Marwadi University

Master of Technology

Structural Engineering

Advanced Structural Analysis

01ST1102 (PCC)

Objective of the Course:

- To analyze the structure using stiffness method member approach
- To apply application of stiffness method into finite element analysis for different type of elements.
- To understand of determining structural response with complex geometry and different type of generalized loading pattern using Finite Element Method.

Credit Earned: 4

Students learning outcomes:

After successful completion of the course it is expected that student will be able to,

1. Analyse the skeletal structure using stiffness member approach.
2. Apply the concept of stiffness method to secondary effects.
3. Derive the finite element properties for structural analysis problems.
4. Demonstrate the role and significance of shape functions in finite element formulations.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Term Work (TW)	
03	01	00	04	50	30	20	25	25	150

Detailed Syllabus

Sr No.	Title of the unit	Number of hours
1	**Stiffness Member Approach**	**20**
	Formulation of stiffness matrix in local and global Axis, Analysis of Continuous beams, Truss, Frames using Stiffness Member Approach. **Secondary Effects:** Concept of Symmetry and Antisymmetry, Effects of Temperature changes, Lack of Fit, Joint Displacements	
2	**Introduction to Finite Element Method**	**11**
	Principle and Application of Finite Element Method, Idealization discretization and element aspect ratio, Variational Approach of FEM Computation of properties for Bar, Torsional and Beam elements using Cartesian and Natural Coordinates, Lagrange's Polynomial	

3	**Finite Element Method for 2 Dimensional Elements**	**15**
	Convergence Study and Plane Stress/Plane Strain problem, Computation of properties for Triangular and Rectangular elements using Natural Coordinates. Isoperimetric element formulation, Lagrange's element, Serendipity Element, Numerical Integration, Axisymmetric solid element	
		46

Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
5%	5%	20%	25%	25%	20%

Instructional Method and Pedagogy:

1. Use of Learning Management system like canvas
2. Demonstration through presentations on power point and videos and lectures
3. Brainstorming and group discussion sessions
4. Collaborative learning

Recommended Study Material:

Reference Book:

1. Weaver, W., & Gere, J. M. "Matrix Analysis Framed Structures". Springer Science & Business Media.
2. Kassimali, A. "Matrix Analysis of Structures" SI Version. Cengage Learning. Wood,
3. Meghre, A. S. & Deshmukh, S. K, "Matrix Methods of Structural Analysis", Charotar Publication.
4. Bathe, K. J., & Saunders, H. (1984). "Finite element procedures in engineering analysis".
5. Chandrupatla, T. R., Belegundu, A. D., Ramesh, T., & Ray, C., "Introduction to finite elements in engineering" (Vol. 2). Upper Saddle River, NJ: Prentice Hall.
6. Bhavikatti, S. S., "Finite element analysis". New Age International.
7. Godbole, P. N., Sonparote, R. S. and Dhote, S. U., "Matrix Methods of Structural Analysis", PHI Learing Private Limited.
8. Weaver, W., Johnston, P. R., & Douglas, A. S. (1984). "Finite elements for structural analysis". Journal of Applied Mechanics, 51, 705.
9. Desai, Chandrakant S. and Abel, John F., "Introduction to the Finite Element Method: a numerical method for engineering analysis", CBS Publications.
10. Deb Debasis, "Finite Element Method: concepts and applications in mechanics", Prentice Hall of India Pvt Ltd