(CE502) FINITE ELEMENT ANALYSIS

Objective of the Course:

To provide the students an overview on Finite Element Method and equip them with the Finite Element Analysis fundamentals, enable the students to formulate the design problems into FEA.

UNIT-I

Introduction

A brief history of FEM, Need of the method, Equilibrium equations boundary conditions, compatibility; Strain-displacement relations; linear constitutive relations; Principle virtual work; Principle of stationary potential energy.

UNIT-II

Element Properties

Different types of elements; Displacement models; Relation between nodal degrees of freedom and generalized coordinates; Convergence requirements; Compatibility requirement; Geometric invariance; Natural coordinate systems; Shape functions; Element strains and stresses; Element Stiffness matrix ;Element nodal load vector. Isoparametric elements– Definition, Two dimensional isoparametric elements – Jacobian transformation, Numerical integration.

UNIT-III

Direct Stiffness method and Solution Technique

Assemblage of elements–Obtaining Global stiffness matrix and Global load vector; Governing Equilibrium equation for static problems; Storage of Global stiffness matrix in
banded and sky line form; Incorporation of boundary conditions; Solution to resulting simultaneous Equations by Gauss elimination method.

UNIT-IV

Plane-stress and Plane-strain analysis

Solving plane stress and plane-strain problems using constant strain triangle and four noded isoparametric element.

UNIT-V

Analysis of plate bending

Basic theory of plate bending; Shear deformation plates; Plate bending analysis using four noded isoparametric elements.

TEXT BOOKS:

1. Introduction to Finite Elements in Engineering by R.T. Chandrupatla and A.D. Belegundu, Prentice Hall of India, 1997.
2. "The Finite Element Method in Engineering Science" by P.Zienkiewiez, McGraw Hill, 1971.

REFERENCE BOOKS:

1. Finite Element Analysis by Abel and Desai, New Age Publishers, 2007.
2. Finite Element Analysis: Theory and Programming by C. S. Krishnamoorthy, Tata McGraw-Hill, 1995
3. Finite Element Procedures in Engineering Analysis by K. J. Bathe, Prentice Hall Inc., 1996.