CBCS SCHEME

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18CV81

Eighth Semester B.E. Degree Examination, July/August 2022
Design of Prestressed Concrete

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Distinguish between pre tensioning and post tensioning. **(06 Marks)**

b. List the advantages of PSC over RCC. **(04 Marks)**

c. Explain with sketch Hoyer's long line systems of pre-tensioning. **(10 Marks)**

OR

2 a. Explain concept of Thrust line. **(06 Marks)**

b. A rectangular concrete beam of cross section 300mm deep and 200mm wide is prestressed by means of 15 wires of 5mm diameter located 65mm from the bottom of beam and 3 wires of 5mm diameter, 25mm from top. Assuming the prestress in steel as 840N/mm^2, calculate the stresses at the extreme fibres of mid span section. When the beam is supporting its own weight over a span of 6m. If a uniformly distributed live load of 6kN/m is imposed, evaluate the maximum working stress in concrete. **(14 Marks)**

Module-2

3 a. List different types of losses in post tensioning system. Explain any two. **(06 Marks)**

b. A pretensioned beam, 200mm wide and 300mm deep is prestressed by 10 wires, of 7mm diameter initially stressed to 1200N/mm^2, with their centroids located 10mm from the soffit. Find the maximum stress in concrete immediately after transfer, allowing only for elastic shortening of concrete. If the concrete undergoes a further shortening due to creep and shrinkage while there is a relaxation of 5% of steel stress, estimate the final percentage loss of stress in the wires using the Indian Standard Code regulations and following data:

$E_s = 210 kN/mm^2$, $E_c = 5000\sqrt{f_{cu}}$, $f_{cu} = 42$ N/mm^2 creep co-efficient (ϕ) = 1.6, total residual shrinkage strain = 3×10^{-4}. **(14 Marks)**

OR

4 a. Explain:

i) Short term deflection
ii) Long term deflection
iii) Limiting deflection as per IS code. **(06 Marks)**

b. A type-3 post tensioned pre stressed concrete beam of 10m span. The beam is post tensioned using three high tensile bars of 40mm diameter located @ an effective depth of 700mm. The effective cover from each of the vertical face of the beam is 60mm.the effective pre stressing force in each bar after all losses is 600kN. Given, cross section 450mm × 750mm, $\frac{x}{d} = 0.43$, $\frac{I_c}{b_{d^3}} = 0.081$, $f_p = 1035 N/mm^2$, $E_s = 200 kN/mm^2$, $E_c = 28 kN/mm^2$, compute the width of cracks in the tension zone if the service load moment at mid span is 1040kN-m. **(14 Marks)**

Module-3

5 a. Explain failure modes of beam under flexure. **(06 Marks)**

b. A post tensioned bridge girder with unbonded tendons is of box section of overall dimensions 1200mm wide by 1800mm deep, with wall thickness of 150mm. The high tensile steel has an area of $4000mm^2$ and is located at an effective depth of 1600mm. The effective prestress in steel after all losses is $1000N/mm^2$ and the effective span of girder is 24m. If $f_{ck} = 40N/mm^2$ and $f_p = 1600N/mm^2$, estimate the ultimate flexural strength of section. **(14 Marks)**

OR

6 Design a simply supported Type-1 pre stressed beam with total moment $M_T = 435kN\text{-}m$ including self weight moment of $M_{SW} = 55kN\text{-}m$. The height of the beam is restricted to 920mm. The pre stress at transfer $f_{po} = 1035N/mm^2$ and pre stress at service $f_{pe} = 860B/mm^2$. The allowable compressive stresses are $12.5N/mm^2$ at transfer and $11.0N/mm^2$ at service. The pre-stressing tendon is 7 wire strand with nominal diameter of 12.8mm and nominal area of $99.3N/mm^2$. **(20 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 a PSC beam 150×300 is to resist a shear of 100kN. The pre stress at centroidal axis is $5N/mm^2$, and $f_{ck} = 40N/mm^2$. The cover to tension reinforcement is 45mm. Check the section for shear and design suitable shear reinforcement using IS Code recommendation. **(10 Marks)**

OR

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

b. A pre stressed I section has the following properties. Area $= 55 \times 10^3 mm^2$, $I = 189 \times 10^7 mm^4$, statical moment about the centroid $= 468 \times 10^4 mm^3$, thickness of web = 50mm. It is prestressed horizontally by 24 wires of 5mm diameter and vertically by similar wires at 150mm centres. All the wires carry a tensile stress of $900N/mm^2$. Calculate the principal stress at the centroid when shearing force of 80kN acts upon this section. **(14 Marks)**

Module-5

9 a. Write a note on anchorage zone stresses. **(04 Marks)**

b. Explain end zone reinforcement. **(06 Marks)**

c. The end block of a post-tensioned prestressed concrete beam, 300mm wide and 300mm deep, is subjected to a concentric anchorage force of 832.8kN by a Freyssinet anchorage of area $11720mm^2$. Design and detail the anchorage reinforcement for the end block. **(10 Marks)**

OR

10 a. Explain with neat sketches the following pre-stressing systems:
i) Freyssinet's system ii) BBRV system. **(10 Marks)**

b. The end block of a post-tensioned bridge girder is 600mm wide by 1200mm deep. Two cables, each comprising 97 high tensile wires of 7mm diameter, are anchored using square anchor plates of side length 410mm with their centres located at 600mm from the top and bottom edges of beam. The jacking force in each cable is 4500kN. Design a suitable anchorage zone reinforcement using Fe-415 grade HYSD bars conforming to IS:1343 code provisions. **(10 Marks)**

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