R13

Code No: 118DV

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year II Semester Examinations, May - 2017

PRESTRESSED CONCRETE STRUCTURES

(Civil Engineering)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.
Assume any Data suitably if found necessary. Use of relevant IS Codes is permitted.

PART - A

(25 Marks)

1.a) Distinguish between Pre-tensioning and Post-tensioning. [2]
b) Explain the principle of prestressing. [3]
c) What is curvature effect? [2]
d) Explain the total amount of losses allowed in the design of pre-tensioning members. [3]
e) State the assumptions made in the analysis of prestressed concrete flexural members. [2]
f) Explain the concept of load balancing. [3]
g) What are the characteristics of an end block? [2]
h) Explain the salient features of Rowe's method of analysis of an end block. [3]
i) What is the influence of differential shrinkage on composite prestressed concrete members? [2]
j) Explain the importance of control of deflections of flexural members. [3]

PART - B

(50 Marks)

2.a) Explain the advantages of prestressed concrete.
b) Explain the Gifford- Udall system of prestressing. [5+5]

OR

3.a) Explain the limitations of prestressed concrete.
b) Explain the Lee McCall system of prestressing. [5+5]

4.a) Explain the different types of losses of prestress in pre-tensioned members.
b) A simply supported post-tensioned concrete beam of span 10 m has section 200 mm × 450 mm is subjected to an initial prestressing force of 300 kN applied at a constant eccentricity of 75 mm by tendons of 250 mm^2. Find the total loss of prestress in the tendons using the following data: $E_S = 2\times10^5$ N/mm^2, E_C = 35 kN/mm^2, anchorage slip = 3 mm, creep coefficient of concrete = 1.5, shrinkage of concrete = 0.0002 and relaxation of steel = 2%. [4+6]

OR

5.a) Explain the various losses of prestress in post-tensioned members.
b) Determine the total loss of prestress in a simply supported pre-tensioned concrete beam of span 12 m and cross-section 250 mm × 500 mm. The beam is pre-stressed with 900 kN at transfer. The steel cable has a cross-sectional area of 750 mm^2 and has a straight profile with an eccentricity of 150 mm. Use M40 grade of concrete and $E_S = 2\times10^5$ N/mm^2. [4+6]

6. Design an I-section for a simply supported post-tensioned concrete beam of span 12 m subjected to an imposed load of 15 kN/m. Adopt the compressive stresses in concrete at transfer as 18 N/mm^2 and 15 N/mm^2 at working load. Assume 20 % losses in prestress and tensile stresses are not allowed in concrete. [10]

OR

7. Design an I-section for a simply supported post-tensioned concrete beam of span 18 m subjected to an imposed load of 25 kN/m over its entire span. The permissible tensile stress in steel is 1250 N/mm^2 and the permissible stresses in concrete are:
At transfer : 20 N/mm^2 (Compression) and 2.5 N/mm^2 (Tensile)
At working load : 15 N/mm^2 (Compression) and 1.5 N/mm^2 (Tensile) [10]

8. A prestressing force of 400 kN is to be transmitted through a distribution plate 200 mm × 150 mm, the centre of which is located at 150 mm from the bottom of an end block of section 200 mm × 400 mm. Determine the position and magnitude of maximum tensile stress on a horizontal section passing through the centre of the distribution plate. [10]

OR

9. Design an end block of a prestressed concrete beam of section 200 mm × 400 mm to transmit the prestressing force of 400 kN by a distribution plate 200 mm× 200 mm concentrically located at the ends. Also determine the maximum bursting force and the maximum tensile stresses. [10]

10. A simply supported pre-tensioned concrete beam of cross-section 200 mm× 350 mm has an effective span of 8 m, is prestressed by tendons with their centroid is 150 mm from the bottom of the beam. The initial prestressing force in tendons is 400 kN. The beam is incorporated in a composite T-beam by casting a top flange of width 450 mm and thickness 60 mm. If the composite beam is subjected to a live load of 15 kN/m^2, determine the resultant stresses developed in the precast and cast-in-situ concrete assuming the pre-tensioned beam is propped. Adopt the loss of prestress as 20% and the modulus of elasticity of concrete in precast and cast-in-situ is the same. [10]

OR

11. Determine the maximum short-term and the long term deflections of a pre-tensioned concrete beam of section 250 mm×500 mm has an effective span of 15 m. The beam is prestressed by a parabolic cable carrying initial force of 600 kN at transfer. The cable is concentric at the supports and has an eccentricity of 150 mm at its mid-span. The beam is subjected to uniformly distributed live load of 15 kN/m in addition to two concentrated loads of 50 kN each at quarter span points respectively. Adopt M40 grade of concrete, loss of prestress as 20%, creep coefficient is 2 and the permanent load of the transverse load is 25%. [10]

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