R13

B.Tech IV Year II Semester (R13) Supplementary Examinations August 2022
PRESTRESSED CONCRETE
(Civil Engineering)
(For 2014 regular admitted batches only)

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 are the advantages of prestressed concrete?
  (b) List out the various systems of prestressing.
  (c) What do you mean by loss of prestress due to elastic shortening of concrete?
  (d) What are the different losses of prestress present in pre-tensioned and post-tensioned members?
  (e) What is the importance of cable profile in prestressed members?
  (f) Define kern line with neat sketch.
  (g) What is differential shrinkage?
  (h) Define principal stress.
  (i) What are the factors influencing the long term deflections of prestressed concrete members?
  (j) List out the different methods to control deflection of prestressed concrete members.

PART – B
(Answer all the questions: 05 X 10 = 50 Marks)

2 (a) Explain Hoyer system of prestressing with the help of neat sketches.
   (b) Discuss in detail about the pretensioning and post tensioning methods.
OR
3 (a) Discuss Magnel system of prestressing with the help of neat sketches.
   (b) Explain the historical development of pre stressed concrete.

4 (a) Explain in detail about slip in anchorage and wobble frictional losses.
   (b) A prestressed concrete pile is 300 mm × 300 mm in section and is provided with 40 wires of 3 mm diameter distributed uniformly over the section. Initially the wires are tensioned in prestressing beds with a total pull of 450 kN. Determine the final stress in concrete and the percentage loss of stress in the wires.
   Take:
   $E_S = 2.08 \times 10^5$ N/mm^2
   $E_C = 3.2 \times 10^4$ N/mm^2
   Creep shortening = 32×10^{-6} mm/mm per N/mm^2 of stress.
   Total shrinkage strain = 200×10^{-6}.
   Relaxation loss of stress in steel = 4.5 percent of the initial stress.
OR
5 (a) Discuss in detail about losses of prestress due to shrinkage and creep of concrete.
   (b) Explain various failure modes of prestressed concrete beam when subjected to bending.

6 (a) A post tensioned bridge girder with unbounded tendons is of size 1200 mm wide by 1800 mm deep is of box section with wall thickness of 150 mm. The high tensile steel has an area of 4000 mm^2 and is located at an effective depth of 1600 mm. The effective prestress in steel after loss is 1000 N/mm^2 & effective span is 24 m. If f_{ck} = 40 N/mm^2, f_y = 1600 N/mm^2. Estimate the flexural strength.

   (b) Explain the design procedure of I-section for flexure according to IS code.

OR

7 (a) A pretensioned prestressed rectangular concrete beam of 200 mm wide and 400 mm deep has an effective cover of 550 mm. If f_{ck} = 30 N/mm^2 and f_p = 1700 N/mm^2 and the area of prestressing steel A_{st} = 520 mm^2, calculate the ultimate flexural strength of the section using codal provisions.

   (b) Explain in detail about various types of tendons.

8 (a) A PSC beam of rectangular section 300 mm wide and 600 mm deep is pre stressed by a parabolic cable located at an eccentricity of 120 mm at mid span and zero at the supports. If the beam has a span of 10 m and carries a uniformly distributed live load of 8 kN/m, design the shear reinforcement at the supports and quarter span section. Grade of concrete is M40. Yield stress of tendons is 2000 MPa. Area of the tendons is 1000 mm^2. Effective stress in the tendons is 1500 MPa.

   (b) Explain in detail about the design procedure for shear in beams.

OR

9 (a) Explain the importance of differential shrinkage in composite sections.

   (b) The support section of a prestressed concrete beam, 100 mm wide by 250 mm deep, is required to support an ultimate shear force of 80 kN. The compressive prestress at the centroidal axis is 5 N/mm^2. The characteristic cube strength of concrete is 40 N/mm^2. The cover to the tension reinforcement is 50 mm. If the characteristic tensile strength of stirrups is 415 N/mm^2, design suitable shear reinforcements in the section using IS code recommendations.

10 (a) A concrete beam having a rectangular section 100 × 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.

   (b) Explain in detail about the factors influencing short term deflections of prestressed concrete members.

OR

11 (a) Discuss in detail about importance of control of deflection in prestressed concrete beams.

   (b) A PSC beam of rectangular section 120 mm wide and 300 mm deep spans over 6 m. The beam is prestressed by a straight cable carrying an effective force of 180 kN at an eccentricity of 50 mm. If it supports an imposed load of 4 kN/m and modulus of elasticity of concrete is 38 kN/mm^2, compute the upward deflection under prestress and self weight.

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