CBCS SCHEME

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17CV82

Eighth Semester B.E. Degree Examination, July/August 2022
Design of Pre-stressed Concrete Elements

Time: 3 hrs. Max. Marks: 100

Note:* 1. *Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of IS-1343-1980 code book is permitted.

Module-1

1 a. Write any five differences between pre-stressed concrete beam and reinforced concrete beam. **(05 Marks)**

b. Explain the cracking moment in prestressed concrete members. **(05 Marks)**

c. 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 6m. If the modulus of rupture of concrete is 5 N/mm^2. Evaluate the load factor against cracking assuming the self weight of concrete as 24 kN/m^3. **(10 Marks)**

OR

2 a. Write any five differences between pre tensioning and post tensioning. **(05 Marks)**

b. Explain the concept of load balancing in pre stressed concrete design. **(05 Marks)**

c. A pre stressed concrete T beam having a cross section of flange 1200 mm wide and 200 mm thick, the rib is 240 mm wide and 1000 mm deep. The beam carries a load of 12 kN/m due to its own weight at the initial stage over a span of 16 m. Determine the prestressing force and its eccentricity to produce net stress equal to zero and +12 MPa at the top and bottom fibres. **(10 Marks)**

Module-2

3 a. Name the various types of losses of prestress. **(08 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 at the supports and 250 mm at the centre the cable profile being parabolic. Assuming K = 0.15 per 100 metres and μ = 0.35. Determine the loss of stress due to friction at the centre of the beam. **(12 Marks)**

OR

4 a. What are the factors influencing deflections in psc beams? **(08 Marks)**

b. A prestressed concrete beam of span 10 m has a section of area 40×10^3 mm^2, the moment of inertia of the section being 1.7×10^8 mm^4. The beam is prestressed by a parabolic cable providing a prestressing force of 240 kN. The cable has an eccentricity of 50 mm at the centre and no eccentricity at the ends. Ignoring all losses, find the deflection at the centre.

(i) When the beam carries its own weight and prestress.

(ii) When the beam carries its own weight, prestress and a super imposed load of 1.75 kN/m.

Take weight of RCC equal to 25 kN/m^3 and the modulus of elasticity for concrete equal to 40 kN/mm^2. **(12 Marks)**

Module-3

5 a. What are the different modes of failure in flexure? **(08 Marks)**

b. A pre tensioned prestressed concrete beam having a rectangular section 150 mm wide and 350 mm deep has an effective cover of 50 mm. If f_{ck} = 40 N/mm^2, f_p = 1600 N/mm^2 and the area of prestressing steel is 461 mm^2, estimate the flexural strength of the section using the IS 1343 code provisions. **(12 Marks)**

OR

6 a. A pre tensioned T section has a flange which is 300 mm wide and 200 mm thick. The rib is 150 mm wide by 350 mm deep. The effective depth of the C/S is 500 mm. Given A_P = 200 mm^2, f_{ck} = 50 N/mm^2, f_p = 1600 N/mm^2. Estimate the ultimate moment capacity of T section, using IS 1343 code provisions. **(10 Marks)**

b. A tensioned prestressed concrete beam which is bonded is of rectangular section 300 mm wide by 650 mm overall depth. It is prestressed by 800 mm^2 area of high tensile steel at an effective depth of 600 mm. This section is also reinforced with two HYSD bars of 25 mm diameter on the tension side at an effective cover of 50 mm. If f_{CK} = 40 N/mm^2, f_p = 1600 N/mm^2, f_y = 415 N/mm^2. Estimate the ultimate flexural strength of the section. **(10 Marks)**

Module-4

7 a. Name the modes of failure due to shear. **(08 Marks)**

b. A concrete beam having rectangular section 200 mm wide, 400 mm deep is prestressed 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 concrete density = 24 kN/m^3. **(12 Marks)**

OR

8 a. Name three ways of improving the shear resistance of structural concrete members by pre stressing techniques. **(08 Marks)**

b. A concrete beam of rectangular section, 200 mm wide and 400 mm deep is prestressed by 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 udl 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. **(12 Marks)**

Module-5

9 The precast tension unit of rectangular section of size 100 mm × 200 mm is used as a part of composite beam to a span of 5.0 m. This unit is prestressed by tendons with their centroids coinciding with the bottom Kern point. The initial force in the tendon is 150 kN. The loss of prestress may be assumed to be 15%. The unit is incorporated as web of a composite beam by casting a slab of flange width of 400 mm and thickness of 40 mm. On the top of the pre cast unit with the composite beam supports a live load of 8 kN/m. Compute the resultant final stresses developed in the precast and cast in situ concrete assuming the pretensioned unit as propped construction. Draw the resultant stress diagrams. **(20 Marks)**

OR

10 a. Write a note on different types of composite construction. **(05 Marks)**

b. Write the advantages of composite construction. **(05 Marks)**

c. A proposed pre tensioned of rectangular section has a breadth of 150 mm and a depth of 250 mm. The beam with an effective span of 6m is prestressed by Tendons with their centroids coinciding with bottom Kern initial force in the Tendons is 200 kN. The loss of prestress may be assumed to be 15%. The beam is incorporated in a composite T beam by casting a top flange of breadth 450 mm and thickness of 50 mm. If the composite beam supports a live load of 8 kN/m^2. Calculate the resultant stresses developed in the precast and in situ cast concrete assuming the pre tensioned beam as unpropped and propped during the casting of slab. Assumed the same modulus of elasticity for concrete in precast beam and in situ cast slab. **(10 Marks)**

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