CBCS SCHEME

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18CV81

Eighth Semester B.E. Degree Examination, Dec.2024/Jan.2025
Design of Pre-Stressed Concrete

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of IS1343, code book is permitted.

Module-1

1 a. Define pre-stressed concrete. State advantages over reinforced concrete. **(06 Marks)**
b. Distinguish between pre-tensioning and post tensioning. **(08 Marks)**
c. Explain Magnel-Blaton post tensioning system with a neat sketch. **(06 Marks)**

OR

2 a. Explain load balancing concept in pre-stressed concrete members. **(06 Marks)**
b. A simply supported concrete of rectangular cross-section 400 × 600 mm is loaded with a total UDL of 60 kN/m over a span of 6 m. Draw the distribution of stress at mid span. If the pre-stressing force is 1920 kN and the parabolic profile of the tendon has an eccentricity of 100 mm at ends and 200 mm at mid-span. **(14 Marks)**

Module-2

3 a. List the various losses in pre-tensioned and post-tensioned beams. **(04 Marks)**
b. A post-tensioned pre-stress concrete beam of 30 m span is subjected to a pre-stress force of 250 kN at 28 days strength. The profile of cable in parabolic with maximum eccentricity of 200 mm at mid span. Determine the loss of pre-stress and has a cross-section of 500 mm × 800 mm deep beam is prestressed with 9-cables each consists of 12 wires of 5 mm diameter. Take ES = 2.1×10^6 N/mm^2 and EC = 3.5×10^4 N/mm^2. One cable is tensioned at a time. **(16 Marks)**

OR

4 a. Explain the load deflection characteristics of a typical pre-stressed concrete beam under flexure with a diagram. **(06 Marks)**
b. A rectangular concrete beam of cross-section 150 mm wide and 300 mm deep is simply supported over a span of 8 m and is prestressed by means of a symmetric parabolic cable, at a distance of 75 mm from the bottom of the beam at mid span and 125 mm from the top of the beam at support sections. If the force in the cable is 350 kN and the modulus of elasticity of concrete is 38 kN/mm^2. Calculate i) The deflection at mid span when the beam is supporting its own weight ii) The concentrated load which must be applied at mid-span to restore it to the level of support. **(14 Marks)**

Module-3

5 a. Explain with a neat figure of the various types of flexure failures encountered in PSC members. **(06 Marks)**
b. A pre-tensioned T-section has a flange width of 300 mm and the thickness of the flange is 200 mm. The rib is 150 mm wide by 350 mm deep. The effective depth of the cross-section is 500 mm. Given A_p = 200 mm^2, f_{ck} = 50 N/mm^2, f_p = 1600 N/mm^2. Determine the flexural strength of the section. **(14 Marks)**

OR

6 A post-tension bridge girder with unbounded tendons is of box section of over all dimensions 1200 mm wide by 1800 mm deep with wall thickness of 150 mm. The high strength steel has an area of 4000 mm^2 and is located at an effective depth of 1600 mm. The effective pre-stress in steel after all losses is 1000 N/mm^2 and the effective span of girder is 24 m. If f_{ck} = 40 N/mm^2, f_p = 1600 N/mm^2. Calculate the ultimate flexural strength of the section IS:1343 codal provisions. **(20 Marks)**

Module-4

7 a. Explain with neat sketches types of shear cracks. **(06 Marks)**

b. A prestressed I-section has the following properties are = 55 × 10^3 mm^2, second moment area = 189 × 10^7 mm^4. Statical moment about the centroid = 468 × 10^4 mm^3. Thickness of web = 50 mm. It is pre-stressed horizontally by 24 wires of 5 mm diameter and vertically by similar wires at 150 mm centers. All the wires carry a tensile stress of 900 N/mm^2. Calculate the principal stresses at the centroid when a shearing force of 80 kN acts upon this section. **(14 Marks)**

OR

8 The support section of a pre-stressed concrete beam, 100 mm wide and 250 mm deep is required to support an ultimate shear force of 60 kN. The compressive pre-stress 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 steel in stirrups is 250 N/mm^2, design suitable reinforcement at the section using IS code recommendations. **(20 Marks)**

Module-5

9 The end block of a post-tensioned prestressed member is 550 mm wide and 550 mm deep. Four cables, each made up of 7 wires of 12 mm diameter strands and carrying a force of 1000 kN, are anchored by plate anchorages, 150 mm by 150 mm, located with their centres at 125 mm from the edges of the end block. The cable duct is of 50 mm diameter. The 28-days cube strength of concrete fcu is 45 N/mm^2. The cube strength of concrete at transfer fci is 25 N/mm^2. Permissible bearing stresses behind anchorages should confirm with IS : 1343. The characteristics yield stress in mild steel anchorage reinforcement is 260 N/mm^2. Design suitable anchorages for the end block. **(20 Marks)**

OR

10 The end block of a post-tensioned bridge girder is 600 mm wide by 1200 mm deep. Two cables, each comprising 97 high-tensile wires of 7 mm diameter, are anchored using square anchor-plates of side length 410 mm with their centres located at 600 mm from the top and bottom edges of the beam. The jacking force in each cable is 4500 kN. Design a suitable anchorage zone reinforcement using Fe-415 grade HYSD bars confirming to IS 1343 code provisions. **(20 Marks)**

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