Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–IV • EXAMINATION – SUMMER 2015

Subject Code: 731504 **Date: 02/05/2015**

Subject Name: Plates and Shells

Time: 2:30 pm to 5:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks**

Q.1	**(a)**	Differentiate Isotropic and Orthotropic plates with their specific applications.	**07**
	(b)	Determine the strain energy expression in terms of ówô-function of a plate element subjected to following: (a) Bending moment M_x and M_y (Pure bending) (b) Twisting moment M_{xy} (Pure twisting)	**07**
Q.2	**(a)**	For simply supported rectangular plates, subjected to hydrostatic pressure, determine the expression for deflection at centre.	**07**
	(b)	Find the value of stresses generated in a spherical shell under udl and point load at crown.	**07**
		OR	
	(b)	Show that for a flat circular steel plate subjected to a uniform pressure on one surface, the maximum stress when periphery is simply supported is 1.50 times that when the periphery is clamped. Take Poissonôs ratio = 0.25.	**07**
Q.3	**(a)**	Give merits and demerits of Navierôs solution and Levyôs solution.	**07**
	(b)	Show that the sum of bending curvatures in any two mutually perpendicular directions, n and t, at any point of the middle surface, is a constant.	**07**
		OR	
Q.3	**(a)**	Derive the basic fourth order partial differential equation for a plate. Also write down the equation for shear and corner forces.	**07**
	(b)	Using membrane theory, derive the condition of equilibrium for doubly curved surfaces.	**07**
Q.4	**(a)**	Give the classification of shell based on shell curvature with neat sketches.	**07**
	(b)	A circular cylindrical chimney shell of height L and radius R is subjected to a wind pressure óP3ô. The chimney shell is ýxed at its base and free at the top. Assuming that the wind pressure is constant over the height of the chimney and in the circumferential direction is approximated by the polynomial P3 = P(-0.7 + 0.5 cosć + 1.2 cos 2ć), find the membrane forces in the shell.	**07**
		OR	
Q.4	**(a)**	Explain the superiority of curved elements compared to linear.	**07**
	(b)	Elaborate the force displacement relation for the shell structure.	**07**
Q.5	**(a)**	Develop basic equation of membrane analysis of a paraboloid of revolution. Give stress function ū , Z & R if 2a = 20 m, 2b = 24m, rise = 3.5m and thickness = 90 mm.	**07**
	(b)	Find the maximum deflection in a circular plate subjected to a concentrated load óPô at the centre. The plate is fixed all around the edges. Take radius = 2.8 m, t = 70 mm, ε = 0.25, E = 200 GPa. P = 35 kN.	**07**
		OR	

Q.5	**(a)**	A simply supported at (x = 0 and x = L) semicircular cylindrical shell is subjected to a snow load óqô which is uniformly distributed over its plan area. Given the radius of the shell is óaô, thickness is óhô, modulus of elasticity and Poissonôs ratio are E and ε respectively, find the membrane stresses in the shell.	**07**
	(b)	Use Fourier series to derive the expression for deflection of a simply supported plate subjected to UDL of size a x b. Find out the values of moment and deflection at centre.	**07**

****