Seventh Semester B.E. Degree Examination, Dec.2017/Jan.2018
Design of Presstrssed Concrete Structures

Time: 3 hrs. Max. Marks:100

Note: 1. *Answer FIVE full questions, selecting at least TWO questions from each part.*
2. *Use of IS : 1343 – 1980 is permitted.*

PART – A

1 a. Explain the necessity of using high strength concrete and high tensile steel in prestressed concrete structures. **(08 Marks)**

b. Distinguish between pretensioing and port tensioning. **(06 Marks)**

c. Explain with neat sketches, Freyssinet system of pre-stressing. **(06 Marks)**

2 a. Explain the concept of load balancing with different cable profiles. **(06 Marks)**

b. A rectangular concrete beam, 100mm wide by 250mm deep spanning over 8m is prestressed by a straight cable carrying an effective pre-stressing force of 250kN located at an eccentricity of 40mm. The beam supports a live load 1.2kN/m.

i) Calculate the resultant stress distribution for the central cross section of the beam. The density of concrete is 24kN/m^3.

ii) Find the magnitude of prestressing force with an eccentricity of 40mm which can balance the stresses due to dead and live loads at the bottom fibre of the central section of the beam. **(14 Marks)**

3 a. List the various types of losses in PSC beams and write the equations used to determine them. **(06 Marks)**

b. A pretensioned beam, 200mm wide and 300mm deep is prestresses by 10 wires of 7mm diameter, initially stressed to 1200N/mm^2, with their centroids located 100mm 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 a relaxation of five percent of steel stress, estimate the final percentage loss of stress in the wires using IS:1343 regulations. Use following data : E_s = 210kN/mm^2 ; $E_c = 5700\sqrt{f_{ck}}$, f_{ck} = 42N/mm^2. Creep coefficient is 1.6 and total residual shrinkage strain is 3×10^{-4}. **(14 Marks)**

4 a. List the factors influencing deflections. **(04 Marks)**

b. Obtain an expression for computing deflection at midspan in a PSC beam with trapezoidal tendons with eccentricity 'e' at mid third points, with linear variation towards support. The Mohr's theorem. **(04 Marks)**

c. A concrete beam having rectangular section 100mm wide and 300mm deep is prestressed bya parabolic cable carrying an initial force of 240kN. The cable has an eccentricity of 50mm at the centre of span and is concentric at the supports. If the span of the beam is 10m and live load is 2kN/m. estimate short term deflection at the centre of span. Assuming E = 38kN/mm^2 and creep coefficient ϕ = 2.0, loss of prestress is 20 percent of the initial stress after 6 months. Estimate the long terms defection at the centre of span at this stage, assuming that the dead and live loads are simultaneously applied after the release of pre-stress. **(12 Marks)**

PART – B

5 a. Explain with sketches, the different types of flexural failures in PSC beam. **(06 Marks)**

b. A post tensioned beam with unbounded tendons is of rectangular section 400mm wide with an effective depth of 800mm. The cross sectional area of the pre-stressing steel is 2840mm^2. The effective pre-stress in steel after all losses is 900N/mm^2. The effective span of the beam is 16m. If f_{ck} = 40N/mm^2, estimate the ultimate moment of resistance of the section using IS : 1343. **(07 Marks)**

c. A post tensioned pre-stressed concrete T-beam with unbounded tendons is made up of a flange 300mm wide and 150m thick and the width of the rib is 150mm. The effective depth of the section is 320mm. The beam is pre-stressed by 24wires of 5mm diameter having a characteristic strength of 1650N/mm^2. The effective stress after all losses is 900N/mm^2. If the cube strength of concrete is 56N/mm^2. Estimate the flexural strength of the section using IS:1343 – 1980. Assume $\left(\frac{L}{\delta}\right)$ ratio as 20. **(07 Marks)**

6 a. Explain the types of shear cracks in structural concrete. **(06 Marks)**

b. A concrete beam of rectangular section 200mm wide and 650mm deep is prestressed by a parabolic cable located at an eccentricity of 120mm at midspan and zero at the supports. If the beam has a span of 12m and carries a uniformly distributed live load of 4.5kN/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 25kN/m^3. **(14 Marks)**

7 a. Explain the concept of stress distribution in End block. **(08 Marks)**

b. The end block of a post tensioned beam is 300mm wide and 400mm deep. Ten cables each made up of 12 wires of 5mm diameter strands are stressed to 1200N/mm^2. The wires are located at constant eccentricity of 100mm below the centroidal axis. Design the end block and detail the reinforcement. If the anchorage plate is 200mm×200mm and diameter of the duct is 100mm, permissible stress in concrete at transfer is 20N/mm^2, permissible shear stress in steel is 94.5N/mm^2. Determine the thickness of anchorage pate. **(12 Marks)**

8 A prestressed beam has an unsymmetrical I-section with an overall depth of 1840mm. The top and bottom flange withs are 1800 and 820mm respectively. The thickness of the top flange varies from 180mm at the ends to 430mm at the junction of web, which is 1800mm thick. The thickness of the bottom flange varies from 150mm at the ends to 450mm at the junction of the web. The beam is designed for a simply supported span of 40m. the permissible compressive stress at the transfer and working load is limited to 16N/mm^2, while the tensile stress at the transfer and working load is limited to zero and 1.4N/mm^2, respectively. The loss ratio is 0.80 calculate :

a. The permissible uniformly distributed imposed load

b. The magnitude of the prestressed face if at the mid-span section if is located 130mm from the soffit and

c. The vertical limits within which the cable must is at midspan and support sections.

(20 Marks)

* * * * *