**19CE32E1– ADVANCED STRUCTURAL ANALYSIS**

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| **Course Category** | Professional Elective | **Credits** | 3 |
| **Course Type** | Theory | **Lecture - Tutorial - Practical** | 3 - 0 - 0 |
| **Prerequisite** | Structural Analysis I & II. | **Sessional Evaluation** | 40 |
| **Semester End Exam Evaluation** | 60 |
| **Total Marks** | 100 |

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| **Course Objectives** | 1. To learn the fundamental concepts of matrix methods in structural analysis. 2. To understand the analysis of continuous beams of two and three spans with different end conditions by flexibility and stiffness matrix methods. 3. To summarize the analysis of two dimensional portal frames with different end conditions by flexibility and stiffness matrix methods. 4. To learn the concepts of the stiffness method and flexibility method and apply it to a two dimensional pin jointed truss. 5. To understand the transformation of matrices from local to global coordinates using element stiffness matrix. 6. To be familiar with various methods of equation solvers for the analysis of structures. | |
| **Course Outcomes** | CO1 | Calculate unknown components of forces and displacements using stiffness and flexibility matrix method. |
| CO2 | Perform the analysis of continuous beams by stiffness and flexibility matrix method. |
| CO3 | Perform the analysis of two dimensional portal frames by stiffness and flexibility matrix method. |
| CO4 | Analyze two dimensional pin jointed trusses by stiffness and flexibility matrix method. |
| CO5 | Transform matrices from local to global coordinates using element stiffness matrix. |
| CO6 | Analyze structures by using different equation solvers. |
| **Course Content** | **UNIT – I**  **INTRODUCTION TO MATRIX METHODS OF ANALYSIS:** Flexibility and stiffness matrices – Force displacement relationships for axial force, couple and torsional moments– Stiffness method of analysis and flexibility method of analysis.  **UNIT – II**  **ANALYSIS OF CONTINUOUS BEAMS:** Stiffness method and flexibility method of analysis – Continuous beams of two and three spans with different end conditions – Internal hinges.  **UNIT – III**  **ANALYSIS OF TWO-DIMENSIONAL PORTAL FRAMES**: Stiffness and flexibility method of analysis of 2D portal frames with different end conditions – Plotting of bending moment diagrams.  **UNIT – IV**  **ANALYSIS OF TWO-DIMENSIONAL PIN JOINTED TRUSSES**: Stiffness and flexibility methods – Computation of joint displacement and member forces.  **UNIT – V**  **TRANSFORMATION OF COORDINATES:** Local and Global coordinate systems – Transformation of matrices from local to global coordinates of element stiffness matrix – Direct stiffness method of analysis – Assembly of global stiffness matrix from element stiffness matrices – Static condensation – Sub structuring**.**  **UNIT – VI**  **EQUATION SOLVERS**: Solution of system of linear algebraic equations– Direct inversion method – Gauss elimination method – Cholesky method – Banded equation solvers frontal solution technique. | |
| **Textbooks and References** | **TEXTBOOKS:**   1. G.S. Pandit & S.P. Gupta, *Structural Analysis A matrix approach*, McGraw Hill education, 2nd edition, 2008. 2. C.S.Reddy, *Basic Structural Analysis*, McGraw Hill education, 3rd edition, 2017. 3. R.C.Hibbeler, *Structural Analysis*, Pearson Education, 9th Edition, 2017.   **REFERENCE BOOKS:**   1. R.C. Coates, M.G. Coutie, F.K. Kong, *Structural Analysis*, CRC Press, 3rd Edition, 1997. 2. William M.C.Guire, Gallagher, Richord H. Gallagher, Ronald D Ziemian, *Matrix Structural analysis*, John Wiley and sons, 2nd Revised edition, 1999. 3. C.K.Wang, *Intermediate Structural Analysis*, McGraw Hill education, 1982. | |

**CO-PO Mapping:** 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

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|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 2 | - | - | 1 | 2 | - | - | - | - | - | - | 2 |
| **CO2** | 2 | - | 2 | - | 2 | - | - | - | - | - | - | 2 |
| **CO3** | 2 | - | 2 | - | 2 | - | - | - | - | - | - | 2 |
| **CO4** | 2 | - | 2 | - | 2 | - | - | - | - | - | - | 2 |
| **CO5** | 2 | 2 | - | - | 2 | - | - | - | - | - | - | 2 |
| **CO6** | 2 | 2 | 2 | 1 | 3 | - | - | - | - | - | - | 2 |