Total No. of printed pages = 6

CE 131701

Roll No. of candidate

2018

B.Tech. (CE) 7th Semester End-Term Examination

DESIGN OF STRUCTURE – III

Full Marks – 100   Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer question No. 1 and any *six* from the rest.

IS 456, IS 800, IS 1343, IS 804, IS 3370 Part-I & II and
Steel Table are permitted.

1. Answer the following : (MCQ/Fill in the blanks)
   $(10 \times 1 = 10)$

   (i) A rectangular simply supported pre-stressed concrete beam, of span L is subjected to a pre-stressing force of P acting centrally at end sections and the pre-stress tensions are parabolic draped with maximum eccentrically of e_{max} at the mid span section. The uniformly distributed upward load (w) on the beam due to pre-stressing will be ——————.

(ii) Intermediate vertical stiffeners are provided in plate girder —————.

(iii) Gantry girders carrying electrically operated overhead travelling cranes, the lateral force are increased by —————.

(iv) The side face reinforcement, if required, in a T-beam will be —————.

(v) The hoop tension in R.C.C water tank must be resist by —————.

(vi) Effective length of the rafter member between two nodes at a distance L, perpendicular to the plane of truss is —————.

(vii) Eccentric tendons in a concrete beam section induces —————.

(viii) Loss of stress in steel due to relaxation of steel is influenced by —————.

(ix) The surge loads in gantry girders are —————.

(x) In the plate girder, the vertical stiffeners are provided when the ratio of clear depth to the thickness of the web exceeds —————.

2. (a) A rectangular beam 300 mm wide 200 mm deep is pre-stressed by means of 15 wires each 5 mm diameter wires located 65 mm from the bottom of beam and three 5 mm wires located 25 mm from the top of the beam. If the wires are initially tensioned to a stress of 840 N/mm². Calculate the % loss of stress in steel immediately after transfer allowing for the stress due to elastic deformation of concrete only. E_s=210 kN/mm², E_c=35 kN/mm².

(b) A pre-stressed concrete beam of section 200 mm wide by 300 mm deep is used over an effective span of 6 m to support an imposed load of 4 kN/m. At the centre of span section of the beam, find the magnitude of

(i) The concentric pre-stressing force necessary for zero fibre stress at the soffit when the beam is fully loaded; and

(ii) The eccentric pre-stressing force located 100 mm from the bottom of the beam which would nullify the bottom fibre stress due to loading. (8+7=15)

3. (a) What are the different components of a plate girder? Identify with a neat sketch.

(b) Discuss briefly about the type of stiffeners provided in a plate girder.

(c) The section of a welded plate girder consist of flange plates 575 mm × 35 mm and a web plate 1780 mm × 10 mm. Determine the moment capacity of the section, and the shear resistance corresponding to web buckling. Intermediate stiffeners are not present. (3+5+7=15)

4. (a) Differentiate between surge load and drag load as applied to gantry girder carrying cranes.

(b) A gantry girder of span 10 m supports a crane girder of span 24 m. An EOT crane of 400 kN capacity is operating on the crane girder, its minimum approach distance from the gantry girder being 1.5 m. The wheel base of the crane girder is 3.6 m. Calculate the design forces on the gantry girder. Self weight of the crane girder is 300 kN and weight of the crab is 40 kN. (5+10=15)

5. (a) Explain the basic difference in structural behavior between transversely supported stairs and longitudinally supported stairs.

(b) The main stair of an office building has to be located in a stair hall measuring 3m × 5m. The vertical distance between the floors is 3.3 m. Design the dogged-legged stair. Allow live load of 2 kN/m². Use M20 concrete and mild steel reinforcement. (5+10=15)

6. (a) Explain and differentiate between primary and secondary type of torsion.

(b) A beam of rectangular cross section of width 300 mm and 600mm deep is subjected to a factored bending moment 115 kNm, factored shear force 95 kN, factored twisting moment of 45 kNm. Design the beam section for longitudinal reinforcement. (5+10=15)

7. (a) Write briefly on joints in a water tank.

(b) Design a circular water tank to the following requirements:

(i) Diameter of the tank = 4m

(ii) Depth of water = 3m

(iii) The tank rests on ground.

(iv) The walls and the base slab are not monolithic.

Use M20 concrete and Fe415 steel. (7+8=15)

8. (a) Write briefly on bracing of an industrial building.

(b) What is an industrial building bent? What are its various types? Briefly discuss the design issues involved in such a bent. (5+10=15)

9. (a) What are the advantages and disadvantages of tubular structures?

(b) A pressed steel tank is to be installed in a residential campus to supply 1 million liters of water. Proportion the tank size and calculate the requirement of steel plates for construction. Also evaluate the forces in the diagonal stays of the tank and design the most critical one.

(5+10=15)

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