

ATGE 324: Finite Element Methods

(02 credits – 50 marks)

Course outcomes

The student should be able to–

CO1	Formulate numerical model for a given system.
CO2	Obtain numerical Solutions for boundary value problems.
CO3	Solve mechanical engineering problems using Finite Element Method
CO4	Explain the weighted residual methods

Course Content:

Module-I: Introduction to Finite Element Methods

(5 hours)

Introduction, Basic concept of Finite Element methods, Discretization of continuum, Stiffness Matrix and Boundary Conditions, Introduction to elasticity, Plane Stress and Plain strain Problem.

Module II: Finite Element Formulation Techniques

(6 hours)

Virtual Work and variational principle, Variational Formulation of Boundary Value problem, Variational Method: Ritz and weighted Residual methods. Galerkin Method, Potential Energy Approach, Displacement Approach

Module III: Element Properties

(7 hours)

Natural coordinates, Triangular Elements Rectangular Elements, Lagrange and Serendipity Elements, Solid Elements Isoparametric Formulation Stiffness Matrix for Isoparametric Elements, Numerical Integration

Module IV: Displacement Models

(06 hours)

Convergence requirements, Shape functions, Element stresses and strains Strain—Displacement Matrix for Bar Element, Strain Displacement Matrix for CST Element, Strain Displacement Relation for Beam Element

Module –V: Assignments / seminars / case studies on Module -I to Module – IV (06 hours)

References:

1. S.S.Bhavikatti, —Finite Element Analysis, New Age International Publication, 2nd Edition.
2. Desai and Abel, —Introduction to FEM, 2nd Edition.
3. Zienkiewicz & Taylor, —The Finite Element Method for Solid and Structural Mechanics Elsevier Publications, 6th Edition, 2005.
4. J. N. Reddy, —Finite Element Analysis, McGraw Hill Book Co.6th Edition 2010.
5. S. S. Rao, —Finite Element Method in Engineering, 4th Edition, Dec. 2004Pergamon Press.

