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Question Paper Code : 31088

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 20[illegible].

Seventh Semester

Civil Engineering

CE 1402 — PRESTRESSED CONCRETE STRUCTURES

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the sources of prestress force?

2. Enumerate load balancing concept.

3. Write any two assumptions on the compatibility of strains.

4. What is "Effective reinforcement ratio"?

5. Define two stage construction.

6. Write any two general failures of prestressed concrete tanks.

7. How do you compute the shirnkage and resultant stresses in composite member?

8. Distinguish between propped and unpropped construction methods.

9. Write any three advantages of prestressed concrete bridges.

10. Write a short note on post tensioned bridge decks.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the factors influencing deflections? (8)

(ii) What is the necessity of using supplementary or untensioned reinforcement in prestressed concrete members? (8)

Or

(b) A prestressed concrete beam of section 125mm wide and 300mm deep is used over an effective span of 6.25m support a udl of 4.5 kN/m including selfweight. The beam is prestressed by a straight cable carrying a force of 190kN and located at an eccentricity of 50mm. Determine the location of the thrust line in the beam and plot its position. (16)

12. (a) A prestressed concrete beam of effective span 16m is of rectangular section 400mm wide and 1200mm deep. A tendons consist of 3300mm^2 of strands of characteristic strength 1700 N/mm^2 with an effective prestress of 910 N/mm^2. The strands are located 870mm from the top face of the beam. If F_{cu} = 60 N/mm^2, estimate the flexural strength of the section as per British Code Provisions for the following cases.

(i) Bonded tendons

(ii) Unbonded tendons (16)

Or

(b) (i) The end block of a post tensioned prestressed concrete beam. 300mm wide and 300mm deep is subjected to a concentric anchorage force of 832.8 kN by a Freyssinet anchorage of area 11720mm^2. Design and detail the anchorage reinforcement for the end block. (8)

(ii) Explain the effect of varying the ratio of depth anchorage to the depth of end block on the distribution of bursting tension. (8)

13. (a) (i) Explain the general features of prestressed concrete tanks. (8)

(ii) Explain the junctions of tank wall and base slab with neat sketch. (8)

Or

(b) A cylindrical prestressed concrete water tank of internal diameter 30m is required to storewater over a depth of 7.5m. The permissible compressive stress in concrete at transfer is 13 N/mm^2 and the minimum compressive stress under working pressure is 1 N/mm^2, the loss ratio is 0.75, wires of 5mm dia with an initial stress of 1000 N/mm^2 are available for circumferential winding and Freyssinet cables madeup of 12 wires of 8mm dia stressed to 1200N/mm^2 are to be used for vertical prestressing. Design the tank walls assuming the base as fixed. The cube strength of concrete is 40 N/mm^2. For the thickness of wall is 150mm.

14. (a) (i) Explain the types of composite construction with neat sketch. (8)

(ii) Explain the precast prestressed concrete stresses at serviceability limit state. (8)

Or

(b) Design a composite slab for the bridge deck using a standard invested T-section. The top flange is 250mm wide and 100mm thick. The web thickness is 100mm and the overall depth of the inverted T. Section is 655mm. The bridge deck has to support a characteristic imposed load of 50 kN/m^2 over an effective span of 12m. Grade 40 concrete is specified for the precast pretensioned T-with a compressive strength at transfer of 36 N/mm^2. Concrete of grade-30 is used for the insitu part. Determine the minimum prestress necessary and check for safety under service ability limit state. Section properties: Area = $180500mm^2$, Position of centroid = 220mm from the sobbit. $I = 81.1 \times 10^8 mm^4$, $Zt = 18.7 \times 10^6 mm^3$, $Z_b = 37 \times 10^6 mm^3$. loss ratio $(\eta) = 0.8$ Mmin = 0.

15. (a) (i) Explain the advantages of prestressed concrete bridges. (8)

(ii) Explain the post-tensioned prestressed concrete bridge decks with neat sketch. (8)

Or

(b) Design a post-tensioned prestressed concrete T-beam slab bridge deck for a national highway crossing to suit the following data.

Effective span = 30m, width of road = 7.5m, kerbs = 600mm on each side, Footpath = 1.5m wide on each side, thickness of wearing coat = 80mm, live load = IRC class AA tracked vehicle. For the deck slab, adopt M_{20} grade concrete, for prestressed concrete girders adopt M = 50 grade concrete with cube strength at transfer as 40 N/mm^2, Loss ratio = 0.85, spacing of cross girders = 5m, Adopt F_e415 grade steel. 7.ply H.T strands of 15.2mm diameter conforming to Is: 6006 – 1983 are available for use. Design the girder as class-I type structure. (The design upto check for stresses) (16)