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10CV74

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020
Design of Prestressed Concrete Structures

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting at least TWO full questions from each part.*
2. IS:1343-1980 permitted
3. Assume any data required suitably and indicate.

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.

PART – A

1 a. Explain why high strength steel and high strength concrete are used in prestressed concrete. **(06 Marks)**

b. Explain with neat sketch, Hoyer's longline system of prestressing. **(07 Marks)**

c. Explain with neat sketch, freyssinet system of prestressing. **(07 Marks)**

2 A concrete beam of symmetrical I section spanning over 10m has a width of 300mm and thickness of 80mm for both the flanges. Thickness of web is 100mm. The overall depth is 500mm. The beam is prestressed by a parabolic cable with an eccentricity of 150mm at mid span and concentric at the ends. The initial and final prestressing force in the cable is 100kN and 160kN respectively. The beam supports a live load of 10kN/m. Calculate the stresses in concrete at mid span section at transfer and working load stages. Sketch the stress distribution diagrams. **(20 Marks)**

3 a. List the different types of losses in pre tensioning and post tensioning prestressed concrete members. **(05 Marks)**

b. A post tensioned beam is of symmetrical I section having width of flange 300mm each, thickness of flange 100mm each and width of wet is 150mm. The total depth of beam is 600mm. The beam is having simply supported span of 10m. The beam is having a parabolic cable with zero eccentricity at supports and an eccentricity of 100mm below CGC at mid span. The area of steel is 900mm^2, stressed initially to 1200N/mm^2. Concrete is of M45 grade.
Creep coefficient = 1.50
Shrinkage strain = 0.0002
Relaxation of steel = 3%
Anchorage slip = 1mm/anchorage
Coefficient of friction between steel and concrete = 0.55
Coefficient for wave effect = 0.15 per 100m
Tensioning is done at both ends.
Find the total percentage loss of prestress in the beam. **(15 Marks)**

4 a. Explain the load deflection characteristics of typical beam under flexure with a sketch. **(05 Marks)**

b. A prestressing concrete beam spanning over 8m is of rectangular section 150mm × 300mm. The beam is prestressed by a parabolic cable having an eccentricity of 75mm below cgc at mid span and at an eccentricity of 25mm above cgc at supports. The initial prestressing force in the cable is 350kN. The beam supports three concentrated live loads of 10kN each at interval of 2m. $E_c = 38kN/mm^2$.
i) Estimate the short term deflection due to prestress and self weight.
ii) Allowing for 20% loss of prestress, estimate the long term deflection due to prestress, self weight and live loads creep coefficient = 1.80.
iii) Check the deflections as per IS:1343-1980 requirements. **(15 Marks)**

PART – B

5 a. Explain with the help of stress block, how do you estimate the flexural strength of a flanged PSC section using limit state method. **(06 Marks)**

b. A post tensioned PSC T beam with bonded tendon is made up of a flange 300mm wide and 150mm thick. The thickness of web is 150mm. The effective depth of the section is 350mm. the beam is prestressed by 24 wires of 5mm diameter wires. The characteristic strength of steel is 1650N/mm^2. Grade of concrete is M40.

i) Estimate the flexural strength of the beam.

ii) For a span of 8m, what is the total working load per m the beam can support. **(14 Marks)**

6 a. How to improve the shear strength of PSC members? **(03 Marks)**

b. A prestressed concrete beam of rectangular section 150mm × 300mm is prestressed by a parabolic cable with an effective prestress of 200kN. The cable eccentricity is 25mm at the ends and 100mm at mid span. The beam supports a udl of 15kN/m inclusive of self weight. Determine the shear resistance of the uncracked section and suggest suitable shear steel.
Span = 8m fck = 45MPa. **(17 Marks)**

7 a. What is transmission length? List the factors influencing transmission length. **(06 Marks)**

b. A post tensioned beam having end section 600mm × 1000mm is provided with two cables of 300kN each. The two cables are spaced at 200mm on either side of the centroid of the beam with 4° inclination.

i) Design the necessary anchor plates.

ii) Calculate the bursting torsion and design the anchorage reinforcement. Sketch the details of reinforcement.
f_{ck} = 40N/mm^2
The cube strength of concrete at
Transfer = 30N/mm^2. **(14 Marks)**

8 Design a simply supported post tensioned prestressed concrete beam of symmetrical I section to carry a super imposed load of 10kN/m and a central concentrated load of 20kN over a span of 16m.
Permissible tensile stress in steel = 1000N/mm^2
Loss of prestress = 20%
Permissible stresses in concrete are
At transfer, 12N/mm^2 (comp) and 1N/mm^2 (tensile)
At working load, 14N/mm^2 (comp)
0.5N/mm^2 (tensile). **(20 Marks)**

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