CBCS SCHEME

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15CV82

Eighth Semester B.E. Degree Examination, June/July 2024
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 – 2012 is permitted.***
3. ***Missing data, if any, may be suitably assumed.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. State the advantages and disadvantages of pre-stressed concrete. **(04 Marks)**

b. Explain with the help of neat sketches Freyssinet and Magnel Blaton method of pre-stressing. **(06 Marks)**

c. What is pressure line? Draw the pressure line for a simply supported rectangular beam of size B × D subjected to udl and pre-stressed by force P at a constant eccentricity of D/6 such the bottom fibre stress at mid span 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. How do you estimate the loss of pre-stress due to :
i) Elastic deformation of concrete
ii) Shrinkage of concrete
iii) Friction between cable and duct. **(06 Marks)**

b. A PSC beam of 200mm × 300mm is pre-stressed with steel wires of area 320mm^2 located at constant eccentricity of 50mm and carrying an initial stress of 1100N/mm^2, span of the beam is 9m. Calculate percentage of loss of stress in wires if beam is post tensioned. If E_S = 210GPa, E_C = 35GPa, relaxation of stress in steel = 4.8%, shrinkage of concrete is 200×10^{-6} per post tensioning, creep coefficient = 1.6, slip at anchorage is 1mm and friction coefficient for wave effect is 0.0012/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 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 types of shear cracks. **(04 Marks)**

b. A PSC beam 250mm wide 150mm deep is subjected to SF 900 kN fiber stress under working load is 4 N/mm^2 effective pre-stress is 1000 N/mm^2 and area of cable is 1500 mm^2. Design shear reinforcement slope of cable at support is (1/6). **(12 Marks)**

OR

8 a. Explain different methods of improving shear resistance of PSC members. **(04 Marks)**

b. Differentiate between web shear, flexural and flexural shear cracks in PSC members. **(06 Marks)**

c. The support section of PSC beam 150mm × 300mm is required to carry an ultimate shear force of 120kN. The compressive stress at centriodal axis is 5 N/mm^2 and f_{ck} = 40N/mm^2, f_y = 415N/mm^2, cover to reinforcement 60mm. Design the suitable shear reinforcement at the section. **(06 Marks)**

Module-5

9 a. Explain stress distribution in End Block. **(04 Marks)**

b. Explain Indian Standard Code IS-1343 method for calculation of Burstire force. **(04 Marks)**

c. The end block of a post tensioned pre-stressed concrete beam 300mm × 300mm is subjected to a pre-stressing force 832.8 kN. Anchorage area 11720 mm^2. Design suitable anchorage reinforcement. **(08 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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