SEMESTER S4

STRUCTURAL ANALYSIS - II

(Common for Civil Engineering Branches)

Course Code	**PCCET403**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	PCCET303/ Equivalent	**Course Type**	Theory

Course Objectives:

1. To introduce classical and matrix methods of structural analysis and understand the behaviour of statically indeterminate structures.

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SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Concept of displacement approach to structural analysis:** Introduction to displacement methods of analysis. Kinematic indeterminacy **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 2 **Moment Distribution method:** Concept and derivation of basic equation, Analysis of beams and non-sway frames; analysis of sway frames (Illustration only)	**11**

2	**Approximate Methods of Analysis of Multi-storeyed Frames:** Analysis for vertical loads-substitute frames-loading condition for maximum hogging and sagging moments in beams and maximum bending moment in columns. Analysis for lateral loads – portal method, cantilever method. **Plastic Theory:** Introduction – plastic hinge concepts – plastic modulus – shape factor – redistribution of moments – collapse mechanisms – Plastic analysis of beams and portal frames by equilibrium and mechanism methods. (single storey and single bay frames only)	**11**
3	**Matrix analysis of structures:** **Flexibility method:** Definition of flexibility influence coefficients - Concepts of physical approach. Flexibility matrices for truss and frame elements-load transformation matrix- development of total flexibility matrix of the structure-analysis of simple structures (determinate & indeterminate)-plane truss and plane frame-nodal loads and element loads	**10**
4	**Stiffness method:** Definition of stiffness influence coefficients - Concepts of physical approach. Development of stiffness matrices by physical approach-stiffness matrices for truss and frame elements-displacement transformation matrix-analysis of simple indeterminate structures-plane truss and plane frame-nodal loads and element loads. Introduction to direct stiffness method- stiffness matrix of beam elements, assembly of load vector and stiffness matrix, solution of two span continuous beams.	**12**

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Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

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Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Apply displacement methods of analysis for indeterminate structures.	**K3**
CO2	Apply approximate methods for analysis of multi-storeyed framed structures	**K3**
CO3	Understand the principles of plastic theory and apply the same for limit analysis of steel structures.	**K3**
CO4	Apply the principles of matrix methods of structural analysis.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										2
CO2	3	3										2
CO3	3	3										2
CO4	3	3										2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Mechanics of Structures Vol I & II	S.B. Junnarkar & H.J. Shah	Charotar Publishing House,	2015
2	Structural Analysis	Devdas Menon	Narosa Publishers, NewDelhi	3rd edition 2023
3	Structural Analysis	R.C. Hibbler	Pearson Education	10 th edn. 2022

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Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Intermediate Structural Analysis,	C.K. Wang	Tata McGraw Hill Publishers	2017
2	Elementary Structural Analysis	J.B. Wilbur, C.H. Norris, and S. Utku	McGraw Hill, NewYork	2006
3	Matrix Analysis of Framed Structure	Weaver, W. Jr. and Gere, J.M	CBS Publishers, NewDelhi	2000
4	Matrix Methods of Structural Analysis	Praveen Nagarajan	CRC Press, Taylor & Francis	2019

Video Links (NPTEL, SWAYAM…)	
Sl. No	**Link ID**
1	https://nptel.ac.in/courses/105105166
2	https://nptel.ac.in/courses/105106050
3	https://nptel.ac.in/courses/105105109