# COMPUTATIONAL STRUCTURAL MECHANICS

| Offering Branches | CE | | | |
|---|---|---|---|---|
| Course Category: | Honors Course | | Credits: | 4 |
| Course Type: | Theory | | Lecture-Tutorial-Practical: | 3-1-0 |
| Prerequisites: | Nil | | Continuous Evaluation: | 30 |
| | | | Semester End Evaluation: | 70 |
| | | | Total Marks: | 100 |

**Course Outcomes**

Upon successful completion of the course, the student will be able to:

| CO1 | Gain basic knowledge of structural systems and **application** of concepts of flexibility and stiffness matrices for simple elements | K3 |
|---|---|---|
| CO2 | **Understand** flexibility matrices to **solve** problems in beams and frames using Flexibility matrix Method | K3 |
| CO3 | **Understand** flexibility matrices to **solve** problems in beams and frames using Stiffness matrix Method | K3 |
| CO4 | **Analyse** pin jointed frames both by flexibility and stiffness Matrix methods | K4 |
| CO5 | **Analyse** building frames for lateral loads using approximate methods of analysis | K4 |

**Contribution of Course Outcomes towards achievement of Program Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | 2 | | 2 | | | | | | | | 2 | |
| CO2 | 2 | | 2 | | 2 | | | | | | | | 2 | |
| CO3 | 3 | | 3 | | 3 | | | | | | | | 3 | |
| CO4 | 2 | | 2 | | 2 | | | | | | | | 2 | |
| CO5 | 2 | | 2 | | 2 | | | | | | | | 2 | |
| Avg. | 2 | | 2 | | 2 | | | | | | | | 2 | |

| 1- Low | 2-Medium | 3-High |
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## Course Content

| UNIT-1 | **FLEXIBILITY AND STIFFNESS MATRICES**<br>Structural systems, geometric and material non-linearity, principle of superposition, equilibrium and compatibility conditions, static and kinematic indeterminacy, principle of minimum potential energy and minimum complementary energy, concepts of stiffness and flexibility, Formation of Flexibility and Stiffness matrices up to second degree for continuous beams and rigid jointed frames. | CO1 |
|---|---|---|
| UNIT-2 | **FLEXIBILITY METHOD**<br>Introduction to the structural analysis by flexibility matrix approach and application to continuous beams including settlement of supports and application to rigid jointed frames. | CO2 |
| UNIT-3 | **STIFFNESS METHOD**<br>Introduction to the structural analysis by stiffness matrix approach and application to continuous beams including settlement of supports and rigid jointed frames. | CO3 |
| UNIT-4 | **ANALYSIS OF PIN JOINTED FRAMES BY MATRIX ANALYSIS**<br>Analysis of pin jointed frames by Force Method, Analysis of pin jointed frames by displacement Method. | CO4 |
| UNIT-5 | **LATERAL LOAD ANALYSIS**<br>Application to building frames, analysis for lateral loads (i) Portal method (ii) Cantilever method analysis of tall buildings subjected to lateral loads | CO5 |

## Learning Resources

| **Text Books** | 1. Matrix methods of Structural Analysis by Pandit and Gupta – Tata Mc.Graw Hill |
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| | 2. Analysis of structures Vol. I & II by Vazrani and Ratwani. Khanna publications. |
| | 3. Comprehensive Structural Analysis Vol.1 & 2 by Dr. Vaidyanathan and Dr. P.Perumal - by Laxmi publications Pvt. Ltd.,New Delhi |
| **Reference Books** | 1. Godbole P N et.al, "Matrix Method of Structural Analysis", PHI ltd, New Delhi. |
| | 2. Pundit and Gupta, "Theory of Structures Vol II", TMH publications, New Delhi |
| | 3. A K Jain, "Advanced Structural Analysis", Nemchand Publications, Roorkee |
| | 4. Manikaselvam, "Elements of Matrix Analysis and Stability of Structures", Khanna Publishers, New Delhi. |
| | 5. H C Martin, "Introduction to Matrix Methods in Structural Analysis", International textbook company, McGraw Hill. |
| **e-learning Resources** | 1. http://nptel.ac.in/courses.php |
| | 2. http://jntuk-coeerd.in/ |