Total No. of Questions : 10] **SEAT No. :**

P3017 **[Total No. of Pages : 3**

[5354]-503
B.E. (Civil)
STRUCTURAL DESIGN AND DRAWING - III
(2012 Pattern)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:-

1) ***Answer Q.1 or Q.2; Q.3 or Q.4; Q.5 or Q.6; Q.7 or Q.8; and Q.9 or Q.10***
2) ***Figures in bold to the right, indicate full marks.***
3) ***IS 456, IS 1893, IS 1343, IS 3370 (Part II and Part IV) and IS 13920 are allowed in the examination.***
4) ***The designs should comply with the latest codal provisions.***
5) ***If necessary, assume suitable data and indicate clearly.***
6) ***Use of electronic pocket calculator is allowed.***

Q1) a) Write short note on any four post-tensioning anchorages systems. **[4]**

b) Determine the pre-stressing loss due to friction for the post tensioned beam of 20 m span with cross section of 0.4 m x 1.2 m if pre-stressing force is applied at left end only. **[6]**

Data given is $\mathbf{A}_p$= l200 mm^2, μ = 0.35, k = 0.0015/m, $\mathbf{E}_s$ = 2l0 GPa, f_{pi} =1300 N/mm^2. The cable profile is parabolic with zero eccentricity at support and dip of 0.52 m at center.

OR

Q2) a) Explain the concept of concordant cable profile with neat sketches. **[4]**

b) An I section post tensioned beam has 400 mm × 100 mm top flange; 200 mm × 100 mm bottom flange; 100 mm thick web and 500 mm overall depth. The pre-stressing force is 1200 kN with the tendon placed centrally at the ends. Design the end bearing plate. Strength of concrete at transfer is 40 N/mm^2. **[6]**

Q3) a) Explain with proper sketches load balancing concept. **[4]**

b) For a symmetrical small telephone exchange office building of size 8m×8m having two equal bays has a height of 10.5 m with each storey having height 3.5 m. The building is located in zone V. Soil conditions is medium stiff. SMRF is adopted. DL= 10 kN /m^2 and IL=3 kN /m^2.

P.T.O.

Determine the design seismic forces for the building using seismic coefficient method as per IS 1893 and show the distribution of lateral forces with the building height. **[6]**

OR

Q4) a) Explain the Indian standard code provisions for design of shear reinforcement in pre-stressed beam. **[4]**

b) Details of a substitute frame having continuous beam ABCD is as follows. **[6]**

Thickness of floor = 100 mm, LL = 2 kN/m^2, Floor finish=0.6 kN/m^2, size of beams – 200 mm × 400 mm, size of column – 200 mm × 400 mm. The height of top as well as bottom columns of the substitute frame is 4 m. AB=CD=6 m c/c; and BC=3 m c/c. Find the maximum positive bending moment and maximum negative bending moment at B; the inner support section.

Q5) a) Explain with proper sketches, how the various components of cantilever RCC retaining wall can fail. **[4]**

b) For a T- shaped retaining wall draw the active earth pressure diagram showing the expression for maximum earth pressure for the following conditions. **[4]**

i) Backfill with sloping surface

ii) Backfill is horizontal with uniform surcharge W_s/unit run.

c) The stem of a cantilever retaining wall is 5m tall. The wall retains soil horizontally levelled with the top of stem. The density of soil is 19 kN/m^3. Angle of repose=30°. SBC of soil = 200 kN/m^2. Design the stem of the retaining wall. Adopt curtailment of reinforcement and sketch the detailing. **[8]**

OR

Q6) Design a L-shaped retaining wall to retain a backfill of 3 m. The backfill is horizontal. The unit weight of the soil is 17 kN/m^3, angle of repose = 30°, SBC of soil = 180 kN/m^2, good foundation is available at a depth of 1.0 m. Sketch the details of reinforcement in the wall and base slab. **[16]**

Q7) Two columns spaced 4 m apart carry a service load of 650 kN and 1000 kN each. Design a **slab-beam type combined footing** to support them. The columns are 230 mm × 400 mm and 230 mm × 600 mm respectively. The SBC of soil is 190 kN/m^2. Use M25 grade of concrete and steel of grade Fe 500. Sketch the reinforcement details. **[16]**

OR

Q8) Two columns spaced 4 m apart carry a service load of 650 kN and 1000 kN each. Design a **slab type combined footing** to support them. The columns are 230 mm × 400 mm and 230 mm × 600 mm respectively. The SBC of soil is 190 kN/m^2. Use M25 grade of concrete and steel of grade Fe 500. Sketch the reinforcement details. **[16]**

Q9) a) A circular water tank is 12 m in diameter and 4 m high. Thickness of wall is 170 mm. The tank rests on firm ground and walls of the tank are restrained at the base. Determine the maximum hoop tension and maximum cantilever moment using appropriate coefficients given the IS code. **[6]**

b) Using limit state method, design the section of a circular water tank with flexible base and resting on ground. The wall is subjected to a maximum hoop tension of 300 kN. Use Fe_{500} grade of steel and M_{35} grade of concrete. The limiting design surface crack width may be taken as 0.2 mm. **[12]**

OR

Q10) Design the short wall for a rectangular water tank open at top resting on ground having a size of 8.0 m × 3.6 m × 2.5 m high. Use M_{30} and Fe_{500} grade material. Sketch details of reinforcement for the wall. **[18]**