ADVANCED STRUCTURAL ANALYSIS

I Semester: ST								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BSTC01	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

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. The main objective is to enable the student to have a good grasp of all the fundamental issues in these advanced topics in structural analysis, besides enjoying the learning process, and developing analytical and intuitive skills.

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 finite element 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.	Understand
CO 2	Analyze continuous beams, portal frames for the given loading conditions using the stiffness, flexibility, approximate methods for ensuring structural efficiency.	Analyze
CO 3	Analyze member forces due to applied loads, lack of fit and temperature changes for the indeterminate trusses.	Analyze
CO 4	Apply the concept of stiffness matrix equations in global coordinate system with boundary condition for analyzing member forces in beams and frame structures.	Apply
CO 5	Explain the shape function concepts of one and two-dimensional elements for enriching knowledge on stiffness matrix.	Understand
CO 6	Make use of modified galerkin method for computing approximate solution of one-dimensional boundary value problems.	Apply

IV.SYLLABUS:

MODULE-I: INFLUENCE COEFFICIENTS (09)

Physical Significance, Effects of Settlements, Temperature Change and Lack of Fit, Member Approach and Structure Approach.

MODULE-II: STIFFNESS METHOD APPLIED TO LARGE FRAMES (09)

Force method and displacement method, Degree of Freedom, Local Coordinates and Global Coordinates.

MODULE-III: STIFFNESS MATRIX ASSEMBLY OF STRUCTURES AND APPLICATIONS TO SIMPLE PROBLEMS(09)

Stiffness Matrix in Global Coordinates, Boundary Conditions, Solution of Stiffness Matrix Equations, Calculation of Reactions and Member Forces.

Beams, Plane Trusses, Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach.

MODULE-IV: BOUNDARY VALUE PROBLEMS (BVP) (09)

Boundary Value Problems: Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.

MODULE-V: LINEAR ELEMENT (09)

Linear Element: Shape Functions, Solution for Poisson's Equation, General One Dimensional Equilibrium Problem.

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.1stEdition, 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 a approach", harper and row publishers, 4th Edition, 2007.

VII. WEB REFERENCES:

1. nptel.ac.in/courses/Webcourse-contents/.../Structural%20Analysis/pdf/m2l7.pdf.
2. https://nptel.ac.in/reviewed_pdfs/105106050/lec1.pdf
3. http://web.iitd.ac.in/~sbhalla/rc717.pdf

VIII. E-TEXT BOOKS:

1. https://phindia.com/.../matrix_methods_of_structural_analysis_theory_and_problems
2. http://www.uomisan.edu.iq/library/admin/book/91314849583.pdf
3. http://priodeep.weebly.com/uploads/6/5/4/9/65495087/w._j._spencer__auth._-