CBCS SCHEME

USN | | | | | | | | | | |

17CV82

Eighth Semester B.E. Degree Examination, Dec.2023/Jan.2024
Design of Pre-Stressed Concrete Elements

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of IS code : 1343 is permitted.

Module-1

1 a. What is the necessity of using high strength concrete and high strength steel in pre-stressed concrete? **(08 Marks)**

b. List the advantages and disadvantages of pre-stressed concrete over reinforced cement concrete. **(08 Marks)**

c. What is pressure line? Explain its significance. **(04 Marks)**

OR

2 a. A pre-stressed concrete beam supports a liveload of 4 kN/m over a simply supported span of 8m. The beam has an I-section with an overall depth of 400mm. The thickness of the flange and web are 60mm and 80mm respectively. The width of the flange is 200mm. The beam is to be prestressed by an effective pre-stressing force of 23 kN at a suitable eccentricity such that the resultant stress at the soffit of the beam at the center of the span is zero.

(i) Find the eccentricity required for the force

(ii) If the tendon is concentric, what should be the magnitude of the prestressing for the resultant stress to be zero at the bottom of the fiber of the central span section? **(12 Marks)**

b. Explain with neat sketch, Freyssinet of post-tensioning. **(08 Marks)**

Module-2

3 a. List the various types of loss of prestress and post-tensioned members and write equations used to calculate the loss. **(08 Marks)**

b. A prestressed concrete beam, 200mm wide and 300mm deep, is srestressed with wires of area 320mm^2 located at a constant eccentricity of 50mm and carrying an initial stress of 1000N/mm^2. The span of beam is 10m. Calculate the percentage loss of stress in wires.

(i) The beam is pre-tensioned.

(ii) The beam is post tensioned, using the following data.

E_s = 210 kN/mm^2 and E_c = 35 kN/mm^2, Shrinkage of concrete = 300×10^{-6} for pre-tensioning and 200×10^{-6} for post-tensioning. Creep coefficient = 1.6, Slip at anchorage = 1mm, frictional wave effect = 0.0015/m **(12 Marks)**

OR

4 a. Discuss the importance of deflection control of PSC member. **(08 Marks)**

b. A concrete beam having a rectangular section 150mm × 300mm is prestresed by a parabolic cable at an eccentricity of 75mm below centroidal axis at midspan and 30mm towards top at support sections. The effective prestressing force is 350 kN. The beam supports a concentrated load of 20 kN at centre span is addition to the self weight with span under pre-stress, self weight and live load. Find also the long term deflection. If the loss ratio is 0.8% and the creep coefficient is 1.6E_c = 38 kN/mm^2. **(12 Marks)**

Module-3

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

b. A pre-tensioned T-section having a flange width and depth of rib is 300mm and 1500mm respectively. The area of high tensile steel is 4700mm^2 located at an effective depth of 1600mm. If the characteristic strength of concrete and steel are 40 N/mm^2 and 1600 N/mm^2. Calculate the flexure strength of the T-section using IS-1343 code provision. **(12 Marks)**

OR

6 Design a pre-stressed concrete beam as Type-1 member to carry a super imposed load of 12 kN/m over a simply supported span of 25m. The permissible stress in compression for concrete at transfer and working loads are 14 N/mm^2 and 12 N/mm^2 respectively. Initial stress in pre-stressing cable is 1000 N/mm^2 loss of prestress is 20%. Adopt Freyssenet cables each of 12 wires of 5mm diameter. **(20 Marks)**

Module-4

7 a. Discuss briefly the modes of failure due to shear. **(08 Marks)**

b. A concrete beam of section 200mm wide and 650mm deep is pre-stressed by a parabolic cable located at an eccentricity of 120mm at mid-span and zero at the supports. If the beam has a span of 12m and carries a uniform distributed live load 4.5 kN/m, find the effective force necessarily in the cable for zero shear stress at the support section. For this condition calculate the principle stress. The density of concrete is 24 kN/m^2. **(12 Marks)**

OR

8 a. Explain different method of improving shear resistance of PSC member. **(08 Marks)**

b. A PSC beam of symmetrical I-section has an overall depth of 2m and the thickness of the web is 200mm, the effective span of the beam is 40m. The beam is pre-stressed by a cable which are concentric at supports and have an eccentricity of 750mm at center of the span. The force in the cable is 12000 kN at transfer stage, f_{ck} = 60 N/mm^2. Estimate the ultimate shear resistance of the support section. If the ultimate shear force at the support due to loads is 2834 kN and loss ratio is 0.8, design suitable shear reinforcement using Fe415 steel bars, area of the section = 0.88×10^6 mm^4. **(12 Marks)**

Module-5

9 A precast pretension unit of rectangular section of size 100mm × 200mm is used as a part of composite beam to a span of 5.0m. This unit is prestressed by tendons with their centroids coinciding with the bottom kern point. The initial force in the tendon is 150 kN. The loss of prestress may be assumed to be 15%. The unit is incorporated as web of a composite beam by casting a slab of flange width of 400mm and thickness of 40mm. On the top of the process unit the composite beam supports a live load of 8 kN/m. Compute the resultant final stresses developed in the precast and cast in-situ concrete assuming the pretensioned unit as propped construction. Draw the resultant stress diagram. **(20 Marks)**

OR

10 A composite T-girder of span 5m is made up of a pre-tensioned rib 100mm × 200mm with an cast in-situ cast slab 400mm wide and 20mm thick. The rib is pre-stressed by a parabolic cable having an eccentricity of 33.33mm at centre of span and zero at supports carrying an initial force of 150 kN. The loss of prestress may be assumed to be 15%. Check the composite T-beam for the limit state of deflection if it supports an imposed load of 3.2 kN/m for (i) unpropped construction and (ii) Propped construction. Assume modulus of elasticity of 35 kN/mm^2 for precast beam and cast in situ elements. **(20 Marks)**

* * * * *