FINITE ELEMENT METHOD WITH STRUCTURAL APPLICATIONS

Course Code: 13CE 2212 **L P C**
4 0 3

Course Educational Objectives:

1. To familiarize the student with understanding of shape functions and stiffness matrix for various elements used in FEM
2. To create awareness among students about analysis of bars, trusses, beams and frames using FEM

Course Outcomes:

1. Student demonstrate his ability to write suitable shape function and stiffness matrix for a given element
2. Student shall be capable of analyzing a truss, bar, beam and frames using FEM including temperature loads

UNIT- I (10 Lectures)

Introduction : Concept of Finite Element Method - Merits and demerits, applications, relevant software's. Steps involved in FEM as applicable to structural mechanics problems. Descritization interpolation model, Convergence and compatibility criteria.

UNIT-II

Shape Functions - Methods of Determination

Element Stiffness matrix Equation - Derivation of stiffness matrix based on Principle of minimization of Total Potential Energy and Principle of Virtual Work.

Assemblage of Element Stiffness Matrices – Assembly procedure, solution of nodal displacement, Element Stresses and Strains, Interpretation of results, Post processing, Static condensation.

UNIT- III

2D Analysis using FEM : Stiffness Matrix for a Two noded Truss Element, Three noded Truss Element and Two noded Beam Element in Local, and Global (2D)

Stiffness Matrix for a three noded Constant Strain Triangular (CST) Four noded for Plane Stress and Plane Strain Condition.

UNIT- IV

Isoparametric Formulation: Isoparametric, sub-parametric and super parametric Elements, Procedure for Formulation, Advantages of Isoparametric Elements, Shape functions for Isoparametric Elements, Transformation of axes, Co-ordinate systems in FEM - Jacobian – Relevance to FEM.

UNIT-V

Application of F.E.M to Structural Mechanics Problems : Analysis of 2D –Truss, Initial Strain/Rise in Temperature, 3D Truss, Analysis of Propped Cantilevers, Fixed beams, Continuous beams and Portal Frames.

TEXT BOOKS

1. Chandrupatla,T.R., Belegunde, A.D,*"Introduction to Finite Elements in Engineering",* 3rd edition, PHI, 2010.

2. S.S. Bhavikatti, *"Finite Element Analysis"* , 2nd edition, New age international, 2010.

REFERENCES

1. Klaus-Jurgen Bathe, *"Finite Element Methods",* 2nd edition, Prentice Hall, 2010

2. Reddy, J.N., *"Introduction to Finite Element Method",* 3rd Edition, Mc Graw Hill, 2002

3. Desai,Y.M., Eldho.TI, Shah,A.H, *"Finite Element methods with application in Engineering",* 1st edition, Pearson, 2011

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