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10CV74

Seventh Semester B.E. Degree Examination, June/July 2019
Design of Prestressed Concrete Structures

Time: 3 hrs.

Max. Marks:100

- Note: 1. Answer any FIVE full questions, selecting at least TWO questions from each part.**
2. Use of IS:1343-1980 is permitted.
3. Assume any suitable missing data.

PART – A

- 1 a. What is the necessity of using high strength concrete and high steel in prestressed concrete? (08 Marks)
b. Differentiate between pretensioning and post tensioning. (05 Marks)
c. What are the factors influencing the creep and shrinkage of concrete. (07 Marks)
- 2 a. What is pressure line or thrust line? Explain its significance with sketches. (06 Marks)
b. A concrete beam of symmetrical I section supports a superimposed load of 3 kN/m over a span of 8m. It is prestressed by a cable carrying a force of 120 kN at an eccentricity of 150mm at midspan section. The bottom and top flanges of the I – beam are 250mm wide and 80mm deep, thickness of the web is 80mm and overall depth is 450mm. Determine the resultant stresses at midspan section for the following cases:
(i) Prestress + Self weight
(ii) Prestress + Self weight + live load
Neglect the loss, Density of concrete = 24 kN/m³ (14 Marks)
- 3 a. List the various types of loss of prestress in pretensioned and post tensioned members and write equations used to calculate the losses. (06 Marks)
b. In a prestressed pretensioned concrete beam of c/s 200mm × 300mm depth and span of 6 m, with an initial pre-stressing force of 400kN, at an eccentricity of 70mm by tendons of area 400mm². Assume $E_s = 2 \times 10^5$ N/mm², and $E_c = 0.33 \times 10^5$ N/mm², creep coefficient is 2 shrinkage of concrete = 0.0002 and relaxation in steel = 3% of initial stress. Find the percentage loss in prestress. (14 Marks)
- 4 a. Distinguish clearly between short term and long term deflections of prestressed concrete beams. (06 Marks)
b. The deck of a prestressed concrete culvert is made up of a slab 500mm thick. The slab is spanning over 10.4m and supports uniformly distributed load comprising the dead and live loads of 33.5 kN/m². The modulus of elasticity of concrete is 38 kN/mm². The concrete slab is prestressed by straight cables each containing 12 high-tensile wires of cables are spaced at 328mm intervals in the transverse direction. Estimate the instantaneous deflection of the slab at centre of span under prestress and imposed loads. (14 Marks)

PART – B

- 5 a. What are the different flexural failure modes observed in prestressed concrete beams? Explain with neat sketches. (08 Marks)



- b. A post-tensioned prestressed Tee beam having a flange width of 1200mm and flange thickness of 200mm, thickness of web being 300mm is prestressed by 2000mm² of high tensile steel, located at an effective depth of 1600mm. If $f_{ck} = 40 \text{ N/mm}^2$ and $f_p = 1600 \text{ N/mm}^2$, estimate the flexural strength of the unbonded Tee section, assuming span/depth ratio as 20 and $f_{pc} = 1000 \text{ N/mm}^2$. (12 Marks)
- 6 a. Distinguish between web shear, flexural-shear cracks in concrete beam with sketches. (05 Marks)
- b. A prestressed concrete beam, span = 10m of rectangular section, 120mm wide and 300mm deep, is prestressed by force of 180 kN. The beam supports a total uniformly distributed load of 5 kN/m which includes self weight of the member. Compare the magnitude of the principal tension developed in the beam, for the following cases.
(i) with axial prestress
(ii) without axial prestress
(iii) with parabolic cable having max eccentricity of 100mm at the centre of span and zero at the supports. (15 Marks)
- 7 a. What is transmission length? List the various factors influencing transmission length. (06 Marks)
- b. The end block of a post tensioned beam is 80mm wide and 160mm deep. A prestressing wire, 7mm in diameter, stressed to 1200 N/mm² has to be anchored against the end block at the centre. The anchorage plate is 50mm by 50mm. The wire bears on the plate through a female cone of 20mm diameters. Given the permissible stress in concrete at transfer f_{ci} as 20 N/mm² and the permissible shear in steel as 94.5 N/mm², determine the thickness of the anchorage plate. (14 Marks)
- 8 a. Write a short note on limiting zone for cables in PSC. (06 Marks)
- b. A prestressed concrete beam of rectangular section 90mm wide and 180mm deep is to be designed to support two loads of 3.5kN each located at one third points over a span of 3m. The tensile stress is not permitted both at transfer and working stage. Calculate the minimum prestressing force and the corresponding eccentricity loss factor as 0.8. (14 Marks)
