

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY****THIRD SEMESTER M.TECH DEGREE EXAMINATION****Civil Engineering****(Structural Engineering & Construction Management)****04 CE 7409 DESIGN OF CYLINDRICAL SHELLS AND FOLDED PLATES**

Duration: 3 Hours

Max. Marks: 60

*Assume suitable data where ever required, use of IS 2210-1988 is permitted***PART A***(Each question carries 3 marks)*

1. Distinguish between shells of rotation and shells of translation and mention their suitability for adoption in different situation.
2. Sketch variation of meridional stresses and hoop stresses in dome due to (a) dead load (b) live load
3. Explain difference between the forces acting on (a) conical roof and (b) conical umbrella roof.
4. Explain with sketches the structural action of a hyper shell showing forces developed in the shell when it supports its self weight and imposed loads.
5. What are the salient steps involved in the analysis of folded plates using Whitney's method
6. What are assumptions made in analysis of folded plate?
7. Sketch typical reinforcement used in V-Shaped folded plates showing their arrangements in the cross section and plane of folded plate.
8. Briefly explain structural behaviour of folded plate.

8x3=24 marks

## PART B

*(Each question carries 6 marks)*

9. A reinforced concrete shell with a circular directrix has the following dimensions, Distance between transverse= 30m, radius of the shell= 8m, thickness of the shell= 60mm semi central angle=  $60^\circ$ , if the water proofing course and occasional live load is  $1 \text{ kN/m}^2$  of the roof calculate (a) the maximum compressive stress in the shell (b) design the shell.

**OR**

10. A reinforced concrete shell having semi circular directrix is freely supported between the transverse separated by a distance of 35m. If radius and thickness of shell are 10 m and 60 mm respectively, calculate membrane forces at the crown and edge due to its own self weight. Also calculate the maximum compressive stress in concrete and maximum tension in the edge members.

11. A reinforced concrete shell has the following particulars, Radius  $R= 6\text{m}$ , Span of the shell = 24 m, semi central angle  $\Phi = 45^\circ$ , thickness of the shell  $t = 70\text{mm}$ . Calculate the maximum stress in concrete due to self weight only in the shell using beam theory.

**OR**

12. A dome for water tank is 12 m in span. Design dome and the ring beam. Use Fe 250 M 20 concrete.

13. A conical umbrella roof is supported at the centre by a circular column and has the following dimension, height of conical roof =1m, slope angle with vertical  $\alpha = 78^\circ 41'$ , shell thickness= 70mm, column diameter =400mm, radius of shell from centre of column =5m, total load = $2.1 \text{ kN/m}^2$ . Design the shell and the column.

**OR**

14. A conical roof is 10 m diameter and its height is 3m and its semi vertical angle is  $45^\circ$ , assume slab thickness of 100mm. Analyse shell and ring beam.

15. Design a hyper shell of umbrella type to suit the following data, area to be covered  $12\text{m} \times 12\text{m}$  it consist of hyper shells  $a=b=6\text{m}$ , central dip  $h = 1.2\text{m}$ . Using M20 concrete and Fe 415 steel design (a) sloping compression member (b) the edge beams.

**OR**

16. Discuss about various types of hyperbolic paraboloids.

17. Design a hipped hyper shell on four supports to cover an area 20mX15m. Adopt four HP shells each of  $a=10\text{m}$ ,  $b=7.5\text{m}$ . Design (a) shell part (b) sloping edge member (c) ridge members at gable end.

**OR**

18. Explain the steps involved in Simpson's method of analysis of folded plates.

19. A folded plate with two folds AB and BC is subjected to moments in the plane of plates- using following data. Calculate stresses in the folded plate using equations of three shears, thickness of plate BA  $t_1= 100\text{mm}$ , depth of plate BA  $h_1= 2\text{m}$ , thickness of plate BC  $t_2= 150\text{mm}$ , depth of plate BC  $h_2 =2\text{m}$ , moment in the plate BA  $m_1= 300\text{kNm}$  and moment in plate BC  $m_2= 350\text{kNm}$

**OR**

20. Analyse the symmetrical V- shaped folded plate shown in figure. Determine transverse moment and the corresponding reinforcement. Span of folded plate =20m, thickness of plate= 100mm, live load=  $0.6\text{kN/m}^2$ . Use M20 Fe415 steel

