundary conditions.

Module -2

Discritisation; finite representation of infinite bodies and discritisation of very large bodies, Natural Coordinates, Shape functions; polynomial, LaGrange and Serendipity , one dimensional formulations; beam and truss with numerical examples.

Module -3

2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, Static Condensation of nodes, degradation technique, Axisym metric Element.

Module -4

Isopara metric concepts; is opera metric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isopara metric Elements, Numerical integration by Gaussian quadrature rule for one, two and three dimensional problems.

Module -5

Techniques to solve nonlinearities in structural systems; material, geometric and combined non linearity, incremental and iterative techniques.
Structure of computer program for FEM analysis, description of different modules, exposure to FEM softwares.

Course outcomes: The student will have the knowledge on advanced methods of analysis of structures.

Question paper pattern:

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. Krishnamoorthy C.S., "Finite Element analysis" -Tata McGraw Hill
2. Desai C &Abel J F.," Introduction to Finite element Method" , East West Press Pvt. Ltd.,
3. Cook R D et.al. "Concepts and applications of Finite Element analysis", John Wiley.

Reference Books:

1. Daryl L Logan, "A first course on Finite element Method", Cengage Learning.
2. Bathe K J - "Finite Element Procedures in Engineering analysis"- Prentice Hall.

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