

[5871]-503

B.E. (Civil)

Structural Design and Drawing - III
(2015 Pattern) (Semester - I)

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, Q. 9 or Q. 10.
- 2) Figures to the right side indicate full marks.
- 3) IS 456, IS 1343, IS 3370 and IS 1893 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) Explain the P-line and C-line concept for finding the stresses in a section of prestressed beam. [4]

- b) A simply supported post tensioned concrete beam has a rectangular cross section of 420×670 mm. It is prestressed by strands of 400 mm^2 area carrying initial prestressing force of 450 kN. The profile of the prestressing wire is parabolic with zero eccentricity at support and 75 mm at mid span. The transfer of stress takes place at the age of 14 days. Calculate loss of stress due creep in general using IS 1343 provisions for relative humidity 90%. Take M50 grade of concrete, $E_s = 200 \text{ Gpa}$. [6]

OR

Q2) a) Explain the procedure to design two way prestressed slab. [4]

- b) The permissible compressive stress in concrete is 14 MPa and permissible tensile stress in concrete is 1.4 MPa. A pre-stressed concrete beam is pre-stressed with 12 wires of 3 mm diameter as shown in Fig. 2. The wires are subjected to a pre-stress of 1000 MPa. Neglecting all the losses, determine the total sagging moment that can be applied to the beam during service stage. The cross section of the beam at mid span is as shown in the Fig. 1. [6]

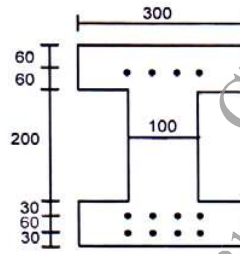


Fig. 1

- Q3)** a) A post-tensioned bonded prestressed concrete beam is prestressed by 300 mm^2 of high tensile steel located at an eccentricity of 100 mm. The cross section of the beam is 230 mm wide and 400 mm deep. Using the codal provisions of IS 1343, estimate the ultimate moment capacity of the section. Take the characteristic cube compressive strength of concrete as 40 MPa and the characteristic tensile strength of prestressing steel as 1600 N/mm^2 . [4]
- b) What are Flat slabs? Explain the procedure to find the cable profile in flat slab in relevance to the cable zone. [6]

OR

- Q4)** a) Explain the design of a prestressed section for shear using the codal provisions. [4]
- b) A continuous flat slab spread over area of $24 \text{ m} \times 24 \text{ m}$ is supported by columns of $500 \text{ mm} \times 500 \text{ mm}$ with drop of $2 \text{ m} \times 2 \text{ m}$ at 8 m c/c in both directions. Calculate design moments for an interior and exterior slab panel. Adopt $\text{LL} = 4 \text{ kN/m}^2$ and $\text{FFL} = 1.0 \text{ kN/m}^2$. [6]

- Q5)** a) Explain with neat sketches, the deformation of T shape retaining wall and show the position of the main reinforcement to be provided. [3]
- b) Propose suitable dimensions and perform the stability analysis for 4 m high T-shaped retaining wall provided to retain a backfill inclined at angle of 12° having unit weight equal to 18 kN/m^3 . Angle of repose = 30° , Coefficient of friction between concrete and soil = 0.55, SBC of soil = 150 kN/m^2 , depth of foundation = 1.0m. [13]

OR

- Q6)** Design a L-shaped retaining wall of height 5.2 m to retain a submerged levelled backfill. Dry density of soil is 18 kN/m^3 and submerged density is 12 kN/m^3 and angle of repose equal to 28° . Coefficient of friction between concrete and soil = 0.55, SBC of soil 150 kN/m^2 , depth of foundation = 1.2 m. Sketch the details of reinforcement in the wall and base slab. [16]

- Q7)** a) Explain the limit state of serviceability criteria for design of water tanks. [6]
- b) Design a circular water tank with fixed base for a capacity of 80,000 litres. Use Fe 500 grade of steel and M30 grade of concrete. Provide detailing of reinforcement. [12]

OR

Q8) Design a rectangular water tank open at top resting on ground having a size of $7\text{ m} \times 3.0\text{ m} \times 3\text{ m}$ high. Use M 30 and Fe 500 grade material. Sketch details of reinforcement for the wall. [18]

Q9) a) Explain in brief the following terms related to theory of vibration : [8]

- i) Degree of freedom ii) Resonance
- iii) Damping ratio iv) Mathematical model

b) Determine the seismic forces in X and Y direction at each floor level for the residential RCC structure of 12 m height shown in the Fig. 2. The building is located in seismic zone V. The soil conditions are medium stiff. The special moment resisting RC frames are in-filled with brick-masonry. The lumped weight due to dead loads may be taken as 12 kN/m^2 . The floors are to cater a live load of 4 kN/m^2 on floors and 1.5 kN/m^2 on the roof. Consider floor height as 3 m. [8]

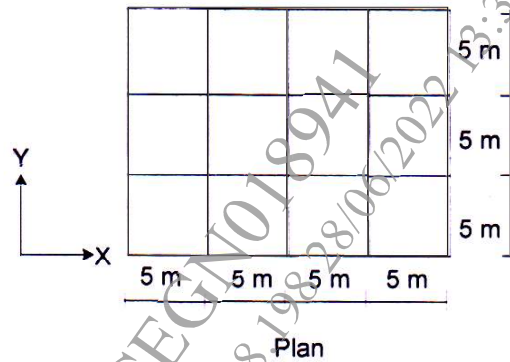


Fig.2

OR

Q10) a) Determine the equivalent stiffness and natural frequency for the system shown in Fig. 3. Take $L = 1.5\text{ m}$, $E = 200\text{ GPa}$, $I = 1000\text{ mm}^4$, $m = 10\text{ kg}$, stiffness of spring $= k = 1\text{ kN/m}$. [8]



Fig. 3

b) Explain how the combined effect of lateral forces and vertical loading are considered for the analysis of multistoried frames. [8]

