

- (ii) Use M-20 Grade concrete and Fe-415 steel.
- (iii) Sketch the details of reinforcement.
- (iv) Use of IS-456, IRC and other relevant IS codes is permitted.
- (v) Assume required data suitably and state it clearly.

1. (a) Discuss substitute frames and loading conditions for maximum moment values of different critical points of a building frame. 10
- (b) Derive the expression for moment of resistance of a rectangular shear wall. 10

Or

2. A portal frame with ends hinged is to be analysed and design for the following data :

- (i) Spacing of portal frames = 4.5m
- (ii) Height of columns - 4.5m
- (iii) Distance between column centres - 10m
- (iv) Live load on the roof —  $2.5 \text{ kN/m}^2$
- (v) SBC of soil is  $150 \text{ kN/m}^2$

RCC slab is provided over the portal frames. Sketch the reinforcement details.

3. Design the stem and check the stability of a cantilever retaining wall of the following particulars : 20

- (i) Earth embankment 4m high above ground level.
- (ii) The embankment is horizontal at the top with traffic load of Intensity  $= 20 \text{ kN/m}^2$ .
- (iii) Angle of repose of the soil -  $25^\circ$  and unit weight of soil  $= 18 \text{ kN/m}^3$ .
- (iv) Safe bearing capacity of the soil -  $100 \text{ kN/m}^2$ .
- (v) Coefficient of friction between the wall and the ground  $= 0.40$ .

Or

4. Design the counterfort of a counterfort type retaining wall to the following particulars : 20

- (i) Height of wall above base level = 8.0 m
- (ii) Safe bearing capacity of soil = 150 kN/m<sup>2</sup>
- (iii) Angle of repose = 28°
- (iv) Unit weight of fill = 16 kN/m<sup>3</sup>
- (v) Spacing of counterforts = 4.0 m

5. Design a circular tank with fixed base for capacity of 500 kL. The depth of tank is 5.0 m, including a free board of 0.20 m. The tank is free at the top and rests on the ground. 20

Or

6. Design an underground reservoir 12m × 6m × 3.0m deep. The dry density of soil is 18 kN/m<sup>3</sup> and the angle of repose of dry soil is 35°. The outside soil which is 0.3m below the top of the tank wall may be taken as fully saturated upto its full height. 20

7. Design the silo to store maize. Dia of silo = 6m, capacity of silo = 4000 kN. Unit weight of maize = 7.7 kN/m<sup>3</sup>. Angle of Internal friction 28°. Angle of wall friction, during filling = 21° and during emptying = 16.8° 20

Or

8. (a) Derive the expression for finding horizontal and vertical pressure exerted by stored material of height 'h' in a silo. Use Janssens theory. 10

- (b) Using Airy's theory show that the height upto which a bin behaves as a shallow one is given by 10

$$h = b \left[ \mu + \frac{\sqrt{\mu(1+\mu^2)}}{\mu + \mu'} \right]$$

9. Design a solid slab bridge for the following data : 20

Clear span = 6.0 m

Clear width of roadway = 7.6 m

Thickness of wearing coat = 80 mm

Width of bearing = 600 mm

Consider only IRC class AA tracked vehicle loading.

Or

10. (a) Calculate the design moment along long and short span of dock slab

for a T-beam bridge on a national highway considering class AA tracked vehicle only. The following data is given : I

Effective span of beam = 16 m

Carriage way width = 8.0 m

C/c spacing of cross beams = 4.0 m

C/c spacing of longitudinal beams = 2.5 m

Thickness of wearing coat = 80 mm

Thickness of slab = 200 mm

Width of rib of T-beam = 360 mm

(b) Explain the merits and demerits of prestressed concrete. 10