FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF

CIVIL ENGINEERING

Marwadi University
Marwadi Chandarana Group

Advanced Structural Analysis

01CI0611

Objective of the Course:

- To understand the concept of determinate and indeterminate structures subjected to moving loads.
- To analysis the structure using the stiffness member approach.
- To identify the behavior of frame structures using approximate analysis.
- To apply the concept of stiffness method in finite element method.

Credit Earned: 03

Prerequisite: Mechanics of Solids, Structural Analysis-1 and Structural Analysis-2

Students learning outcomes:

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

1. Apply the finite element method to solve one-dimensional civil engineering problems.
2. Determine internal forces and reactions in determinate and indeterminate structures subjected to moving loads.
3. Compute approximate internal forces in framed structures subjected to gravity and lateral loads.
4. Analyze the skeletal structures using the stiffness member approach including the effects of temperature changes and support settlements.

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	00	00	03	50	30	20	25	25	150

Detailed Syllabus

Sr No.	Title of the unit	Number of hours
1	**Influence Line Diagrams**	**12**
	1.1 **Influence line diagrams (ILD) for statically determinate beams-** I.L.D of support reaction, shear force and moment bending moment for beams subjected to u.d.l and several point loads, criteria for	06

	maximum effects, ILD for statically determinate trusses, forces in members for u.d.l and point loads.	
	1.2 ILD for statically indeterminate beams: Muller-Breslau's principle, steps for obtaining I.L for reaction and internal forces in propped cantilever and continuous beams, qualitative I.L diagram for rigid jointed structures having a higher degree of static indeterminacy. ILD for Truss	06
2	**Stiffness Method: Member Approach**	**15**
	2.1 Stability and Determinacy of structure, Formulation of the member stiffness matrix.	04
	2.2 Analysis of skeletal structures using stiffness member approach, Composite Structures.	07
	2.3 Concepts of Symmetry and Anti-symmetry, Temperature change and lack of fit, support settlement, Material and Geometry Non-linearity	04
3	**Approximate Analysis**	**10**
	3.1 Approximate methods of the analysis for the building frames subjected to gravity and lateral loads.,	01
	3.2 Portal method and Cantilever method	04
	3.3 Substitute Frame method	03
	3.4 Calculation of Wind Load	02
4	**Introduction to Finite Element Analysis**	**05**
	4.1 Introduction and History of Finite element method.	02
	4.2 Application of FEM to One-dimensional Problems.	03
	Total	**42**

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 an effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
5%	10%	35%	30%	10%	10%

Instructional Method and Pedagogy:

1. At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
2. Lectures will be taken in class room with the use of multi-media presentations, white board– mix of both.

3. Attendance is compulsory in lectures and laboratory which carries a 5% component of the overall evaluation.
4. Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation
5. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5%.
6. Various task will be assign based on computation analysis by preparing spreadsheet or computer program which will carries 5% component of the continuous evaluation.

Recommended Study Material

1. Vazirani, V. N., Ratwani, M. M., Duggal, S. K., "Analysis of Structure Vol-2", Khanna Publishers, 2011.
2. Junarkar, S. B. & Shah, H. J., "Mechanics of Structures Vol-II", Charotar Publishing House Pvt. Ltd, 2010.
3. Gere. J. M. & Weaver, W. "Matrix Analysis of Framed Structures", C. B. S. Publishers & Distributors, 2004.
4. Wang, C. K., "Indeterminate Structural Analysis", Tata MacGraw Hill Education Private Limited, 2011.
5. Reddy, C. S., "Basics Structural Analysis", Tata MacGraw Hill Education Private Limited, 2011.
6. Ramamrutham, S., Narayan, R., "Theory of Structures", Dhanpat Rai Publishing Company, 2010.
7. Punmia, B. C., Jain, Ashok K., Jain, Arun K., "Theory of Structures", Laxmi Publication Pvt. Ltd., 2014.
8. Desai, Chandrakant S. and Abel, John F., "Introduction to the Finite Element Method: a numerical method for engineering analysis", CBS Publications, 2012
9. Bhavikatti, S. S., "Finite element analysis". New Age International, 2014
10. Deb Debasis, "Finite Element Method: concepts and applications in mechanics", Prentice Hall of India Pvt Ltd, 2014
11. Godbole, P. N., "Introduction to Finite Element Method", I. K. International Publishing House Pvt. Ltd, 2014.

Web Links

1. https://archive.nptel.ac.in/courses/105/106/105106222/
2. https://archive.nptel.ac.in/courses/105/105/105105109/
3. https://archive.nptel.ac.in/courses/105/105/105105180/