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10CV74

Seventh Semester B.E. Degree Examination, June/July 2016
Design of Prestressed 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. Assume any missing data suitably.

PART – A

1 a. Define the following :
i) Tendon ii) Pretensioning iii) Post tensioning iv) Load balancing **(08 Marks)**

b. Explain how PSC is more advantageous as compared to RCC. **(06 Marks)**

c. Explain with neat sketch, Freyssinet system of post tensioning. **(06 Marks)**

2 a. A concrete beam with a double overhang has the middle equal to 10 m and the equal overhang on either side is 2.5 m. Determine the profile of the prestressing cable with an effective force of 250 kN which can balance a uniformly distributed load of 8 kN/m on the beam, which included the self weight of the beam. Sketch the cable profile marking the eccentricity of cable at the support and midspan. **(10 Marks)**

b. A rectangular concrete beam of cross section 120 mm wide and 300 mm deep is prestressed by a straight cable carrying an effective force of 180 kN at an eccentricity of 50 mm. The beam supports an imposed load of 3.14 kN/m over a span of 6 m. If the modulus of rupture of concrete is 5 N/mm^2, evaluate the load factor against cracking assuming the selfweight of concrete as 24 kN/m^3. **(10 Marks)**

3 a. A pretensioned beam of rectangular cross-section 150 mm wide and 300 mm deep is prestressed by 8, 7 mmϕ wires located 100 mm from the soffit of the beam. If the wires are initially tensioned to a stress of 1100 N/mm^2, calculate the effective stress after all losses, given the following:
Relaxation of steel = 70 N/mm^2 ; Shrinkage of concrete = 300×10^{-6}
Creep of concrete = 1.6 ; E_s = 210 kN/mm^2 and E_c = 31.5 kN/mm^2 **(12 Marks)**

b. A simply supported post tensioned concrete beam of span 15 m has a rectangular cross section 300 × 800 mm. The prestress at ends is 1300 kN with zero eccentricity and 250 mm at the centre the cable profile being parabolic. Assuming k = 0.0015 per m and μ = 0.35. Determine the loss of stress due to friction at the centre of the beam. **(08 Marks)**

4 a. Write short note on prediction of long term deflections. **(06 Marks)**

b. A PSC beam of rectangular section 120 mm wide and 300 mm deep spans over 6 m. The beam is prestressed by straight cable carrying an effective force of 180 kN at an eccentricity of 50 mm. If it supports an imposed load of 4 kN/m and modulus of concrete is 38 kN/mm^2. Compute the deflection at the following stages and check whether they comply with the IS code specifications. Take density of concrete as 24 kN/m^3.
(i) Upward deflections under (Prestress + Selfweight)
(ii) Final downward deflections under (Prestress + Selfweight + imposed load) including the effects of creep and shrinkage assuming the creep coefficient as 1.8 and loss of prestress = 20% **(14 Marks)**

PART – B

5 a. Discuss the different types of failure of PSC beam. **(06 Marks)**

b. A pretensioned PSC beam of Double Tee section having a flange 1200 mm wide and 150 mm thick is prestressed by 4700 mm^2 of high tensile steel located at an effective depth of 1600 mm. The ribs have a thickness of 150 mm each. If the cube strength of concrete is 40 N/mm^2 and tensile strength of steel is 1600 N/mm^2, determine the flexural strength of the double T girder using IS : 1343 provisions. **(14 Marks)**

6 a. A concrete beam of rectangular section, 200 mm wide and 400 mm deep, is prestressed by a a parabolic cable located at an eccentricity of 100 mm at midspan and zero at the supports. If the beam has a span of 10 m and carries a uniformly distributed live load of 4 kN/m, find the effective force necessary in the cable for zero shear stress at the support section. For this condition calculate the principal stresses. The density of concrete is 24 kN/m^3. **(10 Marks)**

b. If the support section of a PSC beam 100 mm wide and 250 mm deep is required to support an ultimate shear force of 80 kN. The compressive prestress at the centroidal axis is 5 N/mm^2. The characteristic cube strength of concrete is 40 N/mm^2. The cover to the tension reinforcement is 50 mm. If the characteristic tensile strength of stirrups is 415 N/mm^2, design suitable shear reinforcements in the section using IS code recommendations. **(10 Marks)**

7 a. Explain the analysis of anchorage zone stresses in post tensioned members. How is the bursting tensile force calculated? **(08 Marks)**

b. A high tensile cable comprising 12 strands of 15 mm dia with an effective force of 2500 kN is anchored concentrically in an end block of a post-tensioned beam. The end block is 400 mm wide and 800 mm deep and the anchor plate is 200 mm wide by 260 mm deep. Design suitable anchorage zone reinforcements using Fe415 grade HYSD bars using IS:1343 code provisions. **(12 Marks)**

8 A post tensioned prestressed concrete beam of rectangular section 300 mm wide is to be designed to resist a live load moment of 360 kNm on a span of 12 m. Assuming 10% loss and limiting tensile and compressive stress to 1.5 MPa and 18 MPa respectively. Calculate the minimum possible depth and the prestressing force and corresponding eccentricity. Take $D_c = 24\ kN/m^3$. **(20 Marks)**

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