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10CV74

Seventh Semester B.E. Degree Examination, June/July 2015

Design of Pre-Stressed Concrete Structures

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting atleast TWO questions from each part.***
2. Use of Is : 1343 – 1980 is permitted.
3. Missing data, if any, may be suitably assumed.

PART – A

1 a. Distinguish between the following terms :
i) Uniaxial and biaxial pre-stressing
ii) Concentric and eccentric pre-stressing. **(06 Marks)**
b. What are the factors influencing the creep and shrinkage of concrete. **(06 Marks)**
c. Brief the Magnel Blaton system of post – tensioning with a neat sketch. **(08 Marks)**

2 a. A simply supported pre-stressed concrete beam 250 mm wide by 500 mm deep of effective span 9 m carries a distributed load of intensity 6 kN/m (including self weight). The beam is pre-stressed by a straight tendon carrying a force of 200 kN located 100 mm below the centroidal axis of the beam. Determine the location of the thrust line in the beam and plot its position at quarter, central and support sections. **(08 Marks)**
b. A concrete beam, 120 mm wide and 300 mm deep is pre-stressed by a straight cable carrying an effective force of 180 kN at an eccentricity of 50 mm. The beam spanning over 6 m supports a total udl of 4 kN m which includes the self weight of the beam. The initial stress in the tendons is 1000 N/mm^2. Determine the percentage of stress in the tendons due to the loading on the beam. $E_s = 210$ kN/mm^2 ; $E_c = 35$ kN/mm^2. **(12 Marks)**

3 a. List the various losses of pre-stress in PSC beams and write the equations used to determine them. **(06 Marks)**
b. A pretensioned beam, 200 mm wide and 300 mm deep is pre-stressed by 10 wires of 7 mm diameter initially stressed to 1200 N/mm^2 with their centriods located 100 mm from the soffit. Find the maximum stress in concrete immediately after transfer, allowing only for elastic shortening of concrete. If the concrete undergoes a further shortening due to creep and shrinkage while there is relaxation of five percent of steel stress, estimate the final percentage loss of stress in the wires using the Indian standard code of IS : 1343 – 1980 regulations. Take $E_s = 210$ kN/mm^2 $\phi = 1.6$ residual shrinkage strain $= 3 \times 10^{-4}$ $f_{ck} = 42$ N/mm^2. **(14 Marks)**

4 a. Using Mohr's theorem, obtain an expression for central deflation in a PSC beam due to pre-stress produced by a parabolic cable with eccentricities e_2 above the centroidal axis at supports and eccentricity e_1 below the centroidal axis at midspan. **(06 Marks)**
b. A post tensioned pre-stressed concrete beam of span 8 m with a rectangular section 300 mm wide by 400 mm deep is pre-stressed by a calbe containing initial force of 1500 kN. If the beam supports a live load of 20 kN/m excluding its selfweight, compute the initial deflection due to pre-stress, selfweight and live loads for the following cases :
i) The cable profile is straight with a constant eccentricity of 100 mm
ii) The cable profile is parabolic with a dip of 100 mm at midspan and concentric at supports. Assume the modulus of elasticity of concrete as 36 kN/mm^2. **(14 Marks)**

PART – B

5 a. Explain with sketches, the method of estimating the ultimate flexural strength of flanged pre-stressed concrete sections according to IS : 1343 code specifications. **(06 Marks)**

b. A post tensioned bridge girder with unbounded tendons is of box section of overall dimensions 1200 mm wide by 1800 mm deep, with wall thickness of 150 mm. The high tensile steel has an area of 4000 mm^2 and located at an effective depth of 1600 mm and pre-stress in steel after all losses is 1000 N/mm^2 and the effective span of the girder is 24 m. If f_{ck}= 40 N/mm^2 and f_p = 1600 N/mm^2, estimate the ultimate flexural strength of the section. **(14 Marks)**

6 a. A concrete beam having rectangular section 200 mm wide, 400 mm deep is pre-stressed by a parabolic cable having an eccentricity 120 mm at the centre of span reducing to zero at the supports. The span of the beam is 10 m. The beam supports a live load of 2.5 kN/m. Determine the effective force in the cable to balance the dead and live loads on the beam. Estimate the principal stresses at the support section and take D_C = 24 kN/m^3. **(10 Marks)**

b. A rectangular section having a width of 500 mm and 800 mm deep. The beam spanning over 16 m is pre-stressed using a cable carrying an effective force of 2000 kN/ The cable is parabolic with an eccentricity of 300 mm at centre of span and zero at supports. Estimate the ultimate shear resistance at the support section. Also evaluate the maximum permissible distributed working load on the beam assuming a load factor of 2 and characteristic compressive strength of concrete as 40 N/mm^2 and loss factor as 0.8. **(10 Marks)**

7 a. Explain the process of transfer of pre-stress in pretensioned members. **(08 Marks)**

b. Briefly discuss the stress distribution in the end block of post tensioned members. **(07 Marks)**

c. Explain end zone reinforcements. **(05 Marks)**

8 Determine the minimum depth of 300 mm wide rectangular beam and the corresponding pre-stressing force and corresponding eccentricity to resist a moment of 360 kNm assuming 10% losses and limiting the tensile and compressive stresses to 1.5 MPa and 18 MPa respectively. Take D_C = 24 kN/m^3. The span being 12 m. **(20 Marks)**

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