Code: 15A01803

R15

B.Tech IV Year II Semester (R15) Advanced Supplementary Examinations July 2019

PRESTRESSED CONCRETE

(Civil Engineering)

Use of IS: 1343 code may be permitted in the examination hall.

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What is pretensioning and post-tensioning?
(b) What are the applications of prestressed concrete?
(c) List the types of losses in prestressed concrete beam.
(d) Explain the loss of stress caused due to friction.
(e) What is pressure line? Explain its significance.
(f) What type of stress blocks are adopted in Indian code specifications of flexural strength computations?
(g) Describe the shear and principal stresses.
(h) Distinguish between web shear cracks and flexural shear cracks.
(i) Distinguish between creep and shrinkage.
(j) State any two factors influencing the deflection.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Why is the high strength of concrete and high grade of steel required for prestressed concrete?
(b) Explain any two methods of prestressing system.

OR

3 (a) Define prestressed concrete and bring out the differences between RCC and PSC.
(b) What are the design loads and material strength criteria concerning to limit state design? Explain.

UNIT – II

4 (a) What are the different types of losses of prestress?
(b) A pre tensioned beam 400 mm wide and 600 mm deep is pre stressed by 12 wires each of 10 mm diameter initially stressed to 1200 N/mm^2 with their centroids located 100 mm from the soffit. Estimate the final percentage loss of stress due to elastic deformation, creep, shrinkage and relaxation using the following data: Relaxation of steel stress = 90 N/mm^2 E_S = 210 kN/mm^2, E_C = 35 kN/mm^2, Creep coefficient = 1.5, Residual shrinkage strain 2×10^{-4}.

OR

5 A prestressed concrete pile 250 mm square, contains 60 pre-tensioned wires, each of 2 mm diameter, uniformly distributed over the section. The wires are initially tensioned on the prestresssing bed with a total force for 300 kN. Calculate the final stress in concrete and the percentage loss of stress in steel after all losses, given the following data: E_S = 210 kN/mm^2, E_C = 32 kN/mm^2, Shortening due to creep = 30×10^{-6} mm/mm per N/mm^2 of stress, Total shrinkage = 200×10^{-6} per unit length, Relaxation of steel stress = 5 percent of initial stress, Prestressing force, P = 300 kN.

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UNIT – III

6 (a) Distinguish between standard strand and compound strand.

(b) A beam is of simply supported span 8 m. The size of the beam is 350 mm x 700 mm. A prestressing force of 100 kN was applied. The cable is parabolic with an eccentricity of 100 mm at centre and zero at the supports. It is subjected to an u.d.l of 20 kN/m. Compute the extreme stresses at the midspan.

OR

7 A PSC beam of span 8 m has the following data:
Area = 32×10^3 mm^2
E = 38 kN/m^2
Width of gyration = 72 mm
Cable: parabolic, 6 wires of 7 mm HTS, concentric at supports and eccentric by 50 mm at midspan. Fpe = 1000 N/mm^2. Determine the deflection for the following cases: (i) Self weight + Prestress. (ii) Self weight + Prestress + Live load of 3 kN/m.

UNIT – IV

8 A prestressed concrete beam having unsymmetrical I–section has a fibre stress distribution of 13 N/mm^2 (compression) at the top edge linearly reducing to zero at the bottom. The top flange width and thickness are 2400 mm and 400 mm respectively. The bottom flange width and thickness are 1200 mm and 900 mm respectively and the depth and web thickness are 1000 mm and 600 mm respectively. The total shear force is 2350 kN. Compute and compare the principal stresses at the centroidal axis and the junction of web with lower flange.

OR

9 A composite beam of rectangular section is made of inverted T-beam having a slab thickness of 150 mm and width of 1000 mm, the rib size in 150 mm x 850 mm. The in situ concrete slab has E_C = 30 kN/m^2 and the thickness of cast in situ slab is 1000 mm. If the differential shrinkage in 100×10^{-6} units, estimate the shrinkage stress developed in the precast and cast in situ units.

UNIT – V

10 (a) What are the factors affecting long-term deflections?

(b) A rectangular beam 250 x 500 mm in section is simply-supported over a span of 10 m. It is prestressed with a parabolic cable which has a maximum eccentricity of 200 mm at midspan and 40 mm at support sections. Effective prestressing force is 1450 kN, concrete grade is M40. Determine the deflection due to prestress and self weight.

OR

11 A concrete beam having a rectangular section 100 x 300 mm is prestressed by a parabolic cable with an initial prestressing force of 240 kN. The cable has an eccentricity of 50 mm at the centre and concentric at the supports. If the span of the beam is 12 m and subjected to a live load of 5 kN/m. Calculate the short term deflection at midspan.
Assume E_C = 38 kN/mm^2, creep coefficient = 2, loss of prestress = 20%.
Estimate the long-term deflection.

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