Q. P. Code : 11753

(4 Hours) **CBSGS** **[Total Marks: 80**

N. B.: 1) Question No. 1 is Compulsory.
2) Answer any three from the remaining.
3) Each full question carries equal marks.
4) Assume suitable data, if needed & state it clearly.
5) Use of IS 456:2000 is permitted.

Q. 1) (a) Draw neat sketches, showing the behaviour of vertical stem wall & heel slab of a counterfort retaining wall. What is the reason of providing vertical ties & horizontal ties in the counterfort part? **(04 M)**

(b) What are the various situations, demanding the need of raft Foundation? What are the advantages of Raft Foundation? **(04 M)**

(c) Fig. 1 shows a part plan of the building. Slab (S1) has thickness of 120 mm & slab (S2) has thickness of 140 mm. For the building, live load = 4 kN/m^2, floor finish = 1 kN/m^2. Beam B1 is 8.2 m long, 200 mm wide & 450 mm deep. Also, beam B1 carries a masonry wall 115 mm thick & 3 m high, with masonry unit wt. = 18 kN/m^3. Calculate the factored (design) UDL carried by the beam (B1). Include the self weight of the beam itself. **(04 M)**

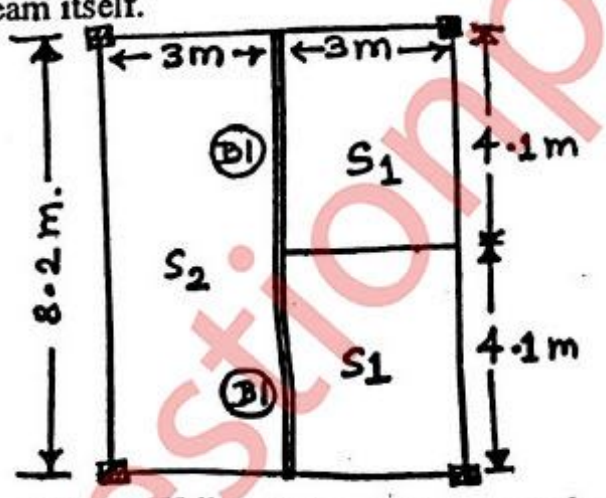

Fig. 1

(d) Write a note on Open Well Staircase, with a neat sketch. **(04 M)**

(e) A rectangular underground water tank has wall height of 3 m. The tank is empty. The soil outside is saturated, with the saturated unit weight = 18 kN/m^3. Unit weight of water = 9.81 kN/m^3. Angle of repose of soil = 30^0. Determine the pressure at the base of the wall. **(04 M)**

Q. 2) Carry out the design for the slab **S2** & beam **B2** (fig. 2). Take Live Load = 3 kN/m^2, Floor Finish = 1.5 kN/m^2. Use M20 grade of concrete & Fe415 grade steel. Take all the necessary checks. Draw neat reinforcement diagram. Use Limit State Method. **(20 M)**

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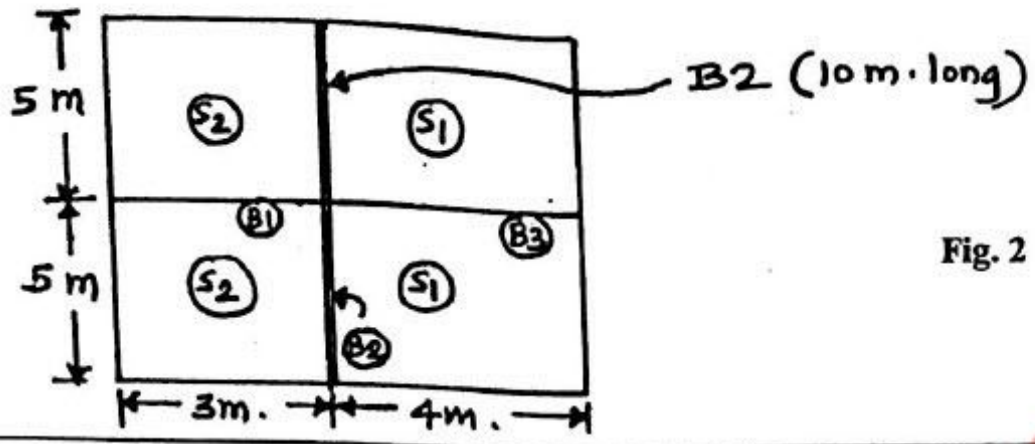

Fig. 2

Q. 3) Carry out the complete design of a cantilever retaining wall to retain the leveled back-fill, 5.2 m above the ground level. Unit weight of the soil is 17 kN/m^3 & its angle of repose is 30^0. Safe Bearing Capacity of the foundation soil is 220 kN/m^2. The coefficient of friction between the soil & concrete at the base is 0.60. Use M20 grade of concrete & Fe415 steel. Carry out all the necessary stability checks. Draw a neat sketch, indicating the reinforcement details. Adopt Limit State Method. **(20 M)**

Q. 4) **(a)** Design a dog-legged staircase for an office building in a room which measures 3 m X 6 m (clear dimensions or inside dimensions). Floor to floor height is 3.5 m. The building is liable to over-crowding, as it's a public building. Stairs are supported on brick walls 230 mm thick at the ends of the landings (i. e. landing spans parallel to the stairs). Provide M20 concrete & Fe415 steel. Fixing the dimensions of risers & treads for the human comfort, is expected. Carry out the necessary checks. Show the reinforcement details. Use Limit State Method. **(14 M)**

(b) Write a note on the types of joints in a water tank, as per IS 3370 (Part 1): 2009. Draw the neat sketches. **(06 M)**

Q. 5) **(a)** Design a circular water tank of 13 m internal diameter & 5 m height. The tank has flexible base & it rests on the ground. Use M30 concrete & Fe415 steel. Use Working Stress approach. The permissible stress in steel under direct tension is 130 MPa. The permissible stress in the concrete under direct tension is 1.5 MPa. The following table can be referred to fix the thickness of the tank wall or, alternate approaches can be adopted. Draw reinforcement details. Use Working Stress approach. **(08 M)**

Table: Minimum Thickness of Members in Direct Tension (Uncracked Condition)

Grade of Concrete	Thickness of members in (mm) for tension T in (Newtons)	
	Mild Steel	HYSD Bars
M 25	T/1465	T/1444
M 30	T/1682	T/1660

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(b) Design a rectangular water tank, open at the top. The clear size to be provided is (3 m X 8 m) & 3 m deep. The tank rests on a firm ground. Provide M25 grade concrete & Fe415 steel. Take σ_{cbc} = 8.5 MPa & permissible stress in steel = 150 MPa. Use approximate method for the analysis. Adopt Working Stress approach. Draw steel details. **(12 M)**

Q. 6) (a) A hall in a building has a floor consisting of a One-Way Continuous Slab cast with Simply Supported beams of width 250 mm, spaced at 4 m c/c **(fig. 3)** The clear span of the beam is 9 m. Assuming a Live Load on the slab as 3 kN/m^2, partition load as 1 kN/m^2 & load due to finishes as 0.6 kN/m^2, design the slab with M20 grade concrete & Fe415 steel. Draw reinforcement details. Adopt Limit State approach. **(12 M)**

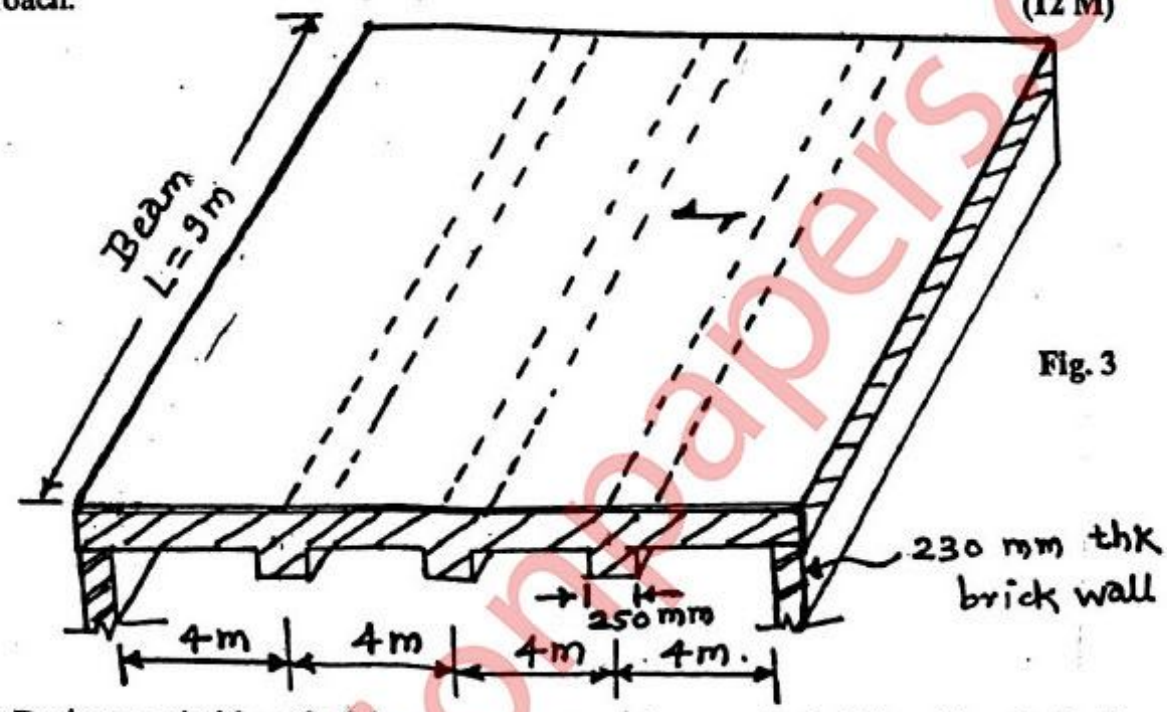

Fig. 3

(b) Design a suitable raft slab connecting the columns of a building (fig. 4). Design of the continuous beam over the raft slab is not needed. The size of the building is (12 m X 12 m), with the columns spaced at 4 m intervals. Service load transmitted by each column is 450 kN, column size is (300 mm X 300 mm). Soil SBC is 120 MPa. Use M20 grade concrete & Fe415 steel. Adopt Limit State Method. **(08 M)**

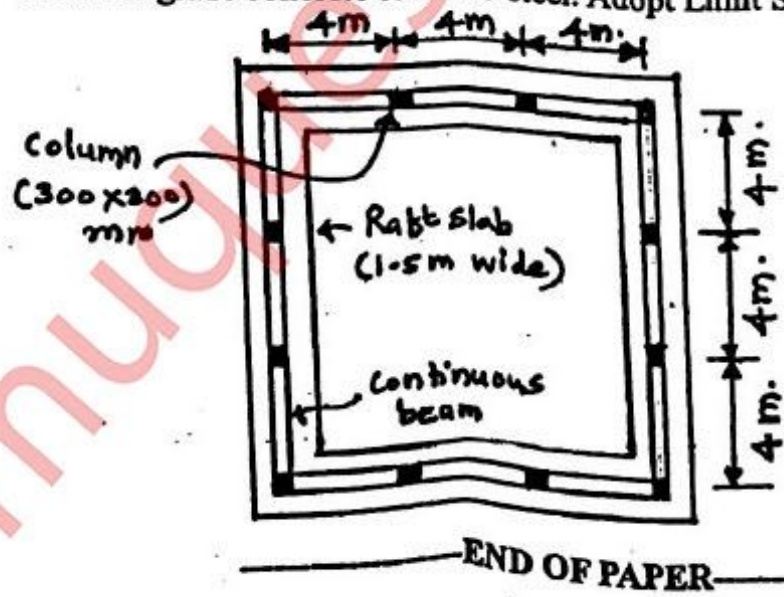

Fig. 4

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