**17CE32E2 - FINITE ELEMENT ANALYSIS**

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| **Course Category** | Core Elective | **Credits** | 3 |
| **Course Type** | Theory | **Lecture-Tutorial-Practical** | 3-0-0 |
| **Prerequisite** | None | **Sessional Evaluation** | 40 |
| **External Evaluation** | 60 |
| **Total Marks** | 100 |

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| **Course**  **Objectives** | 1. To understand the basic principles of finite element methods. 2. To understand the shape functions and discretization of elements. 3. To analyze one dimensional elements using finite element methods. 4. To analyze plane trusses using finite element approach. 5. To develop stiffness matrices for analysis of beams. 6. To understand the analysis of different types of iso-parametric elements. | |
| **Course Outcomes** | CO1 | Identify the application and characteristics of elements such as bars, beams, plane and iso parametric elements, and 3-D element using finite element methods. |
| CO2 | Develop element characteristic equation procedure and generation of global stiffness equation will be applied. |
| CO3 | Apply Suitable boundary conditions to a global structural equation, and reduce it to a solvable form. |
| CO4 | Develop skills needed to effectively evaluate finite element analyses performed by others. |
| CO5 | Develop finite element formulation for beam elements |
| CO6 | Identify model complex geometry problems and solution techniques. |
| **Course**  **Content** | **UNIT –I**  **INTRODUCTION TO FINITE ELEMENT METHOD:** Introduction – Finite Difference Method – Advantages and disadvantages – Basic steps – Limitations.  **UNIT – II**  **FINITE ELEMENT MODELING AND DISCRETIZATION:** Finite element modeling and discretization – Interpolation and shape functions – Types of elements –Nodes and degrees of freedom.  **UNIT – III**  **ONE DIMENSIONAL FINITE ELEMENT:** Introduction – Bar element – Beam element – Bar and beam elements of arbitrary orientation – Assembly of elements –Stiffness matrices – Boundary conditions – Loads – Applications.  **UNIT – IV**  **TRUSSES:** Plane trusses – Local and global coordinate systems – Direction cosines – element stiffness matrix – Assembly of global stiffness matrix – Stress calculation.  **UNIT – V**  **FINITE ELEMENT FORMULATION:** Introduction beam stiffness – Assembly of beam stiffness matrix – Loading – Boundary conditions – Plane stress – Plane strain analysis.  **UNIT – VI**  **ISOPARAMETRIC ELEMENTS AND FINITE ELEMENT MODELLING:**  Mesh requirements – Material properties – Loads and reactions – Boundary conditions – checking the model – Analysis and design software (for practice purpose only). | |
| **Textbooks**  **& Reference books** | **TEXT BOOKS:**   * 1. Finite Element Analysis by C.S.Krishnamoorthy.   2. Finite Element Analysis – S. S. Bhavikatti.   3. Introduction to Finite Elements Engineering. – Chandrupatla & Belegundu.   **REFERENCE BOOKS:**   * + 1. The Finite Element Method - Zienkiewicz.     2. Concepts and Applications of Finite Element Analysis - Robert Cook Davis Mallcus.     3. Theory and Problems of Finite Element Analysis. - George Buchanan. | |