

Sub Code	: 10ME 64	IA Marks	: 25
Hrs/week	: 04	Exam Hours	: 03
Total Lecture Hrs	: 52	Exam Marks	: 100

**PART-A****UNIT-1**

**Introduction:** Equilibrium equations in elasticity subjected to body force, traction forces, and stress-strain relations for plane stress and plane strains. General description of Finite Element Method, Application and limitations. Types of elements based on geometry. Node numbering, Half band width.

07 Hrs

**UNIT-2**

**Basic Procedure:** Euler - Lagrange equation for bar, beam (cantilever / simply supported fixed) Principle of virtual work, principle of minimum potential energy, Raleigh's Ritz method. Direct approach for stiffness matrix formulation of bar element. Galerkin's method.

07 Hrs

**UNIT-3**

**Interpolation Models:** Interpolation polynomials- Linear, quadratic and cubic. Simplex complex and multiplex elements. 2D PASCAL's triangle. CST elements-Shape functions and Nodal load vector, Strain displacement matrix and Jacobian for triangular and rectangular element.

07 Hrs

**UNIT-4**

**Solution of 1-D Bars:** Solutions of bars and stepped bars for displacements, reactions and stresses by using penalty approach and elimination approach. Gauss-elimination technique.

06 Hrs

**PART-B****UNIT-5**

**Higher Order Elements:** Langrange's interpolation, Higher order one dimensional elements-Quadratic and cubic element and their shape functions. Shape function of 2-D quadrilateral element-linear, quadric element Iso-parametric, Sub parametric and Super parametric elements. numerical integration : 1, 2 and 3 gauge point for 1D and 2D cases.

06 Hrs

**UNIT-6**

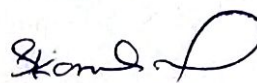
**Trusses:** Stiffness matrix of Truss element. Numerical problems.

06 Hrs

**UNIT-7**

**Beams:** Hermite shape functions for beam element, Derivation of stiffness matrix. Numerical problems of beams carrying concentrated, UDL and linearly varying loads.

06 Hrs



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**UNIT-8**

**Heat Transfer:** Steady state heat transfer, 1D heat conduction governing equations. Functional approach for heat conduction. Galerkin's approach for heat conduction. 1D heat transfer in thin fins.

07 Hrs

**TEXT BOOKS:**

1. **Finite Elements in Engineering**, T.R.Chandrupatla, A.D Belegunde, 3<sup>rd</sup> Ed PHI.
2. **Finite Element Method in Engineering**, S.S. Rao, 4th Edition, Elsevier, 2006.

**REFERENCE BOOKS:**

1. **"Finite Element Methods for Engineers"** U.S. Dixit, Cengage Learning, 2009
2. **Concepts and applications of Finite Element Analysis**, R.D. Cook D.S Maltus, M.E Plesha, R.J.Witt, Wiley 4<sup>th</sup> Ed, 2009
3. **Finite Element Methods**, Daryl. L. Logon, Thomson Learning 3rd edition, 2001.
4. **Finite Element Method**, J.N.Reddy, McGraw -Hill International Edition.

**MECHATRONICS & MICROPROCESSOR**

Sub Code	: 10ME 65	IA Marks	: 25
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**PART - A****UNIT - 1**


**Introduction to Mechatronic Systems:** Measurement and control systems Their elements and functions, Microprocessor based controllers.

06 Hours

**UNIT - 2**

**Review of Transducers and Sensors:** Definition and classification of transducers. Definition and classification of sensors. Principle of working and applications of light sensors, proximity sensors and Hall effect sensors.

07 Hours



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