CBCS SCHEME

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15CV82

Eighth Semester B.E. Degree Examination, June/July 2019
Design of Pre-Stressed Concrete Elements

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define pre-stressed concrete. Write any three differences between pre-tensioning and post-tensioning. **(05 Marks)**

b. Explain with neat sketch Gifford Udal system of pre-stressing. **(05 Marks)**

c. What is pressure line? plot the pressure line for a simply supported rectangular beam of size bxh subjected to uniformly distributed load and pre-stressed by a force P at a constant eccentricity of h/6 such that bottom fibre stress at midspan due to all loads and P equal to zero. **(06 Marks)**

OR

2 a. Explain the concept of load balancing in pre-stressed concrete design. **(06 Marks)**

b. A concrete beam of symmetrical I section of simply supported span 10m has width and thickness of flange 250mm and 80mm respectively. thickness of web is 80mm and overall depth of section is 500mm. The beam is pre-stressed by a parabolic cable with an eccentricity of 150mm below centriodal axis at midspan and concentric at supports. The initial and final pre-stressing force in the cabl eis 250 kN and 200 kN respectively. The beam supports a live load of 3 kN/m. Calculate the fibre stress in concrete at transfer and at working loads sketch the stress distribution. **(10 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 intial 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_{30}. 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 a. A post tensioned unbounded beam section 120mm × 300mm is pre-stressed by 7 wires of 5mm diameter with an effective cover of 50mm and effective stress of 1200 N/mm^2. The beam is of 7.5m span. If M_{40} concrete is used and f_p = 1600 MPa, find the ultimate flexural strength of the section. **(08 Marks)**

b. A post tensioned bounded Tee section has a flange width of 800m and thickness of 250mm. The thickness of web is 200mm. The area of high tensile wire is 4000 mm^2 located at 1200mm from top of flange. The characteristic strength of steel and concrete are 1500 N/mm^2 and 40 N/mm^2 respectively. Calculate the ultimate moment capacity of the section using IS 1343 recommendation. **(08 Marks)**

OR

6 Design a pre-stressed concrete beam as Type–1 member to carry a superimposed load of 12 kN/m over a simply supported span of 25m. The permissible stress in compression for concrete at transfer and working loads are 14 N/mm^2 and 12 N/mm^2 respectively. Initial stress in pre-stressing cable is 1000 N/mm^2. Loss of pre-stress is 20%. Adopt Freyssenet cables each of 12 wires of 5 mm diameter. **(16 Marks)**

Module-4

7 a. Explain different methods of improving shear resistance of PSC members. **(05 Marks)**

b. Explain the mechanism of shear failure in PSC beams. **(05 Marks)**

c. The support section of PSC beam 120mm × 250mm is required to carry an ultimate shear force of 70kN. The compressive stress at the centriodal axis is 5MPa and f_{ck} = 40 MPa, f_y = 415 MPa cover to reinforcement = 50mm. Design the suitable shear reinforcement at the section as per IS – 1343 recommendation. **(06 Marks)**

OR

8 a. Differentiate between web shear, flexural and flexure shear cranks in PSC members with neat sketches. **(06 Marks)**

b. A PSC beam 300mm × 1000mm is subjected to a shear force of 500kN under working loads near support section. The effective pre stressing force in the tendon is 800kN. The cable is parabolic with zero eccentricity at support and 300mm below centriodal axis at midspan. The span of the beam is 12m. If M_{40} concrete is used estimate the principal tension in concrete at support section and if required design the shear reinforcement. **(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 constan 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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