Hall Ticket No | | | | | | | | | | | Question Paper Code: ACEB46

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech VIII SEMESTER END EXAMINATIONS (REGULAR) - JUNE 2022
Regulation: R18
PRESTRESSED CONCRETE STRUCTURES
(CIVIL ENGINEERING)

Time: 3 Hours **Max Marks: 70**

Answer FIVE Questions choosing ONE question from each module
(NOTE: Provision is given to answer TWO questions from any ONE module)
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) List the classifications of pre-stressing. Explain any two of them in detail.
[BL: Understand| CO: 1|Marks: 7]

   (b) A beam of symmetrical I-section spanning 8 m has a flange width of 250 mm and a flange thickness of 80 mm, respectively. The overall depth of the beam is 450 mm. Thickness of the web is 80 mm. The beam is pre-stressed by a parabolic cable with an eccentricity of 150 mm at the center of span and zero at supports. The live load on the beam is 2.5 kN/m.
   i) Determine the effective force in the cable for balancing the dead and live loads on the beam.
   ii) Sketch the distribution of resultant stress at the center-of-span section for the above case.
   iii) Calculate the shift of the pressure line from the tendon-center-line.
[BL: Apply| CO: 1|Marks: 7]

2. (a) Explain the load deflection behaviour of under prestressed, partially prestressed and over prestressed members in detail. [BL: Understand| CO: 1|Marks: 7]

   (b) A prestressed concrete beam 250 mm wide and 375 mm deep is prestressed by concentrically placed to tendon. The span of the beam is 8 m and beam has to support an imposed load of 4.25 kN/m^2. Find the PSF necessary so that tension is just avoided at the soffit at the beam if the tendon is provided at an necessary 65 mm. find the prestressing force necessary so that tension is just avoided at the soffit of the beam. [BL: Apply | CO: 1|Marks: 7]

MODULE – II

3. (a) What is relaxation of stress in steel? How do you account for it in prestressed members?
[BL: Understand| CO: 2|Marks: 7]

   (b) A post-tensioned cable of beam 10 m long is initially tensioned to a stress of 1000 N/mm^2 at one end. If the tendons are curved so that the slope is 1 in 24 at each end, with an area of 600 mm^2, calculate the loss of prestress due to friction given the following data: Coefficient of friction between duct and cable = 0.55; friction coefficient for 'wave' effect = 0.0015 per m. During anchoring, if there is a slip of 3 mm at the jacking end, calculate the final force in the cable and the percentage loss of prestress due to friction and slip. Es = 210 kN/mm^2.
[BL: Apply| CO: 2|Marks: 7]

4. (a) What is anchorage slip? How do you compute the loss of stress due to anchorage slip?
[BL: Understand| CO: 2|Marks: 7]

   (b) A concrete beam is post-tensioned by a cable carrying an initial stress of 1000 N/mm^2. The slip at the jacking end was observed to be 5 mm. the modulus of elasticity of steel is 210 mm^2. Estimate the percentage loss of stress due to anchorage slip if the length of the beam is
   i) 30 m ii) 3 m. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

5. (a) What are the different types of flexural failure modes observed in prestressed concrete beams? Explain with sketches. [BL: Understand| CO: 3|Marks: 7]

   (b) A pre-tensioned prestressed concrete beam having a rectangular section 150 mm wide and 300 mm deep, has an effective cover of 50 mm. if fck=40 N/mm^2, f_p=1600 N/mm^2 and the area of prestressing steel A_p=461 mm^2, calculate the ultimate flexural strength of the section using IS 1343. [BL: Apply| CO: 3|Marks: 7]

6. (a) What is the difference in the types of stress blocks adopted in Indian and British zones of prestressed concrete sections? [BL: Understand| CO: 4|Marks: 7]

   (b) A post-tensioned beam with un bonded tendons is of rectangular section 400 mm wide with an effective depth of 300 mm. the cross sectional area of the pre-stressing steel is 2840 mmm^2. The effective prestress in the steel after all losses is 900 N/mm^2. The effective span of the beam is 16 m if fck=40 N/mm^2. Estimate the ultimate moment of resistance of the section using IS code recommendations. [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

7. (a) What is bond stress in pre-tensioned beams? Explain the variation of bond stress with neat sketches. [BL: Understand| CO: 5|Marks: 7]

   (b) A prestressed beam of rectangular section 200 mm wide by 500 mm deep is pre-tensioned by 5 high tensile wires of 7 mm dia located at an eccentricity of 150 mm. the maximum SF at quarter span section 200kN. The modular ratio is 6. Compute bond stress developed assuming the section is un-cracked and the section is cracked. [BL: Apply| CO: 5|Marks: 7]

8. (a) Explain clearly about the Magnel's method and Guyon's method for end block. [BL: Understand| CO: 5|Marks: 7]

   (b) The end block of a post-tensioned beam is 80 mm wide and 160 mm deep. A pre-stressing wire, 7 mm in diameter, stressed to 1200 N/mm^2 has to be anchored against the end block at the center. The anchorage plate is 50 mm by 50 mm. The wire bears on the plate through a female cone of 20 mm diameter. Given the permissible stress in concrete at transfer, fei, as 20 N/mm^2 and the permissible shear in steel as 94.5 N/mm^2, determine the thickness of the anchorage plate. [BL: Apply| CO: 5|Marks: 7]

MODULE – V

9. (a) Distinguish between propped and unpropped construction methods in composite construction using stress diagrams at various stages of construction. [BL: Understand| CO: 6|Marks: 7]

   (b) A composite beam of rectangular section is made up of a pre-tensioned inverted T-beam having a slab thickness and width of 150 and 1000 mm, respectively. The rib size is 150 mm by 850 mm. The cast in situ concrete has a thickness and width of 1000 mm with a modulus of elasticity of 30 kN/mm². the differential shrinkage is 100 x 10 units, estimate the shrinkage stresses developed in the precast and cast in situ units. [BL: Apply| CO: 6|Marks: 7]

10. (a) Explain the advantages of using precast prestressed elements along with in-situ concrete. [BL: Understand| CO: 6|Marks: 7]

    (b) The cross section of a composite beam is of T-section having a pretension rib, 80 mm wide and 240 mm deep, and an in situ cast slab, 350 mm wide and 80 mm thick. The pre-tensioned beam is reinforced with eight wires of 5 mm diameter with an ultimate tensile strength of 1600 N/mm², located 60 mm from the soffit of the beam. The compressive strength of concrete in the in situ cast and precast elements is 20 and 40 N/mm², respectively. If adequate reinforcements are provided to prevent shear failure at the interface, estimate the flexural strength of the composite section. [BL: Apply| CO: 6|Marks: 7]

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