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Question Paper Code : 21218

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Seventh Semester

Civil Engineering

CE 2404/CE 74 — PRESTRESSED CONCRETE STRUCTURES

(Regulation 2008)

Time : Three hours Maximum : 100 marks

IS : 1343 codes are permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the various methods of prestressing?
2. What are the systems of prestressing?
3. Define partial prestressing.
4. Mention any two functions of end blocks.
5. What are the functions of water stopper (water bar) in water tank construction?
6. Differentiate prestressed cylinder and non cylinder pipe.
7. Define propped construction.
8. How to achieve compositeness between precast and cast in situ part and show the sketches?
9. State any two advantages of prestressed concrete bridges.
10. Draw a typical cross section of pre-tensioned prestressed concrete bridge decks.

PART B — (5 × 16 = 80 marks)

11. (a) A prestressed concrete beam of section 150 mm wide by 350 mm deep is used over an effective span of 8 m to support a uniformly distributed load of 6 kN/m, which includes the self weight of the beam. The beam is prestressed by a straight cable carrying a force of 200 kN and located at eccentricity of 50mm. Determine the location of the thrust — line in the beam and plot its position at quarter and central span section.

Or

(b) A concrete beam with a rectangular section, 150 mm wide and 300 mm deep, is stressed by 3 cables, each carrying an effective force of 200 kN. The span of the beam is 12 m. The first cable is parabolic with an eccentricity of 50 mm below the centroidal axis at the center of the span and 50 mm above the centroidal axis at supports. The second cable is parabolic with zero eccentricity at the supports and an eccentricity of 50 mm at the center of span. The third cable is straight with a uniform eccentricity of 50 mm below the centroidal axis.

If the beam supports a uniformly distributed live load of 6 kN/m and $E_c = 38\,kN/m^2$, estimate the instantaneous deflection at the following stages:

(i) Prestress + Self weight of the beam

(ii) Prestress + Self weight + Live load.

12. (a) Design a post tensioned bridge girder of span 30 m and carries an imposed load of 30 kN/m is prestressing cable each of 7mm dia wires 12 Nos. in freyssinet system and characteristic strength of steel 1600 MPa and M50 grade concrete used, Assume loss of prestress 15%.

Or

(b) The end block of a prestressed concrete beam, rectangular in section, is 100 mm wide and 200 mm deep. The prestressing force of 100 kN is transmitted to concrete by a distribution plate, 100 mm wide and 50 mm deep, concentrically located at the ends. Calculate the position and magnitude of the maximum tensile stress on the horizontal section trough the centre and edge of the anchor plate. Compute the bursting tension on the horizontal planes.

13. (a) Design a cylindrical prestressed concrete water tank to suit the following data:

Capacity of tank = 3.5×10^6 liters. Ratio of diameter to height = 4. Maximum compressive stress in concrete at transfer not to exceed 14 N/mm^2 (compression). Minimum compressive stress under working load to be 1 N/mm^2. The prestress is to be provided by circumferential winding of 5 mm dia wires and by vertical cables of 12 wires of 7 mm diameter. The stress in wires at transfer = 1000 N/mm^2. Loss ratio = 0.75. Design the walls of the tank and details of circumferential wire winding and vertical cables for the following joint condition at the base: Sliding base (Assume coefficient of friction as 0.5).

Or

(b) Design a non - cylinder prestressed concrete pipe of 600 mm internal diameter to withstand a working hydrostatic pressure og 1.05 N/mm^2, using a 2.5 mm high — tensile wire stressed to 1000 N/mm^2 at transfer. Permissible maximum and minimum stresses in concrete at transfer and service loads are 14 and 0.7 N/mm^2. The loss ratio is 0.8. Calculate also the test pressure required to produce a tensile stress of 0.7 N/mm^2 in concrete when applied immediately after tensioniong and also the winding stess in steel if E_s = kN/mm^2 and E_c = 35 kN/mm^2.

14. (a) A rectangular pretensioned concrete beam has a breadth of 100mm and depth of 230 mm, and the pre stress after all losses have occurred is 12 N/mm^2 at the soffit and zero at top. The beam is incorporated in a composite Tee beam by casting a top flange of breadth 300 mm and depth 50 mm.

Calculate the maximum uniformly distributed load that can be supports on a simply supported span of 6.0 m, without any tensile stress occurring

(i) if the slab is externally supported while casting and

(ii) if the pre-tensioned beam supports the weight of the slab while casting.

Or

(b) Briefly out line the design procedure of composite sections and explain the term shrinkage stresses in composite beams.

15. (a) What are the general aspects of prestressed concrete bridges and its advantages over RC bridges.

Or

(b) Briefly out line the design procedure of post-tensioned prestressed concrete slab bridge deck.