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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

(Dundigal-500043, Hyderabad)

B.Tech VII SEMESTER END EXAMINATIONS (REGULAR) - FEBRUARY 2022

Regulation: R18

PRESTRESSED CONCRETE STRUCTURES

Time: 3 Hours **(CE)** **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) Discuss the advantages of pre-stressed concrete over the conventional reinforced concrete. **[7M]**

   (b) A prestressed concrete beam of section 150 mm wide by 300 mm deep is used over an effective span of 7 m to support a uniformly distributed load of 4 kN/m which includes the self weight of the beam. The beam is prestressed by a straight cable carrying a force of 180 kN, located at an eccentricity of 50 mm. Determine the location of the thrust line in the beam and plot its position at quarter and central span sections. **[7M]**

2. (a) Explain with sketches about freyssinet system of post - tensioning. **[7M]**

   (b) A rectangular concrete beam of cross section 200 mm wide and 300 mm deep is pre – stressed by means of 15 wires of 7 mm diameter located 55 mm from the bottom of the beam and 3 wires of 7 mm, 25 mm from the top. Assuming the prestress in the steel as 900 N/mm^2, calculate the stress at the extreme fibres of the mid span section when the beam is supporting its own weight over a span of 6 m. If a uniformly distributed live load 6 kN/m is imposed, evaluate the maximum working stress in concrete. The density of concrete is 24 kN/m^3. **[7M]**

MODULE – II

3. (a) Why loss due shrinkage is more for pretensioned member compared to post tensioned member? List out the types of Losses of prestress in pretensioned and post tensioned member. . **[7M]**

   (b) A concrete beam is prestressed by a cable carrying an initial pre - stressing force of 300 kN. The cross – sectional area of the wires in the cable is 300 mm^2. Calculate the percentage loss of the stress in the cable only due to shrinkage of concrete using IS: 1343 recommendations assuming the beam to be i) pre-tensioned and ii) post–tensioned. Assume Es = 210 kN/mm^2 and age of concrete at transfer 8 days. **[7M]**

4. (a) Explain the provisions made in IS: 1343 for loss of prestress due to friction. **[7M]**

   (b) A concrete beam of rectangular section, 100 mm wide and 300 mm deep, is prestressed by five wires of 7 mm diameter located at an eccentricity of 50 mm, the initial stress in the wires being 1200 N/mm^2 . Estimate the loss of stress in steel due to creep of concrete using the ultimate creep strain method and creep coefficient method. Use the following data: Es = 210 kN/mm^2; Ec = 35 kN/mm^2. Creep coefficient = 1.6, $\epsilon_{cc} = 41 * 10^{-6}$mm/mm per N/$mm^2$. **[7M]**

MODULE – III

5. (a) What are the different ways of improving shear resistance in concrete members? Describe the moment of resistance of flanged sections. **[7M]**

(b) A prestressed concrete beam having a rectangular section, 150 mm wide and 350 mm deep, has an effective cover of 50 mm. If the $f_{ck} = 40$ N/mm^2, $f_p = 1600$ N/mm^2 and the area of pre - stressing steel $A_p = 461$ mm^2, calculate the ultimate flexural strength of the section using IS: 1343 code provisions. **[7M]**

6. (a) What is effective reinforcement ratio? Explain shear and principal stresses with neat sketch. **[7M]**

(b) The support section of a prestressed concrete beam 100 mm wide and 250 mm deep is required to support an ultimate shear force of 75 kN. The compressive prestress at the centroidal axis is 8 N/mm^2. The characteristic cube strength of concrete is 40 N/mm^2. The cover to the tension reinforcement is 60 mm. If the characteristic tensile strength of steel in stirrups is 250 N/mm^2, design suitable shear reinforcements at the section using I.S. Code recommendations. **[7M]**

MODULE – IV

7. (a) Explain with neat sketch the transmission of prestressing force by bond. **[7M]**

(b) Calculate the transmission length at the end of a pre – tensioned beam as per Hoyer's method using following data: Span of the beam = 55 m, Diameter of wires used = 7 mm, β= 0.0174, Coefficient of friction between steel and concrete = 0.1, Poisson's ratio for steel = 0.3, Poisson's ratio for concrete = 0.15, Es = 210, kN/mm^2, and Ec = 30 kN/mm^2. Ultimate tensile strength of steel wire $f_{pu} = 1500$ N/mm^2. **[7M]**.

8. (a) Mention the functions of end block. Describe the stress distribution in end block with neat sketch. **[7M]**

(b) The end block of a post – tensioned prestressed concrete beam, 400 mm wide and 400 mm deep, is subjected to a concentric anchorage force of 952800 N by anchorage of area 12729mm^2. Design and detail the anchorage reinforcement for the end block. **[7M]**

MODULE – V

9. (a) Demonstrate about the differential shrinkage in composite construction. List the effects of differential shrinkage in composite beams. **[7M]**

(b) Design a composite slab for the bridge deck using a standard inverted T-section. The top flange is 250 mm wide and 100 mm thick. The bottom flange is 500 mm wide and 250 mm thick. The web thickness is 100 mm and the overall depth of the inverted T. Section is 655 mm. The bridge deck has to support a characteristic imposed load of 50 kN/m^2, over an effective span of 12m. Grade 40 concrete is specified for the precast pretensioned T with a compressive strength at transfer of 36 N/mm^2. Concrete of grade-30 is used for the in situ part. Calculate the minimum pre stress necessary and check for safety under serviceability limit state. **[7M]**

10. (a) Explain the term primary moment, secondary moment and resultant moment. **[7M]**

(b) A Concrete beam with a cross sectional area of 32 x 10^3 and radius of gyration of 75 mm is prestressed by a parabolic cable carrying an effective span is 10 m. The cable composed of 7 wires of 8 mm diameter, has an eccentricity of 40 mm at the centre and zero at the supports. Neglect all losses, find the central deflection of the beam under

i) Self-weight + Prestress

ii) Self-weight + Prestress + live load of 3kN/m. **[7M]**

– ○ ○ ◯ ○ ○ –