CBCS SCHEME

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18CV81

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

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define pre-stressed concrete. State its advantageous over reinforced concrete. **(06 Marks)**

b. Distinguish between pre-tensioning and post-tensioning methods. **(08 Marks)**

c. Explain the following:
i) Bonded and unbounded member
ii) Anchorage
iii) Stress at transfer. **(06 Marks)**

OR

2 a. Explain the following:
i) Hoyer's long line method ii) Freyssinet system of pre-stressing. **(08 Marks)**

b. A concrete beam of symmetrical I-section is used to support a super imposed load of 3kN/m over a span of 8m. It is pre-stressed by a cable carrying a force of 120kN at an eccentricity of 150mm at centre of the span of the section. The section details are top and bottom flanges are 250mm wide and 80mm thick, thickness of web is 80mm and overall depth is 450mm. Consider density of concrete as $24kN/m^3$. Determine the resultant stresses at midspan section for the following cases of loading:
i) Pre-stress + self weight ii) Pre-stress + self weight + live load. **(12 Marks)**

Module-2

3 a. List the various losses of pre-stress that occur in pre-tensioned and post-tensioned beams. **(06 Marks)**

b. A pre-tensioned concrete beam of rectangular C/S 150mm wide and 300mm deep is pre-stressed by 8 high tensile wires of 7mm diameter located at 100mm from the soffit of the beam. If the wires tensioned to a stress 1100 N/mm^2. Calculate the percentage of loss due to elastic deformation, shrinkage of concrete creep of concrete and relaxation of stress in steel. Take M = 6, shrinkage strain = 0.0003, creep coefficient = 2, stress relaxation in steel = 3%, $E_s = 210\ kN/mm^2$. **(14 Marks)**

OR

4 a. Explain the following:
i) Long and short term deflection in PSC beams.
ii) Factors effecting deflections of PSC beams. **(08 Marks)**

b. A concrete beam with rectangular C/S 300mm wide and 500mm deep is pre-stressed by 2 post tensioned cables of area $600mm^2$ each. Initially stressed to 1600 N/mm^2. The cables are located at an eccentricity e = 100mm through the length of the beam having a span of 10m. $E_s = 210kN/mm^2$ and $E_c = 38kN/mm^2$, density of concrete $24kN/m^3$
i) Neglecting all losses, find the deflection at centre of span where it is supporting its own weight.
ii) Allowing for 20% loss in pre stress, find the final deflection at the centre of span where it carries an imposed load of 18kN/m. **(12 Marks)**

Module-3

5 a. Explain the assumptions in limit state of collapse. **(08 Marks)**

b. A prestressed concrete beam rectangular in C/S 200mm wide and 500mm deep is prestressed by tendons having an area 600mm^2 located at 100mm from soffit of the beam. Given f_{ck} = 40N/mm^2 and f_p = 1600N/mm^2. Estimate the flexural strength of the beam for the following cases as per IS1343 code recommendation:

i) If the beam is pre tensioned

ii) If the beam is post tensioned with effective bond. **(12 Marks)**

OR

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

Module-4

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

b. A pre-stressed concrete beam of rectangular C/S 120mm wide and 300mm deep is axially prestressed by a cable carrying an effective force of 180kN. The beam supports a total uniformly distributed load of 5 kN/m which includes self weight of the member. The span of beam is 10m. Compare the magnitude of the principal tension developed in the beam with and without the axial pre-stress. **(12 Marks)**

OR

8 The support section of a PSC beam 150mm wide and 300mm deep is to resist a shear of 100kN. The pre-stress at centroidal axis is 5N/mm^2, fck = 40N/mm^2. The cover to tension reinforcement is 45mm. Check the section for shear and design suitable shear reinforcement f_t = 1.5N/mm^2. **(20 Marks)**

Module-5

9 a. Explain the stress distribution in end block. **(08 Marks)**

b. The end block of a post tensioned pre-stressed concrete beam 300mm wide and 300mm deep is subjected to a concentric anchorage force of 832800N by a Freyssinet anchorage of area 11720mm^2. Design and detail the anchorage reinforcement for the end block. **(12 Marks)**

OR

10 Explain the following:

a. Freyssinet anchorage system

b. Grifford udall system

c. Thermo-electric pre-stressing

d. Chemical pre-stressing. **(20 Marks)**

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