Code: 13A01805

R13

B.Tech IV Year II Semester (R13) Regular & Supplementary Examinations April 2018

PRESTRESSED CONCRETE

(Civil Engineering)

Use of IS code 1343:2012 is 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) Explain Hoyer's long line system of pre-tensioning.
(b) What is a post-tensioning system?
(c) List the causes for loss of prestress.
(d) How do you predict the loss of prestress in PSC beams?
(e) Illustrate eccentric tendons.
(f) What is elastic design?
(g) How do you improve shear resistance by pre-stressing techniques?
(h) What is differential shrinkage?
(i) What is short term deflection?
(j) Explain the importance of deflection.

PART – B

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

UNIT – I

2 (a) Discuss about Freyssinet system and Magnel system of prestressing.
(b) Discuss about the general principles of prestressing.
(c) What are the high strength concrete characteristics used in PSC?

OR

3 (a) Discuss in detail about the pre-tensioning and post-tensioning methods of PSC.
(b) Discuss about Gifford-Udall system of pre-stressing.
(c) What are the limitations of prestressing?

UNIT – II

4 A pre-tensioned PSC beam of 250 x 300 mm size is stressed by 12 wires of 7 mm diameter initially stressed to 1200 N/mm^2 with their centroids located 100 mm from soffit. Estimate the final percentage loss of stress due to elastic deformation, creep, shrinkage and relaxation using IS1343 and following data: Relaxation of steel stress = 90 N/mm^2; E_S = 210 kN/mm^2; E_C = 35 kN/mm^2; Creep coefficient = 1.6 and Residual shrinkage strain = 3 x 10^{-4}.

OR

5 (a) Write a short note on Loss of pre-stress due to friction.
(b) A 12 m long PSC beam of 150 x 300 mm size is pre-stressed by 3 cables. The area of each cable is 200 mm^2 and initial stress in the cable is 1200 N/mm^2. Cable 1 is parabolic with an eccentricity of 50 mm above the centroid at the supports and 50 mm below at the centre of the span. Cable 2 is also parabolic with zero eccentricity at supports and 50 mm below the centroid at the centre of the span. Cable 3 is straight with uniform eccentricity of 50 mm below the centroid. If the cables are tensioned from one end only, estimate the % loss of stress in each cable due to friction by assuming $\mu = 0.35$ and k = 0.0015 per m.

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UNIT – III

6 (a) Explain the elastic design of PSC beams of rectangular and I-section for flexure.

(b) The cross section of a symmetrical I-section PSC beam is 300 x 750 mm (overall) with flanges and web 100 mm thick. It is post-tensioned by 48 wires of 5 mm diameter at an eccentricity of 250 mm. The ultimate strength of wires is 1799 N/mm^2. Assuming that the grouting of tendons is 100% effective, determine the moment of the section by adopting M40 grade concrete and IS1343 provisions.

OR

7 (a) Distinguish between concordant and non-concordant cable profiles.

(b) A continuous PSC beam (PQ = QR) has a uniform cross section throughout its length. The beam is pre-stressed by a straight cable carrying an effective force F. Show that the cable is concordant if the cable has an eccentricity e towards the soffit at the end supports P and R and e/2 towards the top fibre at the central support Q.

UNIT – IV

8 (a) Explain the improvement of shear resistance by different pre-stressing techniques.

(b) Explain the design of shear reinforcement in the context of IS1343 code provisions.

OR

9 (a) Explain the shear and principal stresses in structural elements of PSC.

(b) Write a short note on differential shrinkage in PSC.

UNIT – V

10 (a) Discuss IS code requirement for maximum deflections of PSC members.

(b) A PSC beam of 150 x 300 mm size is simply supported over a span of 8 m and pre-stressed by a symmetric parabolic cable at a distance of 75 mm from the bottom of beam at mid-span and 125 mm from top of the beam at supports. If E_C = 38 kN/mm^2 and force in the cable is 350 kN, compute the deflection at mid-span when the beam is supporting its own weight.

OR

11 (a) Write a short note on effect of creep of concrete in long-term deflection of PSC members.

(b) A post-tensioned beam of 25 m span has an un-symmetrical I-section with a second moment of area of section of (72490 x 10^6) mm with an overall depth of 1300 mm. The effective eccentricity of group of parabolic cables at the centre of span is 580 mm towards the soffit and 170 mm towards the top of the beam at supports. The cables carry an initial pre-stressing force of 3200 kN. E_C = 38 kN/mm^2, self weight of beam is 10.8 kN/m and live load on the beam is 9 kN/m. if the creep coefficient is 1.6 and total loss of pre-stress is 15%, estimate the instantaneous deflection due to prestress and self weight and the maximum resultant long term deflection allowing for loss of pre-stress and creep of concrete.

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