

Total No. of Questions : 6]

SEAT No. :

P3975

[Total No. of Pages : 2

[4860] - 45

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) Answer 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) Explain the basic difference between plates and beams with respect to geometry and behaviour. [5]
- b) Differentiate between thin and thick plates. [5]
- c) A plate with domain 'R' is bent into a surface which has constant curvature  $1/r_x$ ,  $1/r_y$ ,  $1/r_{xy}$  respectively for all values of x and y in 'R'. Find the deflection surface 'w' of this plate. Include the rigid body displacements of the plate. [15]
- Q2)** a) Derive Navier's solution for deflection a simply supported rectangular plate under uniform intensity of loading q. [16]
- b) Using energy approach, obtain the expression for deflected shape of simply supported isotropic plate subjected to uniform intensity of loading q. [9]
- Q3)** A uniformly loaded circular plate with radius 'a' has its edge simply supported. Starting from basics principles, obtain the expression for maximum deflection. [25]

P.T.O.

## **SECTION - II**

- Q4)** a) An RCC hemispherical dome of radius 6 m and thickness 120 mm is supported on its lower edge by roller support all along the periphery. Determine the membrane forces in the dome considering self weight only. Plot the variation of internal forces along the meridian. **[18]**
- b) What do you understand by Principal curvature at a point on the surface of the shell? Explain the term Gaussian curvature. **[7]**
- Q5)** a) Derive the equations of equilibrium for a small element of a cylindrical shell. Show the stress resultants on this element for general loading. **[15]**
- b) Apply the above equations to obtain the expressions for membrane stresses  $N_x$ ,  $N_\phi$  and  $N_{x\phi}$  for a closed circular cylindrical shell of length  $L$ , radius 'a' subjected to self weight. **[10]**
- Q6)** a) Explain the need for the bending theory for the analysis of the shell structure. **[5]**
- b) Describe in brief, the Lundgren's beam theory for thin shells. **[5]**
- c) For a cantilever cylindrical open shell used for roofing structure, find the membrane stresses due to self weight. **[15]**

