25UCET302	STRUCTURAL ANALYSIS I	Category	L	T	P	R	Credit	Year of Introduction
		PCC	4	0	0	0	4	2025

Preamble: This course provides a thorough understanding of the fundamental theory of structural analysis and 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.

Prerequisite: MOS205 Mechanics of Solids

Course Outcomes: After the completion of the course, the student will be able to:

CO	Course Outcomes	Knowledge Level
CO1	Compute the forces and deflection in truss,cable,suspension bridge and beams.	K3 Apply
CO2	Apply energy and deformation methods to calculate deflections and internal forces in statically indeterminate structures.	K3 Apply
CO3	Apply slope deflection and moment distribution methods for analysis of continuous beams and portal frames.	K3 Apply
CO4	Apply concepts of three-hinged arches and influence lines to determine reactions and internal forces in statically determinate structures.	K3 Apply

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	-	-	-	-	-	-	3	2	-
CO2	3	3	2	1	2	-	-	-	-	-	-	3	2	-
CO3	3	3	2	1	2	-	-	-	-	-	-	3	1	-
CO4	3	3	2	1	2	-	-	-	-	-	-	3	1	-
Avg	**3**	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1.5**	**-**

Mapping of course outcomes with Knowledge and Attitude Profile (WK)

	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	*	*	*	*	*	*		*	
CO2	*	*	*	*	*	*		*	
CO3	*	*	*	*	*	*		*	
CO4	*	*	*	*	*	*		*	

WKs Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*	*	*	*	*	*		*	

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	40	60	2.5 hrs

Continuous Internal Evaluation Pattern:

Attendance : 5 marks
Continuous Assessment Test : 20 marks
Continuous Assessment Assignment : 15 marks

SYLLABUS

Module 1 (15 hrs)

Statically determinate trusses: Method of joints and method of sections.

Cables: Analysis of forces in cables under concentrated and uniformly distributed loads;Anchor Cable supports.

Suspension Bridges: Un-stiffened suspension bridges, maximum tension in the suspension cable and backstays, pressure on towers.

Deflection of statically determinate structures: Introduction and simple illustrative examples of simple beams and cantilever beams :Moment area method and Castigliano's theorem Part I.

Module 2 (15 hrs)

Principle of virtual work, Betti's theorem, Maxwell's law of reciprocal deflections; Unit load method for determination of deflection of statically determinate beams and trusses (simple illustrative numerical problems only)

Analysis of Statically Indeterminate Structures:Degree of static and kinematic indeterminacies; Introduction to force and displacement methods.

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).
Castigliano's theorem Part II, theorem of least work. Minimum strain energy method for analysing statically indeterminate structures (Illustrative simple examples only).

Module 3 (13 hrs)
Slope Deflection Method: Analysis of continuous beams and portal frames without sway; Frames with sway (illustration only); Settlement effects (illustration only) .
Moment Distribution Method: Analysis of continuous beams and portal frames without sway; Frames with sway (illustration only).

Module 4 (13 hrs)
Arches: Theory of arches – Eddy's theorem;Analysis of three-hinged arches; Normal thrust and radial shear due to simple cases of loading.
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 single concentrated load, several concentrated loads, uniformly distributed load shorter and longer than the span – conditions for maximum bending moment and shear force

Text Books

1. Gere, J. M., & Timoshenko, S. P. (2004). Mechanics of Materials (5th ed.). CBS Publishers.
2. Leet, K. M., Uang, C.-M., & Gilbert, A. M. (2011). Fundamentals of Structural Analysis (4th ed.). McGraw Hill Education.
3. Vaidyanathan, R., & Perumal, P. (2003). Comprehensive Structural Analysis, Volume I & II (1st ed.). Laxmi Publications (P) Ltd.

Reference Books

1. Kassimali, A. (2011). Structural Analysis (4th ed.). Cengage Learning.
2. Chandramouli, P. N. (2010). Structural Analysis I: Analysis of Statically Determinate Structures (1st ed.). Yes Dee Publishing Pvt. Ltd.
3. Menon, D. (2008). Structural Analysis (1st ed.). Narosa Publishing House.
4. Hibbeler, R. C. (2012). Structural Analysis (8th ed.). Pearson Education.
5. Reddy, C. S. (2009). Indeterminate Structural Analysis (3rd ed.). Tata McGraw Hill Education.
6. Schodek, D. L. (2014). Structures (7th ed.). Pearson Education.
7. Negi, L. S., & Jangid, R. S. (1997). Structural Analysis (1st ed.). Tata McGraw Hill.
8. Bhavikatti, S. S. (2016). Structural Analysis II (4th ed.). Vikas Publishing House Pvt. Ltd.

END SEMESTER EXAMINATION – MODEL QUESTION PAPER

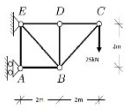
Course Code	**25UCET302**
Course Name	**STRUCTURAL ANALYSIS I**
Max. Marks: 60	**Duration: 2.5 Hours**

Part A

(Answer all questions. Each question carries 3 marks)

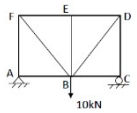
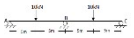
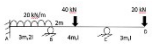
Qn No.	Question	Marks	CO	BL
1	Describe Moment- Area theorems.	3	1	L2
2	Differentiate method of joints and method of sections.	3	1	L2
3	Explain Maxwell's law of reciprocal deflections.	3	2	L2
4	Describe Castigliano's first theorem for deflection.	3	2	L2
5	Explain Distribution Factor used in Moment- Distribution method.	3	3	L2
6	Explain the basic equation used for Slope- Deflection method of analysis and explain each term.	3	3	L2
7	Summarise the types of arches.	3	4	L2
8	Describe the significance of influence line diagram.	3	4	L2

Module I

Qn No.	Question	Marks	CO	BL
9	Calculate the forces in the given truss using method of joints. 	9	1	L3
	OR			
10	Cable of a suspension bridge supports a uniformly distributed load of 10kN/m of horizontal span. Supporting piers are 20m high and 120m apart and dip of the cable is 18m. If the cable passes over frictionless pulley on top of the pier, determine the vertical and horizontal force transmitted to the pier and the maximum bending moment in the pier. Anchor cable is at 30º to the horizontal.	9	1	L3

Module II

Qn No.	Question	Marks	CO	BL

11	Determine the vertical deflection at E of the pin jointed plane truss shown in Fig. using unit load method. All members have cross sectional area 1200mm^2 and E= 200GPa. AB = BC= 3m, AF = 4m. 	9	2	L3
OR				
12	Calculate the vertical force in B in the beam shown using consistent deformation method. 	9	2	L3
Module III				
Qn No.	**Question**	**Marks**	**CO**	**BL**
13	Calculate the final forces in the beam and draw SFD and BMD using slope deflection method . 	9	3	L3
OR				
14	Calculate the final forces in the continuous beam shown in Figure using moment distribution method. Draw bending moment diagram. 	9	3	L3
Module IV				
Qn No.	**Question**	**Marks**	**CO**	**BL**
15	A three hinged parabolic arch of span 40m and central rise 12m supports uniformly distributed load of 3.5kN/m over the left half span. Determine the normal thrust and radial shear at point 3m from left support.	9	4	L3
OR				
16	A uniformly distributed load 40kN/m and 5m long traverses a simply supported beam AB of span 15m from left to right. Draw the influence line diagram for shear force and bending moment at a section 6m from A. Calculate the maximum shear force and bending moment at this section using these diagrams.	9	4	L3

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