Seat No.: ________ Enrolment No.______________

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E-IIIrd SEMESTER–EXAMINATION – MAY- 2012

Subject code: 731504 **Date: 10/05/2012**

Subject Name: Plates and Shells

Time: 10:30 am – 01:00 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)** Distinguish between "membrane theory" and "exact theory" of small deflection of plate. Explain stress resultants in both theories with sketches. **07**

(b) For simply supported rectangular plates, subjected to hydrostatic pressure, deduce expression for deflection at centre. **07**

Q.2 **(a)** 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 1.65 times that when the periphery is clamped. Take poisson's ratio,$\nu = 0.3$. **07**

(b) A simply supported plate 4mX4m and 40 mm thick carries a udl of 20 kN/m^2. Find the maximum deflection, bending stress at a distance of 2.0m from both adjacent sides and reactions at supports. **07**

OR

(b) A circular thin plate having an effective diameter 350 mm is clamped around its periphery and is subjected to uniform pressure of 125 kN/m^2. Find minimum thickness for plate if deflection at the centre not to exceed 0.4 mm.Take E=210 Gpa and μ=0.25. **07**

Q.3 **(a)** Find N_θ and N_Φ for conical dome due to self weight and live load uniformly distributed. **07**

(b) Find M_r for simply supported circular plate of radius 'a', having a hole in the centre of radius 'b'. Assume $\nu = 0.18$, q = 55 N/m^2, a = 4500mm and b = 1200 mm. **07**

OR

Q.3 **(a)** Consider a rectangular plate with two opposite sides (x = 0 and x = a) simply supported; the third edge (y = 0) is built-in, and the fourth edge (y = b) free. The plate is subjected to a uniform pressure of intensity 'p'. Retaining only the first two terms of the Levy's solution, determine the deflection at the midpoint of the free edges and the bending moments at the midpoint of the clamped edge. Take a = 2.5 m; b = 3.25m, h = 0.15m; E = 210GPa; μ=0.3. **07**

(b) Using finite difference method, determine the maximum deflection of a square plate (a x a) fixed all along its edges and subjected to a uniformly distributed loading 'q'. Take mesh size,h = a/2. Compare the result if plate edges are all simply supported. **07**

Q.4 **(a)** Give merits and demerits of Navier's solution and Levy's solution **04**

(b) Give the classification of shell based on shell curvature with neat sketches. **05**

(C) Derive equations of equilibrium for general bending theory of uniformly loaded cylindrical shell. Mark important internal stress resultants. **05**

OR

Q.4 **(a)** State the assumptions made in the derivation of "plate equation" **04**

(b) A planetarium dome may be approximated as an edge-supported truncated cone. It is subjected to a snow load with a maximum accumulation over the dome q = 2.5 kPa. Assume that the dome is constructed of 13 cm thick concrete having the radii of the parallel circles equal to 45 m at the base and 25 m at the top, respectively. Determine the membrane stresses in the dome **10**

Q.5 **(a)** Explain "Finite difference method "of solving rectangular shape plate problem. **04**

(b) A simply supported at (x = 0 and x = L) semicircular cylindrical shell is subjected to a snow load 'q' which is uniformly distributed over its plan area. Given the radius of the shell is 'a', thickness is 'h', modulus of elasticity and Poisson's ratio are E and ν respectively, determine the membrane stresses in the shell. **10**

OR

Q.5 **(a)** Explain the superiority of curved elements compared to linear. **04**

(b) A circular cylindrical chimney shell of height L and radius R is subjected to a wind pressure 'P3'. The chimney shell is fixed 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 $P3 = P(-0.7 + 0.5\cos\theta + 1.2\cos 2\theta)$, determine the membrane forces in the shell. **10**

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