COURSECONTENT

ADVANCED STRUCTURAL MECHANICS								
I Semester-SE								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
2512011	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes:45	**Tutorial Classes:Nil**	**Practical Classes:Nil**				**TotalClasses:45**		
Prerequisites: Structural Analysis I & II.								

Course Overview:

This course focuses on advanced analysis of structural elements under complex loading conditions. It covers unsymmetrical bending, curved beams, beams on elastic foundations, and column buckling behavior. Students are introduced to matrix methods and the direct stiffness method for analyzing indeterminate structures like trusses, beams, and frames. The course enhances analytical skills required for modern structural engineering applications.

Course Objectives:

1. To enable students to analyze and determine stresses and deflections in beams subjected to symmetrical and unsymmetrical bending using the concept of shear center.
2. To develop the ability to compute stresses and deflections in curved beams and beams on elastic foundations under various loading conditions.
3. To understand the behavior of columns under compressive loads and evaluate buckling strength considering elastic, inelastic, and local buckling phenomena.
4. To impart knowledge of stiffness and flexibility matrices for analyzing statically indeterminate structures using matrix methods.
5. To train students to apply the direct stiffness method for analyzing trusses, beams, and frames using systematic assembly and solution procedures.

Course Outcomes: After completion of the course, students will be able to

1. Interpret bending stresses and deflections in beams subjected to unsymmetrical bending.
2. Apply concepts to calculate stresses and deflections in curved beams and beams on elastic foundations.
3. Evaluate the buckling behavior of columns under various loading and boundary conditions.
4. Analyze stiffness matrices and structural systems using matrix methods.
5. Demonstrate the application of the direct stiffness method to analyze trusses, beams, and frames.

SYLLABUS:

UNIT - I

Unsymmetrical Bending:

Definition of Shear Center in Bending - Symmetrical and Nonsymmetrical Bending - Bending Stresses in Beams Subjected to Nonsymmetrical Bending - Deflections of Straight Beams Subjected to Nonsymmetrical Bending

UNIT - II

Advanced Analysis of Beams:

Curved Beams: Circumferential Stresses in a Curved Beam - Radial Stresses in Curved Beams - Correction of Circumferential Stresses in Curved Beams Having I-, T-, or Similar Cross Sections - Deflections of Curved Beams

Beams on Elastic Foundations - Infinite Beam Subjected to a Concentrated Load: Boundary Conditions- Infinite Beam Subjected to a Distributed Load Segment

UNIT - III

Column Buckling:

Concept of Column Buckling - Deflection Response of Columns to Compressive Loads - Euler Buckling of Columns with General End Constraints - Local Buckling of Columns - Inelastic Buckling of Columns

UNIT - IV

Introduction to matrix methods of analysis: Static indeterminacy and kinematic indeterminacy - degree of freedom - coordinate system - structure idealization stiffness and flexibility matrices - suitability element stiffness equations - elements flexibility equations - mixed force - displacement equations-Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates - Assembly of stiffness matrix from element stiffness matrix – Analysis of trusses, beams and frames by stiffness matrix methods

UNIT - V

Direct stiffness method: General procedure - banded matrix - semi bandwidth - assembly by direct stiffness matrix method -Application of direct stiffness method to trusses, simple and continuous beams and frames

REFERENCES:

1. Structural Analysis by Devdas Menon, Narosa Publishing Housing Pvt. Ltd.
2. Indeterminate Structural Analysis by K. U. Muttu, IK International Publishing House Pvt. Ltd. Matrix Analysis of Frame Structures by William Weaver Jr. and James M. Gere, CBS Publications
3. Matrix Structural Analysis by Madhu B. Kanchi
4. Matrix Methods of Structural Analysis by J. Meek
5. Structural Analysis by Ghali and Neyveli

ELECTRONICRESOURCES:

1. https://nptel.ac.in/courses/112101095
2. https://nptel.ac.in/courses/105105690
3. https://nptel.ac.in/courses/105106050

MATERIALSONLINE:

1. Course template
2. Tutorial question bank
3. Definitions and terminology
4. Assignments
5. Model question paper – I
6. Model question paper – II
7. Lecture notes
8. E-Learning Readiness Videos (ELRV)