



**K. K. Wagh Institute of Engineering Education & Research, Nashik**  
(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:II
Class:PG-I	Program:M.Tech
Branch Code:CIV	Pattern:2024
Name of Course:Theory of Plates and Shells	Course Code:2404511
Max. Marks:60	Duration:2.30 Hrs.

**Instructions:** Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 2 pages.
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome of the Question/sub-question.

**Marks CO**

**Question No. 1**

- 1a) Explain the distinction between thin and thick plates and state the assumptions that are made in thin plates with small deflections. (6) CO 1

**Question No. 2**

- 2a) Describe the underlying presumptions of Levy's solutions for rectangular plates with at least two opposing sides that are simply supported while carrying a load that is uniformly distributed. (6) CO 2

**Question No. 3**

- 3a) Determine the transverse deflection  $w$  for a simply supported circular plate with a hole of radius  $a$  that is subject to evenly distributed moments  $M_1$  and  $M_2$  along its inner and outer borders. (8) CO 3  
Therefore, locate expressions for  $M_r$  to solve up to:

$$\therefore M_r = \left\{ \left[ \frac{a^2 b^2 (M_1 - M_2)}{r^2 [(a^2 - b^2)]} \right] - \left[ \frac{b^2 M_1 - a^2 M_2}{(a^2 - b^2)} \right] \right\}$$

**OR**

- 3b) Construct the governing differential equation for a circular plate under axisymmetric loading starting from first principles. (Deflection Equation for Uniformly Loaded Circular Plate) (8) CO 3

- 3c) Determine the transverse deflection  $w$  for a circular plate with radius  $a$  that is simply supported and under evenly distributed load  $q$ . Therefore, determine the formulas for  $M_r$  (Simply supported circular plate exposed to uniformly distributed load). (8) CO 3

$$M_r = -D \left[ 2C_3 + \frac{q}{D} \frac{3r^2}{16} + \frac{\nu}{r} \left( 2C_3 r + \frac{q}{D} \frac{r^3}{16} \right) \right]$$

and

$$\therefore w = \frac{qa^4}{64D} \frac{(5+\nu)}{(1+\nu)}$$

**OR**

- 3d) Derive the formula for bending a circular plate symmetrically under simply supported conditions. (8) CO 3

**Question No. 4**

- 4a) Describe the benefits and drawbacks of shell constructions in comparison to plates and list the presumptions and their implications in the general theory of thin elastic shells. (8) CO 4

**OR**

- 4b) Sort shells according to their geometry. Give examples to illustrate each type. (8) CO 4

- 4c) Draw a cylindrical shell. On the shell surface, display the stress results for a small element. Determine the equilibrium equations for this component. (8) CO 4

**OR**

- 4d) Describe the membrane hypothesis of shells of revolution. What are its presumptions and constraints? (8) CO 4

**Question No. 5**

- 5a) Describe the membrane theory of cylindrical shells. (8) CO 5

**OR**

- 5b) Write in brief about the D-K-J theory for cylindrical shells while taking the Bending Theory: Equilibrium equation into consideration. (8) CO 5

- 5c) Describe the membrane and bending theories used in shell analysis. (8) CO 5

**OR**

- 5d) Describe the benefits and drawbacks of the beam approach of cylindrical shell analysis. (The Beam Theory of Lundgren) (8) CO 5

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