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53 (CE 801) DGST-III

2017

DESIGN OF STRUCTURE-III

Paper : CE 801

Full Marks : 100

Time : Four hours

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

Answer **any five** questions.

1. (a) Define prestressed concrete. Differentiate between pretensioning and post tensioning. Briefly discuss the advantages and disadvantages of prestressed concrete.

2+3+3=8

Contd.

(b) A prestressed concrete beam of rectangular section 750mm deep and 375mm wide has a span of 12m . The effective prestressing force is 1500kN at an eccentricity of 1500mm . The dead load of the beam is 7kN/m and the beam has to carry a live load of 12kN/m . Determine the extreme stresses in concrete

(a) at the mid section without the action of live load.

(b) at the mid section with the action of the live load. 12

2. Explain the basic differences in structural behaviour between the stair slabs spanning transversely and stair slabs spanning longitudinally. Design a 'waist slab' type staircase comprising a straight flight of steps, supported between two stringer beams along the two sides. Assume an effective

span of 1.5m , a riser of 150mm and a tread of 270mm . Assume a live load of 3.0kN/m^2 . Use M20 concrete and Fe 415 steel. Assume mild exposure conditions. Assume appropriate value for any missing datas.

5+15

3. The beam along the longitudinal directions having four spans, such that span of two exterior ones is 5.5m and that for interior ones are 5.1m and 6m for the one near the left span and right span respectively. Dead load and superimposed loads transferred to the beam are 10.5kN/m and 8.4kN/m respectively. Storey height is 3.2m . Design the beams for bending moment and shear force by code recommendations for moment and shear co-efficients. 20

4. (a) A curved beam having a radius of 8.5m subjected to a bending moment of 150kNm , shear force 110kNm and twisting moment of 40kNm . The beam is of rectangular section of size $300 \times 500\text{mm}$. Find the amount of main steel and shear reinforcement. 8

(b) Briefly discuss the various losses in prestressed concrete and also write down their expressions. A prestressed concrete beam of sectional size $200 \times 400\text{mm}$ is subjected to an initial stress of 1250N/mm^2 at an eccentricity of 75mm through five cables of 50mm diameter each. Two cables are parabolic with eccentricity of 60mm above the centroid at supports. Another two cables are also parabolic with zero eccentricity at support. Last cable is straight with constant eccentricity. Find the loss in each cable. And also find the total loss. Take span of beam = 8m , $E_s = 210\text{kN/mm}^2$ and $E_c = 35\text{kN/mm}^2$.

5+7=12

5. (a) Explain with diagram the pressure line or thrust line. A prestressed concrete beam, 300mm wide by 600mm deep section uniform throughout span has a simply supported span of 6.5m . The beam is pretensioned through linearly bent tendon having an eccentricity of 200mm at midspan and zero at end, prestressing force being 1200kN . Find extreme fibre stresses at mid span section if *udl* of 50kN/m excluding self weight acts throughout the span. Locate the position of resultant thrust at midspan and quarter span section.

10

(b) The maximum bending moment and shear force induced on a rectangular beam of $250 \times 500\text{mm}$ is 125kNm and 80kN . If the beam is subjected to a twisting moment of 80kNm , design the beam using IS 456. 10

6. (a) An RCC tank having a storage capacity of 120cum rests on a firm ground. The tank is circular in plan. The wall is monolithic with the base slab. Height of water should be maintained at 2.6m and there should be a free-board of minimum 25cm . Design the tank wall. Use *M20* grade concrete and *Fe415* steel. 10

(b) Design an open-rectangular tank of size $6\text{m} \times 3\text{m} \times 3\text{m}$ deep resting on a fixed ground. Use *M25* grade concrete and *Fe415* steel. Assume any missing data. 10