[Duration: 4hrs] **[Max Marks: 80]**

Instructions:

(1) Question No 1 is **compulsory**.
(2) Attempt any **three full** questions out of the **remaining five.**
(3) Each **full** question carries **20** marks.
(4) Use of all **relevant IS codes** permitted
(5) Assume suitable data, if required and state it clearly.

1. Answer any **FOUR**

a	Represent the dynamic equilibrium of single degree of freedom system using a typical sketch. Also write the corresponding equation.	**05 M**
b	Discuss about the importance of ductile detailing in earthquake resistant structures.	**05 M**
c	Explain counterfort retaining wall with sketches showing behaviors of stem, heel & toe.	**05 M**
d	Enlist various joints in water tank. Explain any two types with neat sketches.	**05 M**
e	Discuss about open-well staircase with a neat sketch.	**05 M**
f	Why high strength concrete & high strength steel are used in prestressed concrete? Discuss with detailed technical reasons.	

2. Design heel, toe & stem of a cantilever retaining wall. It retains a horizontal backfill of height 5.6 m. above the ground level. Adopt Limit State Method. The backfill soil has a density of 18 kN/m^3 and an angle of internal friction of 28 degrees. The safe bearing capacity of foundation soil is 250 kN/m^2. The coefficient of friction between soil and base slab concrete is 0.65. Use M20 concrete and Fe415 steel. Carry out the stability checks. Draw detailed reinforcement sketches. **20 M**

3. Design a circular water tank open at the top. It is having a flexible base. It rests on the ground. Adopt Working Stress Method. The capacity of tank is 6,25000 litres. M30 concrete and Fe415 steel are to be used. Permissible stress in concrete in direct tension is 1.5 MPa and permissible stress in steel is 130 MPa. Draw detailed reinforcement sketches. **20 M**

OR

Design an open rectangular water tank which rests on ground. The dimensions to be provided are (7. 2 m length x 3 m width x 3.2 m height). Use M25 concrete & Fe415 steel. Use working stress method. Draw a sketch showing steel details. **20 M**

4.	**a**	Design a dog-legged staircase for a room with clear dimensions (2.7 m X 4.6 m). Floor to floor height is 3.2 m. Stairs are not liable to overcrowding. Stairs are supported on 230 mm thick walls at the ends of the landings (i.e. landings span parallel to the flights). Use M20 concrete and Fe415 steel. Carry out checks for shear & deflection. Show steel details. Use limit state method.	**15 M**
	b	Distinguish between one-way slab & two-way slab.	**05 M**

5. **a** A rectangular concrete beam has a C/S of 150 mm width and 360 mm depth. It is pre-tensioned by straight wires located 65 mm below the neutral axis. The wires carry an initial force of 195 kN. Young's modulus of steel is 210 kN/mm^2 and that of concrete is 36.5 kN/mm^2. The total area of steel wires is 240 mm^2. Determine the percentage loss of stress in steel due to elastic deformation of concrete. **05M**

b Determine natural time period & natural frequency for the system shown in fig. 1 **05M**

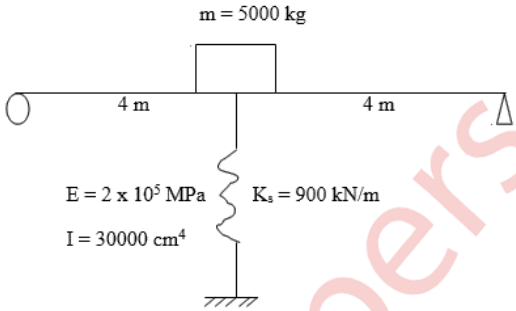

Fig. 1

c Write a note on design load calculation by seismic coefficient method. **05M**

d Figure 2 shows a RCC slab-beam system. Slab S_1 is 160 mm thick and slab S_2 is 135 mm thick. Live load on both the slabs is 4.5 kN/m^2 and floor finish load on both the slabs is 1.1 kN/m^2. Beam B_1 is 280 mm wide and 550 mm deep. It carries a masonry wall of width 230 mm and height 3 m on its entire length. Unit weight of masonry is 20 kN/m^3. Calculate the load carried by beam B_1, including its self weight. Use limit state approach. **05M**

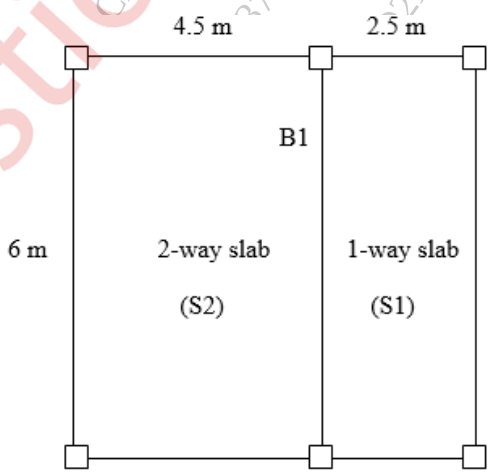

Figure 2

6. Design a slab for a room having clear dimensions (4.5 m X 5.2 m). Adopt Limit State Method. The slab is continuous on all the four edges. Live load on the slab is 3.5 kN/m^2 and floor finish load is 1.2 kN/m^2. Use M20 concrete and Fe415 steel. Carry out the checks for shear, deflection & cracking. Draw neat sketches showing steel details. **20 M**
