Reg. No. : | | | | | | | | | | |

Question Paper Code: 37013

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

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 Relaxation of steel?
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) A prestressed concrete beam 200 *mm* wide and 300 *mm* deep is prestressed with wires (area = 320 mm^2) located at a constant eccentricity of 50 *mm* and carrying an initial stress of 1000 N/mm^2. The span of the beam is 10 *m*. Calculate the percentage loss of stress in wires if (a) the beam is pretensioned and (b) the beam is post-tensioned using the following data:

$E_s = 210\ kN/mm^2$ and $E_c = 35\ kN/mm^2$

Relaxation of steel stress = 5 percent of the initial stress

Shrinkage of concrete = 300×10^{-6} for pretensioning and 200×10^{-6} for post-tensioning

Creep coefficient = 1.6

Slip at anchorage = 1 *mm*

Frictional coefficient for wave effect = 0.0015/*m*. (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) 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)

Or

(b) A cylindrical prestressed concrete water tank of internal diameter 30 *m* is required to store water over a depth of 7.5 *m*. The permissible compressive stress in concrete at transfer is 13 N/mm^2 and minimum compressive stress under working pressure is 1 N/mm^2. The loss ratio is 0.75. Wires of 5mm diameter with an initial stress of 1000 N/mm^2 are available for circumferential winding and Freyssinet cables made up of 12 wires of 8 *mm* diameter stressed to 1200 N/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. (16)