[4760]-46

M.E. (Civil/Structures)

THEORY OF PLATES AND SHELLS

(2008 Pattern) (Semester - II)

Time : 4 Hours]   *[Max. Marks : 100*

Instructions to the candidates :

1) *Attempt any two questions from each section.*
2) *Answers to the two sections should be written in separate books.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right indicate full marks.*
5) *Use of non programmable electronic calculator is allowed.*
6) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) For a thin plate subjected to bending, derive the governing differential equation. Find expressions for moments, shears using various boundary conditions. **[13]**

   b) Differentiate between thin plate theories for small and large deflections. Sketch the free body diagram of a plate element representing lateral loads, moments and shears. State the assumptions in the small deflection theory of thin plate. **[12]**

Q2) a) Derive Levy's solution for a rectangular plate with two opposite edges simply supported and the other two edges clamped; under uniform intensity of loading q. **[18]**

   b) State the advantages of Levy's method over Navier's method. **[7]**

Q3) A circular plate of radius 'a' is having simply supported edges. Find the maximum values of radial and tangential moments when the plate is subjected to central circular patch load over a area of radius a/4 with intensity P_o per unit area. **[25]**

Q4) a) A thin spherical tank is supported on cylindrical rim along a parallel circle. The tank is completely filled with liquid of density w. Derive the expression for the membrane stresses N_θ and N_φ. **[18]**

b) State the advantages and disadvantages of shell structures compared to plates. With neat sketches classify shell surfaces based on Gaussian curvature. **[7]**

Q5) a) For a cantilever cylindrical open shell of length L, radius a, and half angle φ_0 subjected to self weight , obtain the expression membrane stresses N_x, N_φ and $N_{x\varphi}$. **[15]**

b) Differentiate between membrane theory and bending theory for analysis of shells. Explain how membrane theory fails at the supports. **[10]**

Q6) a) Explain Beam theory of cylindrical shells. Discuss the advantages and limitations of the theory. **[7]**

b) Derive the equilibrium equation and hence the equation for deflection using general cylindrical shell theory (considering the bending action) for axisymmetric case. **[18]**

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