CBCS SCHEME

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15CV82

Eighth Semester B.E. Degree Examination, Jan./Feb. 2021
Design of Pre-Stressed Concrete Elements

Time: 3 hrs. Max. Marks: 80

Note: ***1. Answer FIVE full questions, choosing ONE full question from each module.***
2. Use of IS 1343 – 2012 is permitted.
3. Missing data, if any, may be suitably assumed.

Module-1

1 a. State the advantages and disadvantages of pre-stressed concrete. **(04 Marks)**

b. Explain with the help of neat sketches Freyssinet and Magnel Blaton method of pre-stressing. **(06 Marks)**

c. What is pressure line? Draw the pressure line for a simply supported rectangular beam of size B × D subjected to udl and pre-stressed by force P at a constant eccentricity of D/6 such the bottom fibre stress at mid span due to all loads and P equal to zero. **(06 Marks)**

OR

2 a. Explain with neat sketch Gifford Udall system of pre-stressing. **(04 Marks)**

b. Explain concept of load balancing in PSC design. **(04 Marks)**

c. A concrete beam of symmetrical I section spanning 8m, the width and thickness of flanges are 220mm and 60mm respectively, the overall depth of the beam is 410mm, thickness of web is 80mm, the beam is pre-stressed by a straight cable with an eccentricity of 150mm with effective force of 150kN, the live and load on the beam is 2.5kN/m, raw the stress distribution diagram at central section for the loaded beam. **(08 Marks)**

Module-2

3 a. How do you estimate the loss of pre-stress due to :
i) Elastic deformation of concrete
ii) Shrinkage of concrete
iii) Friction between cable and duct. **(06 Marks)**

b. A PSC beam of 200mm × 300mm is pre-stressed with steel wires of area 320mm^2 located at constant eccentricity of 50mm and carrying an initial stress of 1100N/mm^2, span of the beam is 9m. Calculate percentage of loss of stress in wires if beam is post tensioned. If E_S = 210GPa, E_C = 35GPa, relaxation of stress in steel = 4.8%, shrinkage of concrete is 200×10^{-6} per post tensioning, creep coefficient = 1.6, slip at anchorage is 1mm and friction coefficient for wave effect is 0.0012/m. **(10 Marks)**

OR

4 a. List the factors influencing deflections of pre-stressed concrete members. **(06 Marks)**

b. A concrete beam having a rectangular section of 150mm × 300mm is pre-stressed by a parabolic cable having an eccentricity of 75mm at centre of span towards the soffit and an eccentricity of 25mm towards top at support section. The effective force in the cable is 350kN. The beam supports a concentrated load of 20 KW at centre of span is addition to a self weight. If E_C = 38GPa and span is 8m calculate : i) short term deflection at centre of span under pre-stress. Self weight and live load ii) long term deflection if loss ratios 0.8 and creep coefficient as 1.6. **(10 Marks)**

Module-3

5 a. Explain the different types of flexural failures observed is pre-stressed concrete beam. **(06 Marks)**

b. A post tensioned beam with unbounded tendon is of triangular section 400mm wide with an effective depth of 800mm. The cross sectional area of pre-stressing steel is 2840mm^2. The effective pre-stress in steel after all losses is 900N/mm^2. The effective span of the beam in 16m. Determine the ultimate moment capacity of the section if f_{ck} = 40N/mm^2 using IS code 1343 recommendation. **(10 Marks)**

OR

6 A pre stressed beam of rectangular section of 250mm wide is to be designed for an imposed load of 12kN/m on a span of 12m. The stress in the concrete must not exceed 17N/mm^2 is compression or 1.4N/mm^2 in tension at any time and the loss of pre-stress to be 15 percent. Calculate : i) minimum possible depth of the beam ii) minimum pre-stressed force and eccentricity. **(16 Marks)**

Module-4

7 a. Explain the mechanism of shear failure in PSC beams. **(06 Marks)**

b. A PSC beam of size 400mm × 1000mm is subjected to a shear force of 600kN under working loads at support. The effective pre-stressing force in tendon is 800kN. The cable is parabolic with zero eccentricity at support and 300mm below centriodal axis at midspan. The span of the beam 12m. Estimate principle tension in concrete at support section and design the shear reinforcement. Use M40 concrete. **(10 Marks)**

OR

8 a. Explain different methods of improving shear resistance of PSC members. **(04 Marks)**

b. Differentiate between web shear, flexural and flexural shear cracks in PSC members. **(06 Marks)**

c. The support section of PSC beam 150mm × 300mm is required to carry an ultimate shear force of 120kN. The compressive stress at centriodal axis is 5 N/mm^2 and f_{ck} = 40N/mm^2, f_y = 415N/mm^2, cover to reinforcement 60mm. Design the suitable shear reinforcement at the section. **(06 Marks)**

Module-5

9 a. Write a note on Guyon's method of computing the bursting stress in end block. **(06 Marks)**

b. The end block of a post tensioned beam is 80mm × 160mm. A pre-stress wire 7mm in diameter stressed to 1200N/mm^2 has to be anchored against the end block at the centre. The anchorage plate of size 50mm × 50mm, the wire bears on the plate through a female cone of 20mm diameter. Determine thickness of plate if permissible shear in concrete at transfer as 20N/mm^2 and permissible shear in steel as 94.5N/mm^2. **(10 Marks)**

OR

10 A post tensioned PSC bema 550mm × 550mm, four cables each made of 7 wires and 12 mm diameter strands and carrying force of 1000kN are anchored by plate anchorages 150mm by 150mm located with their centre, at 125mm from the edges of the end block. The cable duct is of 50mm diameter, f_{ck} = 45N/mm^2 and strength of concrete at transfer is 25N/mm^2. Permissible stress for anchorage reinforcement is 260N/mm^2. Design suitable anchorage for the end block. **(16 Marks)**

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