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B.E DEGREE EXAMINATIONS: NOV 2015

(Regulation 2009)

Seventh Semester.

CIVIL ENGINEERING

CEE201: Pre - stressed Concrete Structures

Time: Three Hours   **Maximum Marks: 100**

Use of IS 1343, IS 3370 and other relevant codes are permitted

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The purpose of reinforcement in prestressed concrete is to

   a) Provide adequate bond stress   b) Resist tensile stress

   c) Impart initial compressive stress in   d) All of these
      concrete

2. Prestressing losses in post tensioned and pre tensioned beams are respectively

   a) 15% and 20%   b) 20% and 15%

   c) 15% and 10%   d) 10% and 15%

3. If loading on a simply supported PSC beam is uniformly distributed, the centroid of tendons
   should be preferably

   a) A straight profile along the centroidal   b) A straight profile along with lower kern
      axis

   c) A parabolic profile with convexity   d) A parabolic profile with convexity upwards
      downwards

4. In limit state design of PSC structures strain distribution is assumed to be

   a) Linear   b) Non linear

   c) Parabolic   d) Parabolic and rectangular

5. The maximum effective reinforcement ratio of bonded PSC beam at failure according to IS1343
   is limited to a value of

   a) 0.15   b) 0.4

   c) 0.25   d) 0.3

6. The transverse tensile stress in the anchorage zone depends mainly on the

    a) Depth of the beam   b) Width of the beam

    c) Ratio of anchorage depth to overall depth   d) Ratio of depth to width of beam

7. Composite construction using PSC and cast in situ concrete is adopted in

    a) Water tanks   b) Pipes

    c) Bridges   d) Poles

8. Differential shrinkage between precast pre tensioned unit and cast in situ members generally induces at the soffit of precast unit

    a) Compressive stress   b) Tensile stress

    c) Shear stress   d) Zero stress

9. For bridge decks of short span ranging from 15 to 25m, it is economical to use

    a) RC T beam and slab   b) Steel girder and cast in situ slab

    c) Pre stressed concrete cored slab   d) Pre stressed concrete solid slab

10. For long span continuous bridge decks in the span range of 30m to 80m, it is economical to use

    a) PSC box girders   b) PSC T beam and slab

    c) RCC continuous girders   d) Composite construction

PART B (10 x 2 = 20 Marks)

11. What is the necessity of using high strength concrete and high tensile steel in PSC?

12. Distinguish between pre tensioned and post tensioned members

13. What is strain compatibility method?

14. Sketch the typical arrangements of reinforcements in end blocks of pre tensioned PSC beams with single and multiple anchorages.

15. What are the different types of joints used between the walls and floor slab of PSC water tanks?

16. What are the advantages of pre stressed concrete poles?

17. What are the advantages of using composite construction with pre stressed and cast in situ concrete in structural members?

18. Distinguish between propped and un propped construction methods in composite construction

19. List the various advantages of PSC bridges

20. Sketch typical cross section of post tensioned PSC bridge decks commonly used in the construction of bridges

PART C (5 x 14 = 70 Marks)

21. a) What are the various methods of pre stressing? Describe with sketches some of the methods.

(OR)

b) A prestressed concrete beam of rectangular section 120mm wide and 300mm deep spans over 6m. The beam is pre stressed by a straight cable carrying an effective force of 180kN at an eccentricity of 50mm. If it supports an imposed load of 4kN/m and the modulus of elasticity of concrete is $38kN/mm^2$, compute the deflection at the following stages. i) upward deflection under (pre stress + self-weight) and ii) final downward deflection under (pre stress + self-weight + imposed loads) including the effects of creep and shrinkage. Assume the creep coefficient to be 1.8.

22. a) A pre tensioned PSC beam having a rectangular section, 150mm wide and 350mm deep, has an effective cover of 50mm. If fck = 40MPa, fp = 1600MPa, and the area of pre stressing steel Ap = $461mm^2$, calculate the ultimate flexural strength of the section using IS 1343 code procedures.

(OR)

b) The end block of a PSC member is 200mm wide by 300mm deep. The beam is (7) post tensioned by two Freyssinet anchorages each of 100mm diameters with their centres located at 75mm from the top and bottom of the beam. The force transmitted by each anchorage being 2000kN. Compute the bursting force and design suitable reinforcements according to IS 1343 code procedures.

23. a) A cylindrical PSC water tank of internal diameter 30m is required to store water over a depth of 7.5m. The permissible compressive stress in concrete at transfer is 13MPa and the minimum compressive stress under working pressure is 1MPa. The loss ratio is 0.75. Wires of 5mm diameter with an initial stress of 1000MPa are available for circumferential winding and Freyssinet cables made up of 12 wires of 8mm diameter stressed to 1200MPa are to be used for vertical prestressing. Design the tank walls assuming the base as fixed. The cube strength of concrete is 40MPa.

(OR)

b) i) Sketch the different types of cross sections generally used for poles. Also list the (10) various design criteria to be considered while designing poles for power transmission lines.

ii) What are the different types of PSC sleepers? (4)

24. a) A composite beam section is made by casting a 400mm x 60mm in situ top flange on a 120mm wide by 250mm deep precast pre tensioned unit. It has an effective prestress of 15 N/mm^2 at bottom and zero at top fibre. Calculate the uniformly distributed live load for the composite section on a simply supported span of 5m for zero tensile stress at bottom of precast unit for the following two conditions: i) the weight of the slab is carried by the pre tensioned unit during casting and ii) the slab is supported independently while being cast. Assume modular ratio (Ec for slab / Ec for precast unit) as 0.6.

(OR)

b) i) Briefly outline the method of estimating the deflection of composite members. (7)

ii) Outline the method of computing the ultimate flexural and shear strength of (7) composite sections

25. a) Explain the various steps involved in the design of short span PSC solid slab decks for a national highway to support IRC loads

(OR)

b) i) Explain with sketches the typical pre tensioned bridge decks commonly used in (4) the construction of bridges.

ii) Explain the method of designing a slab deck integral with longitudinal girders (10) using Pigeaud's method to support live loads due to IRC class AA tracked vehicle.