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

(An Autonomous Institution affiliated to VTU, Belaagavi)

Third Semester, M.Tech - Mechanical Engineering (MCIM)

Semester End Examination; Dec - 2017/Jan - 2018

Theory of Plates and Shells

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each **unit**.*

UNIT - I

1 a. State the Kirchoff's assumptions made is the analysis of thin plates. 5

b. Obtain the governing differential equation for small deflection of laterally loaded plates. 15

2 a. A rectangular bulkhead of an elevator shaft subjected to a uniformly distributed bending moment applied along its edges. Derive the governing surface deflection for; 15

i) $M_a \neq M_b$ ii) $M_a = -M_b$

b. Write a short note on boundary conditions for rectangular plates. 5

UNIT - II

3 a. Obtain the expression for the deflection and the moments for clamped circular plates subjected, to uniformly distributed load P_0. 12

b. A pressure control system includes a thin steel disc which has to close an electrical circuit by deflecting by 1mm at the centre, when the pressure attains a value of 3 MPa. Calculate the thickness of the disc required if it has a radius of 300 mm and clamped at the edges. Take $\mu = 0.3$ and E = 200 GPa. 8

4 a. Derive an expression for the deflection of a circular plate with a circular hole at the centre subjected to moments. 10

b. Show that the maximum deflection of a uniformly loaded circular plate with clamped edges is $w_{\max} = \frac{Qa^4}{64D}$. 10

UNIT - III

5 a. Derive an expression for maximum deflection of simply support rectangular plate by Navier's approach. 15

b. Differentiate between Navier's and Lavy's approach for the analysis of the plate. 5

6 a. A rectangular warehouse floor slab of sides *a* and *b* is simply supported on all the edges. The loading is given by $P_{(x,y)} = P_0 Sin(\pi x/a) Sin(\pi x/b)$ where P_0 represents the intensity of the load at the center of the plate. Obtain an expression for deflection, maximum deflection, moments, shear force and the total load carried by the plate. 20

Contd…2

UNIT - IV

7	a.	What is a shell? Give the classification of shell.	5
	b.	Mention the advantages and disadvantages of shells	5
	c.	Derive an equation for equilibrium of a cylindrical shell subjected to membrane forces.	10
8	a.	Find the membrane forces in a circular cylindrical shell subjected to a sinusoidal loading of intensity $\frac{4g}{\pi}\cos\left(\frac{\pi x}{L}\right)$ per unit surface area acting vertically downword.	15
	b.	Differentiate between plates and shells.	5

UNIT - V

9	a.	Analyze a water tank of radius "R" and depth "d" if its one edge is fixed at the base slab and top is free and the thickness of the wall is uniform.	15
	b.	List out the assumption made in analysis of shells.	5
10	a.	Derive an equilibrium equation for a symmetrically loaded cylindrical shell.	5
	b.	Explain; i) DKJ theory ii) Beam theory iii) Bending theory.	15

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