COURSE CONTENT

ADVANCED STRUCTURAL ANALYSIS								
I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTD01	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 48	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Analysis of Structures								

I. COURSE OVERVIEW:

This course mainly deals with matrix analysis of structures. It begins with a review of the basic concepts of structural analysis and matrix algebra, and shows how the latter provides an excellent mathematical framework for the former. This is followed by detailed descriptions, and demonstrations through many examples, of how matrix methods can be applied to linear static analysis of skeletal structures (plane and space trusses; beams and grids; plane and space frames) by the stiffness method, and also the flexibility method. Also, it is shown how simple structures can be conveniently solved using a reduced stiffness formulation, involving far less computational effort. Finally, the analysis of elastic instability and second-order response is discussed.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The advanced techniques to know the behavior of structural elements subjected to both vertical and horizontal loads which are used for designing all types of structures.
II. The advanced matrix analysis of various structural elements for design purpose.
III. The Design independently civil engineering structures as per the requirements of client and provide detailed design drawings, quality control reports during construction for ensuring quality and economical structures.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1 Explain the concepts of the static and kinematic indeterminacy of structures for analyzing the structures subjected to different loads.
CO 2 Apply the concept of stiffness matrix equations in global coordinate system with boundary condition for analyzing member forces in beams and frame structures.
CO 3 Analyze continuous beams subjected to different loading conditions using the flexibility method for ensuring structural efficiency.
CO 4 Analyze portal frames for the symmetrical and unsymmetrical loading conditions using the force method for the economical design of structures.
CO 5 Analyze indeterminate beams and frames with different loading conditions using the Stiffness method for the design purpose.
CO 6 Analyze the frames know the maximum shear force and bending moments using approximate methods of analysis.

IV. COURSE CONTENT:

MODULE - I: INTRODUCTION TO MATRIX METHODS OFANALYSIS (09)

Static indeterminacy and kinematic indeterminacy, degrees of freedom, coordinate system, structure idealization, stiffness and flexibility matrices, element stiffness equations, elements flexibility equations, force - displacement equations for truss, beam

MODULE - II: TECHNIQUES FOR ASSEMBLY OF GLOBAL STIFFNESS MATRIX (09)
Assembly of stiffness matrix from element stiffness matrix, direct stiffness method, general procedure, bank matrix, semi bandwidth, computer algorithm for assembly by direct stiffness matrix method.

MODULE - III: FLEXIBILITY METHOD OF ANALYSIS (09)
Introduction to flexibility method, flexibility equations. Analysis of continuous beams with different loading conditions and Plane frames with symmetrical and unsymmetrical loads.

Analysis of plane truss subjected to axial loads and grids by flexibility methods.

MODULE - IV: STIFFNESS METHOD OF ANALYSIS (09)
Introduction to stiffness method, stiffness equations. Analysis of continuous beams with different loading conditions and Plane frames with symmetrical and unsymmetrical loads. Analysis of plane truss subjected to axial loads and grids by stiffness methods.

MODULE - V: APPROXIMATE METHODS OF ANALYSIS (09)
Analysis of multi-storey frames for lateral loads: Portal method and cantilever method; Analysis of multistorey frames for gravity (vertical) loads; Substitute frame method.

V. TEXT BOOKS:

1. G. S. Pandit and 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, 1994.
3. Ashok. K. Jain, "Advanced Structural Analysis", Nem Chand & Bros. 3rd edition, 2010.
4. J. Meek, "Matrix Methods of Structural Analysis", McGraw Hill Education.1st edition, 2011.
5. S S. Bhavikatti, "Finite Element Analysis", New Age International Pvt. Ltd., Publishers.1st edition, 2009.

VI. REFERENCE BOOKS:

1. Todd, J.D., "Structural Theory and Analysis", The Mac Million Press Ltd., New York, 1st edition, 1974.
2. Menon,D., "Advanced Structural Analysis", Narosa Publishing House, New Delhi, 1st edition, 2009.
3. McCarmac, J. and Elling, R. E., "Structural Analysis: A Classical and Matrix Approach", Harperand Row Publishers, 4th edition, 2007.

VII. ELECTRONICS RESOURCES:

1. https://archive.nptel.ac.in/courses/105/106/105106050/
2. https://nptel.ac.in/reviewed_pdfs/105106050/lec1.pdf
3. http://web.iitd.ac.in/~sbhalla/rc717.pdf

VIII. MATERIALS ONLINE:

1. Course Template
2. Tutorial Question Bank
3. Assignments
4. Model Question Paper – I
5. Model Question Paper - II
6. Lecture Notes
7. Power point presentation