CBCS SCHEME

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18CV81

Eighth Semester B.E. Degree Examination, Jan./Feb. 2023
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 IS 1343-1980 is permitted.
3. Assume any data required suitably and indicate.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define pre-stressed concrete. State its advantages over reinforced concrete. **(06 Marks)**
b. Explain with a neat sketch "Hoyer Long Line" system of pre-stressing. **(06 Marks)**
c. Explain the concept of load balancing with different cable profiles. **(08 Marks)**

OR

2 A concrete beam of symmetrical I-section spanning 8 m has the width and thickness of flanges equal to 200 mm and 60 mm respectively. The overall depth of the beam is 400 mm. The thickness of the web is 80 mm. The beam is prestressed by a parabolic cable with an eccentricity of 150 mm at the centre and zero at the supports with an effective force of 100 kN. The live load on the beam is 2 kN/m. Draw the stress distribution diagram at the central section for,
(i) Prestress + Self weight (ii) Prestress + Self weight + Live load.
Take density of concrete as 24 kN/m^3. **(20 Marks)**

Module-2

3 a. List the various types of losses in prestressed concrete beams and write the equations used to determine them. **(08 Marks)**
b. A rectangular beam 200 mm$\times$400mm is simply supported over a span of 8 m. The position of the parabolic pre-stressing cable is 80 mm from Soffit at mid span and 125 mm from top at supports of the force in the cable is 400 kN and $f_{CK} = 38$ MPa,
Calculate
(i) The deflection at mid span when the beam is supporting self weight.
(ii) The magnitude of the central concentrated load which restores the beam at mid span to the level of supports. **(12 Marks)**

OR

4 a. List the various factors affecting deflection in prestressed concrete beams. **(04 Marks)**
b. A post tensioned rectangular beam 300mm$\times$600mm in section is pre-stressed with an internal pre-stress of 950 N/mm^2. There are four straight cables each of area 250 mm^2. The cables are situated at 125 mm from the soffit. Determine the percentage loss of pre-stress due to concrete. Assume the following :
Shrinkage strain of concrete = 2×10^5 ; Modular ratio = 6
Ultimate Creep Strain of concrete = 4×10^{-6} **(16 Marks)**

Module-3

5 A pre-stressed concrete beam rectangular in cross section 200mm$\times$500mm deep is prestressed by tendons having an area of 600 mm^2 located at 100 mm from the soffit of the beam. Take $f_{CK} = 40$ N/mm^2, $f_P = 1600$ N/mm^2. Estimate the ultimate flexural strength of the beam for the following cases as per IS code recommendations.
(i) If the beam is pre tensioned.
(ii) If the beam is post tensioned with effective bond. **(20 Marks)**

OR

6 A post tensioned T-section of overall depth 1200 mm having a flange width of 1000 mm and thickness of flange 150 mm, width of rib 200 mm is stressed with four number of 12-7 mm wires. The centre of gravity of tendons is located at a distance of 150 mm from the soffit of the beam. If $f_{CK} = 40\ N/mm^2$ and $f_P = 1600\ N/mm^2$, calculate the flexural strength of the section. **(20 Marks)**

Module-4

7 A concrete beam of rectangular section, 200 mm wide and 650 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 12 m and carries a uniformly distributed live load of 4.5 kN/M, find the effective force necessary in the cable for zero shear stress at support section. For this condition, calculate the principal stresses. Take density of concrete as 24 kN/m^3. **(20 Marks)**

OR

8 A PSC beam of span 8 m is stressed with parabolic cable of eccentricity e = 20 mm above cgc at ends and 120 mm below cgc at centre. The pre stress is 600 KN. The total load on the beam is 30000 N/m. The cross-section consists of flanges $300mm \times 60mm$ and web $400mm \times 80mm$. Design a suitable shear reinforcement near the support section. Assume M_{50} cement concrete. **(20 Marks)**

Module-5

9 The end section of an I-beam is thickened to a rectangular section 600 mm wide and 300 mm wide and 1200 mm deep for a length of 1200 mm from end and is provided with 3 nos. of cables, each consisting of 120 mm diameter anchorage cone. The cables are placed as shown in Fig. Q9, and effective prestress in each case is 450000 N. Design the end anchorage by the emperical method advocated by cement and Congress association. Assume tensile stress in mild steel as 140 N/mm^2. **(20 Marks)**

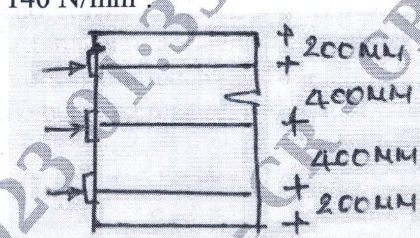

Fig. Q9

OR

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

b. The end block of a prestressed concrete beam 200 mm wide and 300 mm deep, has two Freyssinet anchorages of 100 mm diameter with their centres at 75 mm from the top and bottom of the beam. The force transmitted by each anchorage being 200 kN. Estimate the maximum tensile stress and the bursting tension developed. **(10 Marks)**

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