CBCS SCHEME

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15CV82

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Design of Pre-Stressed Concrete Elements

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Explain the need for High Strength conc and higher grade steel for PSC member. **(04 Marks)**

b. Define Pre-stressed Concrete. Explain the different types of Pre-stressed Concrete. **(04 Marks)**

c. A PSC inverted T beam section web 300×900mm. Flange 300×600mm simply supported over a span of 15m. The beam is tensioned by 3 cables each containing 12 wires of 7 mm diameter placed at 150mm from soffit at midspan. If the initial prestress is 1000 N/mm^2 calculate the max UDL the beam can carry maximum compressive stress is limited to 15 MPa and tensile stress is limited to 1 MPa. Assume 15% loss of pre stress. **(08 Marks)**

OR

2 a. Explain Load Balancing Concept. **(02 Marks)**

b. Explain post tensioning anchorages devices and explain any one in details. **(06 Marks)**

c. A rectangular beam 200×300mm is pre-stressed by 15 wires of 5 mm diameter located at 65mm from bottom and 3 wires of 5mm diameter at 25mm from top initial pre-stress is 840 N/mm^2. Calculate stress at midspan. **(08 Marks)**

Module-2

3 a. List the various types of losses in pre-stressed concrete members. Explain the types of loss of pre-stress in post tensioned members only. **(06 Marks)**

b. A PSC beam 200mm × 300mm is pre-stressed with wires of area 300mm^2 located at an eccentricity of 100mm below centriodal axis at midsapn and zero at supports. Initial pre-stress in the wires is 1 kN/mm^2. The span of the beam is 10m. Calculate the loss of pre-stress and total percentage of loss of pre-stress in wires if i) the bema is pre-tensioned ii) the beam is post tensioned, using the following data :
Grade of concrete M_{40}, E_S = 210 kN/mm^2 shrinkage strain in concrete for pre tensioned member = 300×10^{-6}. Age of concrete at transfer for post tensioned beam = 8 days, creep coefficient = 1.6. Slip at anchorage = 2mm coefficient of friction between concrete and cable duct = 0.55. Friction coefficient for wave effect = 0.0015/m. **(10 Marks)**

OR

4 a. What are the factors affecting deflection of a PSC beam? **(04 Marks)**

b. A PSC beam span supported over a span of 8m is of rectangular section of size 150mm × 300mm. The beam is pre-stressed by a parabolic cable having an eccentricity of 80mm below centriodal axis at mid span and 30mm above the centriodal axis at the ends. The initial pre-stressing force in the cable is 350 kN. The beam supports a concentrated load of 10kN at midspan and uniformly distributed load of 2 kN/m over the entire span. Grade of concrete is M_{40}. Estimate the following deflection :

i) Short term deflection due to pre-stress and self weight
ii) Long-term deflection due to pre-stress, self weight and imposed loads, allowing 20% loss of pre-stress and taking creep coefficient of 1.80
iii) Check the deflection as per IS 1342–1980 requirements. **(12 Marks)**

Module-3

5 An unsymmetrical I section having top flange 750×200mm bottom flange 450×250mm thickness of web 150mm overall depth 1000mm. If permissible tensile and compressive stress at transfer and working load are not to exceed zero in tension 15 N/mm^2 in compression. Determine P and e to resist self weight and applied moment 1012 kNm and 450 kNm. Assume loss of pre stress 15%. **(16 Marks)**

OR

6 Design a post tensioned girder which is spaced 2.4 m c/c and has an effective span of 9m. Live load 15 kN/m^2, DL(3 kN/m^2 + Self weight). Compressive stress at transfer and working load are 14 N/mm^2 and 12 N/mm^2 tension is 1 N/mm^2 at all stages of loading loss Ratio 0.8. Determine number of 7mm diameter wires required if permissible tension is 1000 N/mm^2. Assume cover as 100 mm. **(16 Marks)**

Module-4

7 a. Explain different methods of improving shear resistance of PSC members. **(06 Marks)**

b. A prestressed girder of rectangular section 150mm wide shear force of 130kN. The uniform prestress across the section is 5N/mm^2. Given the characteristic strength (cube) strength of concrete is 40N/mm^2 and Fe-415 HYSD bars of 8mm diameter, design suitable spacing for the stirrups confirming to Indian standard code IS-1343 recommendations. Assume cover to the reinforcement as 50mm. **(10 Marks)**

OR

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

b. The horizontal prestress at the centroid of a concrete beam of rectangular section 120mm × 250mm is 7N/mm^2 and the maximum shearing force on the beam is 70kN. Calculate the maximum principal tensile stress, what is the maximum vertical stress required to eliminate this principal stress? **(10 Marks)**

Module-5

9 a. Write a note on anchorage zone stresses. **(05 Marks)**

b. Explain end zone reinforcement. **(05 Marks)**

c. The end block of a post tensioned beam 500mm × 1000mm is pre-stressed 2 cables each comprising of 5 wires of 7mm diameter. The cable is anchored by square anchor plates 400mm × 400mm with their centre loctaed at 250mm from the top and bottom edges of the beam. The jacking force in the cable is 3000kN. Design a suitable anchorage zone reinforcement as per IS-1343 code provisions. **(06 Marks)**

OR

10 A pre tensioned rectangular beam of size 120mm × 240mm is simply supported over a span of 6m. The beam is prestressed by tendons carrying on initial pre-stressign force of 225 kN at a constant eccentricity of 40mm. The loss of pre-stress is assumed to be 15%. The beam is incorporated in a composite T-beam by casting a top flange of 450mm wide and 40mm thick. Live load on composite beam is 8kN/m^2. Calculate the resultant stress developed in the beam assuming the pre tensioned beam is unpropped during casting of top flange if the modulus of elasticity of the flange portion and the pre tensioned beam are 28 kN/mm^2 and 35kN/mm^2 respectively. Also check the composite T-beam for limit state of deflection. **(16 Marks)**

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