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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Second Semester, M. Tech - Civil Engineering (MCAD)

Semester End Examination; October - 2023

Analysis of Plates and Shells

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Apply the knowledge of mathematics, science, and engineering related to theory of plates and shells.
CO2: Apply Navier's and Levy's solution to rectangular plates.
CO3: Make use of Finite difference method to analyse rectangular thin plates.
CO4: Apply membrane theory and beam theory for the analysis of cylindrical shell roofs.

Note: ***I) PART - A*** *is compulsory.* ***Two*** *marks for each question.*
II) PART - B*: Answer any* ***Two*** *sub questions (from a, b, c) for a Maximum of* ***18 marks*** *from each unit.*
III) *Use of IS: 2210 is permitted.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART - A	**10**			
1 a.	List any two assumptions for plate bending theory.	2	L1	CO1	PO1
b.	Define thick and thin plates.	2	L1	CO1	PO1
c.	Write basic relations in thin plate theory.	2	L1	CO1	PO1
d.	Write neat sketch with its components of cylindrical shells.	2	L1	CO1	PO1
e.	List the boundary condition with respect displacement in terms of deflection and slope for the following cases; i) Fixed edges ii) Free edges with neat sketches	2	L1	CO1	PO1
	II : PART - B	**90**			
	UNIT - I	**18**			
2 a.	Obtain the expression for moment curvature relationships.	9	L3	CO1	PO2,3,4
b.	Derive the differential equation for laterally loaded plate in Cartesian coordinates.	9	L3	CO1	PO2,3,4
c.	Show that maximum and minimum slopes are orthogonal $(\text{Tan}\ \alpha_1)*(\text{Tan}\ \alpha_2) = -1$.	9	L3	CO1	PO2,3,4
	UNIT - II	**18**			
3 a.	For a simply supported rectangular plate with sinusoidal load, construct the expression for deflection, bending moment and twisting moment. Also calculate maximum deflection and maximum bending moment.	18	L4	CO5	PO2,3,4
b.	An all-round simply supported rectangular plate subjected to uniformly distributed load q_0/unit area over entire surface of the plate. Derive the expression for deflection by Levy's method.	18	L4	CO2	PO2

Contd....2

UNIT - III **18**

4 a. Derive the differential equation of equilibrium for symmetrical bending of laterally loaded circular plates. 18 L3 CO2 PO2,3,4

b. Analyse the circular plate of radius 'a' carrying uniformly distributed load *q*. The outer edge having fixed supports all-round. 18 L4 CO2 PO2,3,4

UNIT - IV **18**

5 a. Find the deflection at centre of a square plate with simply supported edges and carrying uniformly distributed load q/unit area using finite difference approach. The plate is divided into a/4 x a/4 square mesh as shown in Fig. Q5a. Size of plate is (a X a) 18 L4 CO3 PO2,3,4

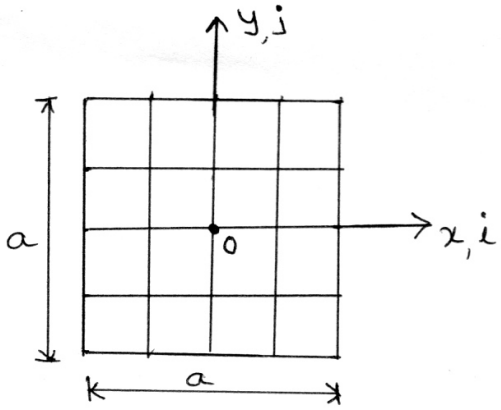

Fig. Q5a

b. A simply supported skew plate is uniformly distributed load throughout as shown in Fig. Q5b. For a given parameters find the maximum deflection at the centre of the plate. 18 L4 CO3 PO2,3,4

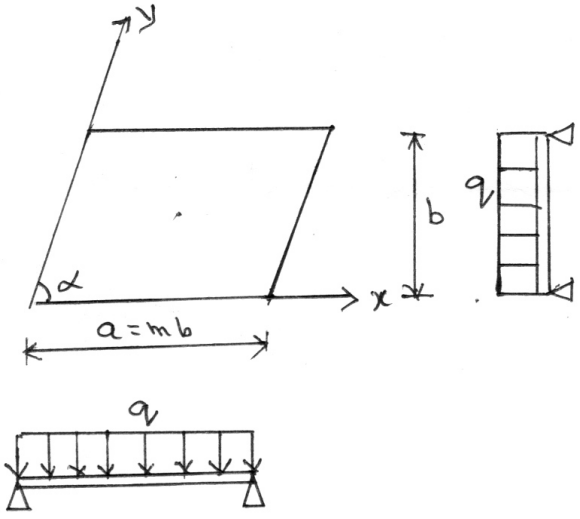

Fig. Q5b

Contd....3

UNIT - V **18**

6 a.	Explain with neat sketch the various types of surface of translation and surface of revolutions.	9	L2	CO4	PO1,2,3,4
b.	Derive equilibrium equation for a cylindrical shell based on membrane theory.	9	L3	CO4	PO1,2,3,4
c.	Discuss the classification of shells. Also explain the degenerated elements.	9	L3	CO4	PO1,2,3,4

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