SEMESTER S3

STRUCTURAL ANALYSIS - I

Course Code	**PCCET303**	**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)	PCCEL205/Equivalent	**Course Type**	Theory

Course Objectives:

1. To provide students with a thorough understanding of the fundamental theory of structural analysis
2. To develop the student's ability to both model and analyse statically determinate and indeterminate structures and to provide realistic applications encountered in professional practice

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Statically determinate trusses:** Analysis using method of joints and method of sections. **Cables and Suspension bridges:** Forces in loaded (concentrated and uniformly distributed) cables - length of cables – supports at same and different levels – maximum tension in the suspension cable and backstays, pressure on towers. Simple suspension bridges with three hinged stiffening girders - bending moments and shear force diagrams. **Deformation Response of Statically Determinate Beams:** **Moment area method**–Mohr's theorems, Applications to determinate deformations of cantilever and simply supported beams (prismatic and beams of varying cross section) subjected to concentrated and uniformly distributed loads.	**12**
2	**Deformation Response of Statically Determinate Beams:** **Conjugate beam method–** Real beam and conjugate beam, boundary conditions; Applications to determinate deformations of cantilever and	**11**

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	simply supported beams (prismatic and beams of varying cross section subjected to concentrated and uniformly distributed loads. **Energy Principles and Energy Theorems:** Castigliano's theorem I, Principle of virtual work, Betti's theorem, Maxwell's law of reciprocal deflections. **Unit load method** for determination of deflection of statically determinate beams, frames and trusses.	
3	**Indeterminate Structures:** Introduction to force method of analysis. Static indeterminacy **Analysis of statically indeterminate structures** Castigliano's theorem II, Minimum strain energy method for analysing statically indeterminate structures (Illustration only) **Method of consistent deformations:** Analysis of beams, frames and trusses. (simple problems with one redundant, illustration only for two-redundant problems). Concepts of effect of pre-strain, lack of fit, temperature changes and support settlement. (Illustration only).	**10**
4	**Three Hinged Arches:** Action of an arch - Eddy's theorem – Three hinged, parabolic and circular arches (with supports at same level) - determination of horizontal thrust, bending moment, normal thrust and radial shear. **Moving Loads and influence lines** Introduction to moving loads - concept of influence lines - influence lines for reaction, shear force and bending moment in simply supported beams and over hanging beams – analysis for different types of moving loads (single concentrated load - several concentrated loads - uniformly distributed load shorter and longer than the span) conditions for maximum bending moment and shear force.	**11**

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

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Micro project	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 appropriate structural mechanics principles for estimation of force and deformation response of structural elements.	K3
CO2	Apply energy-based techniques for estimation of deformation response of structural elements and simple structural systems.	K3
CO3	Analyse statically indeterminate structures using force method.	K3
CO4	Analyse the effects of moving loads on structures using influence lines	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
4	Basic Structural Analysis,	C.S. Reddy	New Delhi: Tata McGrawHill, NewDelhi	3 rd Edn. ,2017

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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	L.S. Negi and R.S. Jangid	Structural Analysis	Tata McGraw Hill	2006

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