SEMESTER S5

ADVANCED STRUCTURAL ANALYSIS

Course Code	PECET521	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	PCCET303/ PCCET403	Course Type	Theory

Course Objectives:

1. This course provides the fundamental concepts of three hinged arches and matrix analysis of structures, specifically on direct stiffness method.
2. This course equips students with the concepts of finite element methods, which in turn is the basis of many structural analysis software, and a brief idea on the concept of structural dynamics.

KTU SPECIAL

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Two hinged Arches:** Analysis of two hinged arches - Support reactions normal thrust and radial shear at any section of a parabolic arch due to simple cases of loading, influence line for horizontal thrust, bending moment, normal thrust, and radial shear. **Matrix Analysis of Structures:** Reviewing the definition of flexibility and stiffness influence coefficients, and concepts of physical approach	9
2	**Direct stiffness method:** Introduction to direct stiffness method-Rotation of axes in two dimensions, stiffness matrix of elements in global co- ordinates from element co-ordinates- assembly of load vector and stiffness matrix, solution of two span continuous beam-single bay single storey portal frame.	9
3	**Structural dynamics:** Introduction - degrees of freedom - equation of motion, D'Alembert's principle-damping- free response of damped and undamped systems- logarithmic decrement-- single degree of freedom systems subjected to harmonic load - transient and steady state responses, simple portal frame problems.	9

4	**Finite Element Methods:** Boundary value problems; Introduction to approximate numerical solutions for solving differential equations. Formulation techniques: Element equations using weighted residual approach - the axial element example.	**9**

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**

KTU SPECIAL

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level
CO1	Apply suitable methods of analysis for arches.	**K3**
CO2	Apply the displacement methods to analyse framed structures.	**K3**
CO3	Remember basic dynamics, understand the basic principles of structural dynamics and apply the same to simple structures.	**K2**
CO4	Understand the basic features of boundary value problems, and fundamental concept of the finite element method, and develop the ability to generate the governing FE equations for systems governed by partial differential equations.	**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	2										
CO2	3	3	1									
CO3	3	3	1									
CO4	3	3	2	1								

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	Comprehensive Structural Analysis Volume I & II	R.Vaidyanathan and P.Perumal	Laxmi Publications (P) Ltd	Fourth 2024
2	Elementary Finite Element Method	Desai, C.S.	Prentice Hall of India	1979
3	Structural Dynamics: Theory and Computation	Mario Paz, William Leigh	CBS Publishers, New Delhi, India	5th ed. 2004
4	Intermediate Structural Analysis,	Wang C.K.	**McGraw Hill Education**	2017
5	Matrix Analysis of Framed Structures	James M Gere & William Weaver	CBS Publishers	2nd edition 2018

KTU SPECIAL

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Structural Analysis II	S.S. Bhavikatti	Vikas Publication Houses (P) Ltd	2016
2	Finite Element Procedures in Engineering Analysis	Bathe, K.J.	Prentice Hall of India	2006
3	Finite Element Analysis Theory and Programming,	Krishnamoorthy, C.S.	Tata McGraw Hill.	2nd edition 2017
4	Dynamics of Structures	Clough R. W. and J. Penzien	McGraw Hill	2nd edition 2015
5	Dynamics of Structures-Theory and application to Earthquake Engineering	Chopra A. K.	Pearson Education India	3rd edition 2008
6	Structural Analysis,	R.C. Hibbeler	Pearson	10th Edition 2022
7	Basic Structural Analysis	Reddy C. S.	Tata McGraw Hill	3rd edition 2017

Video Links (NPTEL, SWAYAM…)	
Sl. No.	**Link ID**
1	https://archive.nptel.ac.in/courses/105/105/105105109/
2	https://onlinecourses.nptel.ac.in/noc21_ce44/preview
3	https://archive.nptel.ac.in/courses/105/101/105101006/
4	https://archive.nptel.ac.in/courses/112/104/112104193/

KTU SPECIAL