CBCS SCHEME

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15CV82

Eighth Semester B.E. Degree Examination, November 2020
Design of Prestressed Concrete Elements

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions irrespective of modules.
2. Use of IS1343-1980 is permitted.

Module-1

1 a. Explain the need for High strength concrete and Higher grade steel for PSC members. **(06 Marks)**

b. A prestressed concrete beam of section 200mm wide by 300mm deep is used over an effective span of 6m to support an imposed load of 4kN/m. The density of concrete is 24kN/m^3. At the centre of span section of the beam, find the magnitude of the concentric prestressing force necessary for zero fibre stress at the soffit when the beam is fully loaded. **(10 Marks)**

2 a. Distinguish between pretensioning and post tensioning. **(06 Marks)**

b. A simply supported prestressed concrete beam spanning over 10m is of rectangular section 500mm wide and 750mm deep. The beam is prestressed by a parabolic cable having eccentricity of 200mm at the centre of the span and zero at the end supports. The effective force in the cable is 1600kN. If the beam supports a total uniformly distributed load of 40kN/m which includes the self weight. Evaluate the extreme fibre stresses at the midspan section using internal resisting couple method. **(10 Marks)**

Module-2

3 a. Name the various types of loss of prestress. **(06 Marks)**

b. A prestressed concrete beam, 200mm wide and 300mm deep is prestressed with wires (area = 320mm^2) located at a constant eccentricity of 50mm and carrying an initial stress of 1000N/mm^2. The span of the beam is 10m. The beam is pretensioned. Calculate the loss of stress in wires using the following data E_s = 210 kN/mm^2, E_s = 35kN/mm^2, Relaxation of steel stress = 5% of initial stress. Shrinkage of concrete is 300 × 10^{-6}. Creep coefficient = 1.6. **(10 Marks)**

4 a. What are the factors influencing the deflections of prestressed concrete members? **(06 Marks)**

b. A concrete beam with a rectangular section 100mm wide and 300mm deep, is stressed by three cables, each carrying an effective force 240kN. The span of the beam is 10m. The first cable is parabolic with an eccentricity of 50mm below the centroidal axis at the centre of the span and 50mm above the centroidal axis at the supports. The second cable is parabolic with zero eccentricity at the supports and an eccentricity of 50mm below the centroidal at the centre of span. The third cable is straight with a uniform eccentricity of 50mm below the centroidal axis. The beam supports a uniformly distributed live load of 5kN/m, E_c = 38kN/mm^2. Estimate the instantaneous deflection at the following stage: prestress + self weight + live load. **(10 Marks)**

Module-3

5 a. What are the different types of flexural failures observed in PSC members? **(04 Marks)**

b. A post tensioned prestressed concrete Tee beam having a flange width of 1200mm and flange thickness of 200mm, thickness of web being 300mm is prestressed by 2000mm^2 of high tensile steel located at an effective depth of 1600mm. If f_{ck} = 40N/mm^2 and f_p = 1600N/mm^2, estimate the ultimate flexural strength of the unbounded tee section, assuming span/depth ratio as 20 and f_{pe} = 1000N/mm^2. **(12 Marks)**

6 a. What are the factors which influences the flexural failures in PSC members? **(04 Marks)**

b. Estimate the effective prestress, area of prestressing steel and the area of the section from preliminary design for a simply supported Type 1 prestressed beam with M_T = 435kNm (including an estimated M_{sw} = 55kNm). The height of the beam is restricted to 920mm. The prestress at service f_{pe} = 860N/mm^2. The allowable compressive stress of concrete at service is 11.0N/mm^2. **(12 Marks)**

Module-4

7 a. Name three ways of improving the shear resistance of structural concrete members by prestressing techniques. **(03 Marks)**

b. A concrete beam of rectangular section has a width of 250mm and depth of 600mm. The beam is prestressed by a parabolic cable carrying an effective force of 1000kN. The cable is concentric at supports and has maximum eccentricity of 100mm at the centre of span. The beam spans over 10m and supports a uniformly distributed live load of 20kN/m. Assuming the density of concrete as 24kN/m^3 estimate the maximum principal stress developed in the section of the beam at a distance 300mm from the support. **(13 Marks)**

8 a. Name the modes of failure due to shear. **(03 Marks)**

b. A prestressed girder of rectangular section 150mm wide by 300mm deep is to be designed to support an ultimate shear force of 130kN. The uniform prestress across the section is 5N/mm^2. Given the characteristic cube strength of concrete as 40N/mm^2 and Fe415 HYSD bars of 8mm diameter, design suitable spacing for the stirrups confirming to IS1343. Assume cover to the reinforcement = 50mm. **(13 Marks)**

Module-5

9 a. Write note on Anchorage zone. **(03 Marks)**

b. The end block of a post tensioned prestressed member is 550mm wide and 550mm deep. Four cables each made up of seven wires of 12mm diameter stands and carrying a force of 1000kN are anchored by plate anchorages, 150mm by 150mm, located with their centres at 125mm from the edges of the end block. The cable duct is of 50mm diameter. The 28 day cube strength of concrete of concrete fcu is 45N/mm^2. The cube strength of concrete of concrete at transfer fci is 25N/mm^2. Permissible bearing stresses behind anchorages should confirm with IS:1343. The characteristic yield stress in mild steel anchorage reinforcement is 260N/mm^2. Design suitable anchorages for the end block. **(13 Marks)**

10 a. Write note on composite construction in PSC. **(03 Marks)**

b. A composite T-beam is made up of a pretensioned rib 100mm wide and 200mm deep and cast in situ slab 400mm wide and 40mm thick having a modulus of elasticity of 28kN/mm^2. If the differential shrinkage is 100×10^{-6} units determine the shrinkage stresses developed in the precast and cast in situ units. **(13 Marks)**

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