

IV Semester

ANALYSIS OF STRUCTURES			
Course Code	21CV44	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3
Course objectives: This course will enable students <ol style="list-style-type: none">1. To determine slope and deflections in beams and trusses.2. To analyse arches and cable structures.3. To analyse different structural systems and interpret data using slope deflection method.4. To apply matrix operations in analysing structures.			
Teaching-Learning Process (General Instructions) These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes. <ol style="list-style-type: none">1. Video tube, NPTEL materials2. Quiz/Assignments/Open book test to develop skills3. Encourage collaborative learning in the class with site visits related to subject and impart practical knowledge			
Module-1			
Deflection of Beams: <i>Moment area method</i> – Derivation, Mohr's theorems, Sign convention; Application of moment area method to determinate prismatic beams, beams of varying cross section; Use of moment diagram by parts; <i>Conjugate beam method</i> – Real beam and conjugate beam, conjugate beam theorems; Application of conjugate beam method to determinate beams of varying cross sections.			
Teaching-Learning Process	Chalk and talk, Demonstration using relevant structural analysis software.		
Module-2			
Energy Principles and Energy Theorems: <i>Principle of virtual displacements; Principle of virtual forces</i> , Strain energy and complementary energy; Strain energy due to axial force, bending shear and torsion; Deflection of determinate beams and trusses using total strain energy; Deflection at the point of application of single point load; <i>Castigliano's theorems</i> , application of Castigliano's theorems to calculate deflection of trusses, frames; Special application – Dummy unit load method.			
Teaching-Learning Process	Chalk and talk, Demonstration using relevant structural analysis software.		
Module-3			
Arches and Cables: Three-hinged circular and parabolic arches with supports at the same and different levels; Determination of normal thrust, radial shear and bending moment; Analysis of cables under point loads and UDL; Length of cables with supports at the same and different levels; Stiffening trusses for suspension cables.			
Teaching-Learning Process	Chalk and talk, Demonstration using relevant structural analysis software.		
Module-4			
Slope Deflection Method: Introduction, sign convention, development of slope deflection equation; Analysis of continuous beams including settlement of supports; Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy up to 3.			
Teaching-Learning Process	Chalk and talk, Demonstration using relevant structural analysis software.		

Module-5	
Matrix Methods of Structural Analysis: Definition of stiffness and flexibility methods, comparison to classical methods. Stiffness Method: Stiffness matrix, Analysis of continuous beams and plane trusses using system approach; Analysis of simple orthogonal plane frames using system approach with kinematic indeterminacy up to 3.	
Teaching-Learning Process	Chalk and talk, Demonstration using relevant structural analysis software.
Course outcome (Course Skill Set) At the end of the course the student will be able to : <ol style="list-style-type: none"> 1. Evaluate slope and deflections in beams using geometrical methods. 2. Determine deflections in trusses and frames using energy principles. 3. Analyse arches and cables for stress resultants. 4. Apply slope deflection method in analysing indeterminate structures and construct bending moment diagram. 5. Analyse continuous beams, frames and trusses using stiffness matrix method of analysis. 	
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together Continuous Internal Evaluation: Three Unit Tests each of 20 Marks (duration 01 hour) <ol style="list-style-type: none"> 1. First test at the end of 5th week of the semester 2. Second test at the end of the 10th week of the semester 3. Third test at the end of the 15th week of the semester Two assignments each of 10 Marks <ol style="list-style-type: none"> 4. First assignment at the end of 4th week of the semester 5. Second assignment at the end of 9th week of the semester Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours) <ol style="list-style-type: none"> 6. At the end of the 13th week of the semester The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be scaled down to 50 marks (to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course). CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course. Semester End Examination: Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours) <ol style="list-style-type: none"> 1. The question paper will have ten questions. Each question is set for 20 marks. 2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module. The students have to answer 5 full questions, selecting one full question from each module	
Suggested Learning Resources: Text Books <ol style="list-style-type: none"> 1. Reddy, C.S., <i>Basic Structural Analysis</i>, 3rd ed., Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2011. 2. Hibbeler, R.C., <i>Structural Analysis</i>, 9th edition., Pearson publications., New Delhi, 2012. 3. Thandavamoorthy, T.S., <i>Structural Analysis</i>, 6th edition., Oxford University press., New Delhi, 2015. 	

Reference Books

1. Charles Head Norris, John Benson Wilbur and Senol Utku., Elementary Structural Analysis, 4th edition., Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2003.
2. Hall, A. and Kabaila, A.P., *Basic Concepts of Structural Analysis*, Pitman Publishing, London, John Wiley & Sons, New York, 1977.
3. Wang, C.K., Intermediate Structural Analysis, McGraw-Hill International Book Co., 1985.

Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/105105166>
- <https://nptel.ac.in/courses/105105166>
- <https://nptel.ac.in/courses/105105166>
- <https://nptel.ac.in/courses/105105109>
- <https://nptel.ac.in/courses/105105109>
- <https://nptel.ac.in/courses/105105109>

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars /Quiz (to assist in GATE preparations)
- Demonstrations in using softwares
- Self-Study on simple topics
- Simple problems solving by Etabs/Staad pro.


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