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10CV74

Seventh Semester B.E. Degree Examination, Dec.2015/Jan.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.

PART – A

1 a. Define prestressed concrete. State advantages as over reinforced concrete. **(06 Marks)**

b. Distinguish between pre-tensioning and post-tensioning. **(08 Marks)**

c. Explain Magnel – Blaton post tensioning system with a neat sketch. **(06 Marks)**

2 a. Explain load balancing concept in a prestressed concrete members. **(04 Marks)**

b. A simply supported concrete of rectangular cross section 400 × 600 mm is loaded with a total UDL of 60 kN/m over a span of 6 m. Draw the distribution of stress at mid span. If the prestressing force of 1920 kN and the parabolic profile of the tendon has an eccentricity of 100 mm at ends and 200 mm at mid span. **(16 Marks)**

3 A prestressed concrete beam of inverted T-beam as shown in Fig.Q3 and is simply supported over a span of 16 m. The beam is post-tensioned with a 3-Freyssinet cables, each containing 12 wires of 7 mm dia placed as shown at the mid span. If the initial prestress is 1000 N/mm^2, calculate maximum uniformly distributed load if the maximum compressive stress in concrete is limited to 14 N/mm^2 and tensile stress is limited to 1 N/mm^2. Assume loss of prestress as 15%. **(20 Marks)**

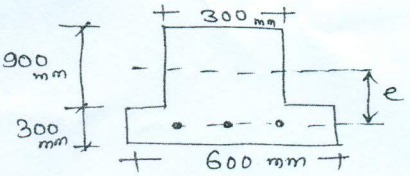

Fig.Q3

4 a. List the various losses in pre-tensioned and post tensioned beams. **(04 Marks)**

b. A post tensioned prestress concrete beam of 30 m span is subjected to a prestress force of 250 kN at 28 days strength. The profile of cable is parabolic with maximum eccentricity of 200 mm at mid span. Determine the loss of prestress and has a cross section of 500mm × 800mm deep beam is prestressed with 9 cables each consists of 12 wires of 5 mm dia. Take $E_s = 2.1\times10^5$ N/mm^2 and $E_c = 3.5\times10^4$ N/mm^2. The cable is tensioned at time. **(16 Marks)**

PART – B

5 a. Explain the load deflection characteristics of typical prestressed concrete beam under flexure with a diagram. **(06 Marks)**

b. A rectangular concrete beam of cross-section 150 mm × 300 mm deep is simply supported over a span of 8 m and is prestressed by means of a symmetric parabolic cable at a distance of 75 mm from the bottom of the beam at mid span and 125 mm from the top of the beam at support section. If the force in the cable is 350 kN and the modulus of elasticity of concrete is 38 kN/mm^2, calculate (i) The deflection at mid span when the beam is supported its own weight and (ii) the concentrated load which must be applied at mid span to restore it to the level of supports. **(14 Marks)**

6 a. Explain the mechanism of shear failure in PSC beams. **(06 Marks)**

b. A pre-stressed T-section has a flange width of 300 mm and the thickness of the flange is 200 mm. The rib is 150 mm wide by 350 mm deep. The effective depth of the cross section is 500 mm. Given $A_p = 200$ mm^2, $f_k = 50$ N/mm^2 and $f_p = 1600$ N/mm^2. Determine the flexural strength of the section. **(14 Marks)**

7 a. What is transmission length? List the factors influencing transmission length. **(06 Marks)**

b. A pretensioned beam is prestressed using 5 mm diameter wires with an initial stress of 80 percent of the ultimate tensile strength of steel, $f_{pu} = 1600$ N/mm^2. The cube strength of concrete at transfer is 30 N/mm^2. (i) Calculate the transmission length (ii) Compute the bond stress at 1/4 and 1/2 the transmission length from the end and (iii) Calculate the overall average bond stress. **(14 Marks)**

8 a. Explain end zone reinforcements. **(04 Marks)**

b. A pre-tensioned beam of 8 m span has a symmetrical I-section. The flanges are 200 mm wide and 60 mm thick. The web thickness is 80 mm and the overall depth of girder is 400 mm. The member is prestressed by 8 wires of 5 mm diameter located on the tension side such that the effective eccentricity is 91 mm. The initial stress in the wires is 1280 N/mm^2 and the cube strength of concrete at transfer is 42 N/mm^2.

(i) Determine the maximum vertical tensile stress developed in the transfer zone and

(ii) Design suitable mild steel reinforcement assuming the permissible stress in steel as 140 N/mm^2. **(16 Marks)**

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