AMME21 FINITE ELEMENTS METHODS IN ENGINEERING

UNIT-1 INTRODUCTION
1.1 Introduction. Historical Background. Design Considerations. Need of Finite Element Method.
1.2 The Process Of Finite Element Method, Field And Boundary Conditions, Steps Involved In Fem, The Standard Discrete System, Transformation Of Co-Ordinates.

UNIT-2 FINITE ELEMENTS OF ELASTIC CONTINUUM DISPLACEMENT APPROACH
2.1 Introduction, Direct Formulation Of Finite Element Characteristic, Generalized Nature Of Displacements, Strains, And Stresses, Generalization To The Whole Region--Internal Nodal Force Concept Abandoned,
2.2 Displacement Approach As A Minimization Of Total Potential Energy, Convergence Criteria, Discretization Error And Convergence Rate,
2.3 Displacement Functions With Discontinuity Between Elements--Non-Conforming Elements And The Patch Test,
2.4 Bound On Strain Energy In A Displacement Formulation, Direct Minimization.

UNIT-3 GENERALIZATION OF THE FINITE ELEMENT CONCEPTS WEIGHTED RESIDUAL AND VARIATIONAL APPROACHES
3.1 Introduction, Weighted Residual Methods, Approximation To Integral Formulations: The Weighted Residual Method,
3.2 Virtual Work As The 'Weak Form' Of Equilibrium Equations For Analysis Of Solids Or Fluids, Variation Principles,
3.3 Establishment Of Natural Variation Principles For Linear, Self-Adjoin Differential Equations, Maximum, Minimum, Or A Saddle Point,
3.4 Constrained Variation Principles, Lagrange Multipliers And Adjoin Functions.

UNIT-4 STRAIN PLANE STRESS AND PLANE
4.1 Introduction, Element Characteristics, Some Practical Applications,
4.2 Special Treatment of Plane Strain With An Incompressible Material.

UNIT-5 AXI-SYMMETRIC STRESS ANALYSIS
5.1 Introduction, Element Characteristics, Some Illustrative Examples.

UNIT-6 THREE–DIMENSIONAL STRESS ANALYSIS
6.1 Introduction, Tetrahedral Element Characteristics.

UNIT-7 ELEMENT SHAPE FUNCTIONS SOME GENERAL FAMILIES OF CONTINUITY
7.1 Introduction, Two–Dimensional Elements, Completeness Of Polynomials, Rectangular Elements – Lagrange Family,

7.2 Rectangular Elements–'Serendipity' Family, Triangular Element Family, One-dimensional Elopements, Three-Dimensional Elements, Other Simple Three-Dimensional Elements.

UNIT-8 CURVED, ISOPARAMETRIC ELEMENTS AND NUMERICAL INTEGRATION
8.1 Introduction, Parametric Curvilinear Co-Ordinates, Geometrical Conformability Of Elements, Variation Of The Unknown Function With In Distorted, Curvilinear, Elements, Continuity Requirements,
8.2 Transformations, Element Matrices, Area and Volume Co-Ordinates, Convergence of Elements in Curvilinear Co-Ordinates, Numerical Integration.

UNIT-9 SOME APPLICATIONS OF ISOPARAMETRIC ELEMENTS IN TWO- AND THREE-DIMENSIONAL STRESS ANALYSIS
9.1 Introduction, a Computational Advantage of Numerically Integrated Finite Elements.

Reference Books:
1. Introduction to Finite Elements in Engineering by T R Chandrupatla and A D Belegundu.
2. Introduction to the Finite Element Method by J N Reddy
3. Finite Element Analysis: Theory and Programming by C S Krishnamoorthy.