Advanced Structural Design (CE 705)

Full Marks :70   Time :3hrs.

FIRST HALF

Answer any five

All question carry equal marks (5x7=35)
Use of relevant Indian Standard Code of Practice is permitted

1. Calculate the equivalent bending moment(s) for a beam section of size 500x300mm subjected to a bending moment of 30kNm and twisting moment of 45kNm. Use IS:456 specifications.

2. Calculate the factor of safety against overturning for a cantilever retaining wall with the following parameters. Base slab width = 3m, Toe slab width = 1m, Base slab thickness = 300mm, Wall height = 4500mm, Wall thickness = 300mm, Height of earth retained at toe and heel are 1800mm and 4800mm respectively, Active and passive earth pressure coefficients are 0.33 and 3 respectively, Unit weight of concrete and earth are $25kN/m^3$ and $18kN/m^3$ respectively.

3. Calculate the maximum membrane forces for the bottom circular dome of an intze tank with the following data. Weight of water above the dome = 5000kN, thickness of dome = 250mm, rise of dome = 1.5m, diameter of dome bottom = 10m.

4. Calculate the loss in pre-stressing force due to friction for a post-tensioned PSC beam of span 30m, pre-stressed from one end, with the following data. Pre-stressing force at transfer = 2500kN, cable profile is parabolic (rectangular) with maximum sag at mid-span as 150mm and zero at support. Take μ = 0.3 and k = 15×10^{-4} per meter. Use IS:1343 specifications.

5. Calculate the width of column strip and middle strip of the interior panel in each direction of a flat slab construction having three continuous spans in each direction. The interior panel is of size 6x4m and the adjacent panels spans 4.5 m in each direction. All measurements are with respect to column centre line.

6. Calculate the location of the neutral axis of base section of a chimney, which is subjected to a vertical load of 300kN and a moment of 12kNm. Take following cross sectional parameter. Internal and external diameter of the reinforced concrete shell is 3.6m and 4.0m respectively. Area of vertical steel is 45000 mm^2.

7. Calculate the maximum horizontal and vertical pressure at emptying and filling condition respectively on a cylindrical silo wall with the following data. The unit weight of the material stored = 8000 N/m^3. The angle of internal friction of the material stored = 35^0. The internal diameter of the Silo wall = 5m. The height of the Silo wall = 15m. Use IS:4995 specifications.

SECOND HALF

Answer any three
All question carry equal marks (3x11=33)
Two marks are reserved for neatness
Use of relevent Indian Standard Code of Practice is permitted

8. Design the side wall of a square bunker to store 400kN of coal for the following given data:
   The conical dome has central opening of 50cm. Unit weight of coal 850kg/m3. Angle of repose 45°. The stored coal is to be surcharged at angle of repose. Use IS code IS:4995-1968. Also show the reinforcement details.

9. An Intze tank of 800,000 liters capacity has to be designed. Determine the dimensions of the tank. Show the dimensions with neat sketch. Also design the top dome and top ring beam. Show the reinforcement details for both dome and ring beam.

10. A circular beam with radius 4m is supported on four columns. The beam carries a uniform distributed load of 25kN/m length of beam inclusive self weight. Draw the bending moment, Shear force and torsional moment diagram.

11. Design the side wall of the silo mentioned in Q.7. Use I.S. code method. Show reinforcement details with neat sketch.