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Question Paper Code: 37103

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

Seventh Semester

Civil Engineering

01UCE703 - PRESTRESSED CONCRETE STRUCTURES

(Regulation 2013)

Duration: Three hours — Maximum: 100 Marks

Answer ALL Questions

[IS1343-2012 and IS 3370 are permitted]

PART A - (10 x 2 = 20 Marks)

1. What is the basic principle of prestressing?
2. State the losses in post-tensioning method of prestressing.
3. What are the types of flexural failure?
4. What is meant by Type 2 structure?
5. What are the factors influencing deflection of prestressed concrete members?
6. What is meant by end zone?
7. What is primary moment?
8. What is a concordant cable profile?
9. What are the various shapes of prestressed concrete tank?
10. What is meant by partial prestressing?

PART - B (5 x 16 = 80 Marks)

11. (a) An unsymmetrical I-section beam is used to support an imposed load of 2 *kN/m* over a span of 8 *m*. The sectional details are top flange, 300 *mm* wide and 60 *mm* thick; bottom flange 100 *mm* wide and 60 *mm* thick; thickness of web = 80 *mm*; overall depth of beam = 400 *mm*. At the centre of span, the effective prestressing force of 100 *kN* is located at 50 *mm* from the soffit of beam. Estimate the stresses at the centre of span section of the beam for the following load conditions (a) Prestress + self-weight (b) Prestress + self-weight + live load. (16)

Or

(b) Describe briefly Fressinet system of post tensioning. (16)

12. (a) A prestressed concrete beam of (span=10 m) of rectangular cross section, 120 mm wide and 300 mm deep, is axially prestressed by a cable carrying an effective force of 180 N. The beam supports a total udl of 5 kN/m which includes the self weight of the member. Compare the magnitude of the principal tension developed in the beam with and without the axial prestress. (16)

Or

(b) A pretensioned prestressed concrete beam having a rectangular section 150 *mm* wide and 350 *mm* deep has an effective cover of 50 *mm*. If f_{ck} = 40 N/mm^2, f_p = 1600 N/mm^2 and area of prestressing streel A_p = 461 mm^2, calculate the flexural strength of the section using IS1343 code. (16)

13. (a) The end block of a post tensioned prestressed concrete beam, 300 mm wide and 300 mm deep, is subjected to a concentric anchorage force of 832.8 kN by a Freyssinet anchorage of area 11720 mm^2. Design and detail the anchorage reinforcement for the end block. (16)

Or

(b) The end block of prestressed concrete beam is rectangular section 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. Estimate the position and magnitude of maximum tensile stress and bursting tension on the horizontal section through the centre and edge of anchor plate. (16)

14. (a) A precast pre-tensioned beam of rectangular section has a breadth of 100 *mm* and a depth of 200 *mm*. The beam with an effective span of 5 *m*, is prestressed by tendons with their centroids coinciding with the bottom kern. The initial force in the tendons is 150 *kN*. The loss of prestress may be assumed to be 15%. The beam is incorporated in a composite *T* beam by casting a top flange of breadth 400 *mm* and thickness 40 *mm*. If the composite beam supports a live load of 8 kN/m^2, calculate the resultant stresses developed in the precast and in-situ concrete assuming the pre-tensioned beam as:

(i) unpropped

(ii) propped during the casting of slab. Assume the same modulus of elasticity for concrete in precast beam and in situ cast slab. (16)

Or

(b) The cross section of a composite beam is of T section having a pretensioned rib, 80 mm wide and 240 mm deep, and an in situ cast slab 350 mm wide and 80 mm thick. The pretensioned beam is reinforced with eight wires of 5 mm dia with an ultimate tensile strength of 1600 N/mm^2, located 60 mm from the soffit of the beam. The compressive strength of concrete in the in situ cast and precaste elements is 20 mm and 40 N/mm^2 respectively. If adequate reinforcements are provided to prevent shear failure at the interface, estimate the flexural strength of the composite section. (16)

15. (a) Design a non-cylindrical prestressed concrete pipe of 600 *mm* internal diameter to withstand a working hydrostatic pressure of 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 the test pressure required to produce a tensile stress of 0.7 N/mm^2 in concrete when applied immediately after tensioning and also the winding stress in steel if E_s = 210 kN/mm^2 and E_c = 35 kN/mm^2. (16)

Or

(b) A prestressing cylinder pipe is to be designed using a steel cylinder of 1000 mm internal diameter and thickness 1.6 mm. The circumferntial wire winding consists of a 4 mm high tensile wire, initially tensioned to a stress of 1000 N/mm^2.Ultimate tensile strength of wire=1600 N/mm^2. Yield stress of a steel cylinder=280 N/mm^2. The maximum permissible compressive stress in concrete at transfer is 14 N/mm^2 and no tensile stresses are permitted under working pressure of 0.8 N/mm^2.Determine the thickness of the concrete lining required, the number of turn of circumferential wire winding and the factor of safety against bursting. Assume modular ratio as 6. (16)