(4 Hours) [Total Marks: 80

N. B.: 1) Question No. 1 is **COMPULSORY.**
    2) Attempt any **THREE** from the remaining.
    3) Each **FULL** question carries **20** marks.
    4) **ASSUME** suitable data, if needed & **state** it clearly.
    5) Use of **IS codes** is **PERMITTED.**

Q. 1) (a) Draw neat sketches of various joints in water tank. Explain briefly. **(05M)**

(b) With the help of neat sketches, explain the behavior of stem & heel slab of a counterfort retaining wall. **(05 M)**

(c) Draw a sketch showing plan view of Open Well Staircase. Discuss in brief. **(05 M)**

(d) Write a note on design of one-way continuous slab. **(05 M)**

Q. 2) Design a cantilever retaining wall to retain a leveled back-fill, 5.3 m above the ground level. Soil has unit weight of 18 kN/m^3 & angle of repose of 30^0. Safe Bearing Capacity of the foundation soil is 230 kN/m^2. The coefficient of friction between the soil & concrete at the base is 0.65. Use M20 grade of concrete & Fe415 steel. Draw neat sketches, showing the reinforcement details. **(20 M)**

Q. 3) (a) Design a dog-legged staircase in a room measuring 2.6 m X 4.93 m (clear dimensions). Floor to floor height is 3.2 m. Take riser as 160 mm & tread as 270 mm. Provide a gap between two flights as 100 mm. Provide the landing width equal to the width of flight. Live load is 5 kN/m^2 & finishes load is 0.6 kN/m^2. Assume the stairs to be supported on 230 mm thick masonry walls at the outer edges of the landing, parallel to the risers. Use M20 concrete and Fe 415 steel. Assume mild exposure conditions. Draw neat sketches showing all the details. **(16 M)**

(b) An underground rectangular water tank has wall height of 4 m. Tank has no water. The soil is saturated. It has saturated unit weight of 19 kN/m^3. Unit weight of water is 9.81 kN/m^3. Soil has angle of repose of 28^0. Calculate the pressure at the base of the wall. **(04 M)**

Q. 4) (a) Design a rectangular water tank, open at the top, using Working Stress Method. The clear size is (3.5 m X 8 m). It is 3.2 m deep. Tank rests on a firm ground. Use M25 concrete & Fe415 steel. Take σ_{cbc} = 8.5 MPa & permissible stress in steel = 150 MPa. Use approximate method for the analysis. Sketch the reinforcement details. **(16 M)**

(b) Write a brief note on elevated water tanks. **(04 M)**

Page: 1

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Q. 5) The slab system in **fig. 1**, is supported on load-bearing masonry walls, 230 mm thick. Assuming a floor finish load of 1 kN/m^2 & a live load of 4 kN/m^2, design the multi-panel slab system. Use M20 concrete & Fe415 steel. Assume mild exposure conditions. **(20 M)**
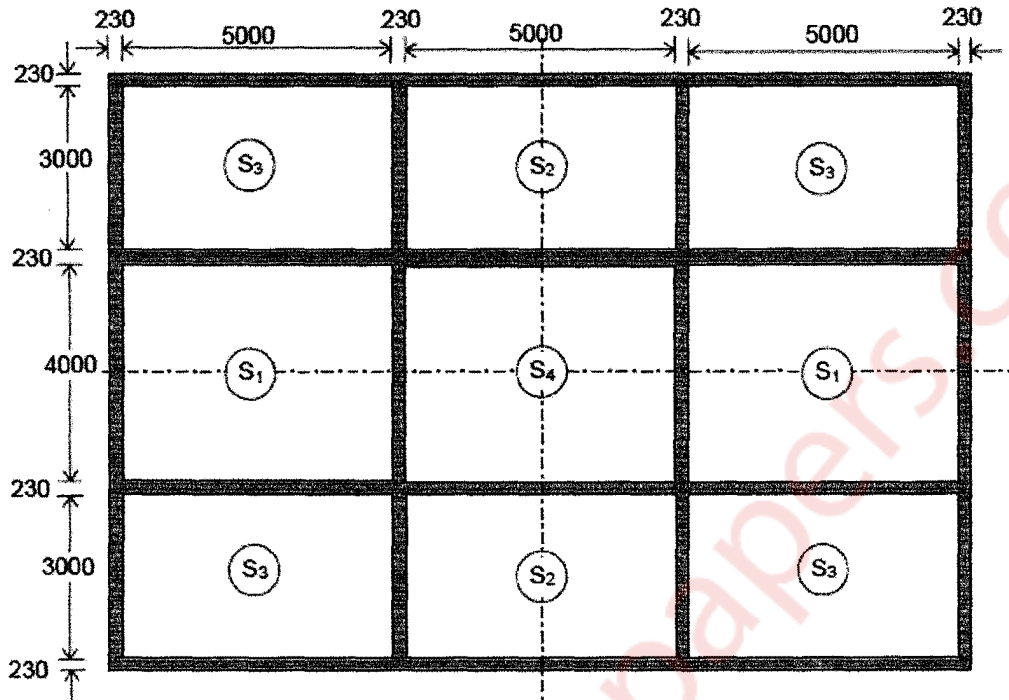

Fig. 1

Q. 6) (a) Using Working Stress Method, design a circular water tank with flexible connection at base for a capacity of 4,00,000 liters. The tank rests on a firm level ground. The height of tank, including a free board of 200 mm should not exceed 3.5 m. The tank is open at top. Use M 20 concrete and Fe 415 steel. Take σ_{ct} = 1.2 MPa for concrete & σ_{st} = 150 MPa for steel. Draw to a suitable scale: **(12 M)**
i) Plan at base
ii) Cross section through the centre of tank.

(b) Draw the neat sketches, showing various types of raft foundations. Write, in detail, the necessity of raft foundation. What are the advantages of providing a raft foundation? **(08 M)**

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