Code No: 128DV **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year II Semester Examinations, May - 2019
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.

Use of Relevant IS codes is permitted.

PART - A

(25 Marks)

1.a) What are the limitations of prestressed concrete? [2]
b) Explain the necessity of high strength steel in the prestressed concrete construction. [3]
c) List out the percentage of loss of prestress in prestressed concrete members. [2]
d) Explain the Wobble effect. [3]
e) State the assumptions made in the analysis of PSC flexural members. [2]
f) Explain the factors affecting the shear strength of a PSC flexural member. [3]
g) Define transmission length. [2]
h) Explain the importance of Anchorage zone reinforcement. [3]
i) What is the effect of differential shrinkage on the behavior of composite prestressed concrete members? [2]
j) Explain the various factors influencing deflections of PSC beams. [3]

PART - B

(50 Marks)

2.a) Explain the general principles of prestressing.
b) Explain the Freyssinet system of prestressing. [4+6]

OR

3.a) Explain the classification of prestressing.
b) Explain the various systems of prestressing. [4+6]

4. A pre-tensioned beam 230 mm × 300 mm is prestressed by 12 wires of 7 mm diameter initially stressed to 1200 N/mm^2 with their centroid located 50 mm from the sofit. Determine the percentage loss of stress due to elastic deformation, creep, shrinkage and relaxation. Use the following data: Relaxation of steel stress is 125 N/mm^2, creep coefficient is 1.6 and residual shrinkage strain is 3×10^{-4}. [10]

OR

5. A simply supported post-tensioned concrete beam of span 12 m has a section of 250 mm × 500 mm is subjected to an initial prestressing force of 500 kN applied by parabolic tendons of 450 mm^2 with zero eccentricity at the supports and 150 mm at mid-span. Find the total loss of prestress in the tendons using the following data: M40 grade of concrete, $E_S = 2\times10^5$ N/mm^2, anchorage slip = 5 mm, creep coefficient of concrete = 1, shrinkage of concrete = 0.0002 and relaxation of steel = 2%. [10]

6. Design a rectangular pre-tensioned concrete beam of span 6 m subjected to working loads of 25 kN each at the one-third span points. The permissible stresses in tension are zero at transfer and 1.5 N/mm^2 under working loads. The permissible tensile stress in the prestressing wires is 1500 N/mm^2. Assume the loss of prestress is 15%. [10]

OR

7. A beam of unsymmetrical I-section, top flange 300 mm wide and 75 mm thick; bottom flange 200 mm wide and 75 mm thick; the thickness of the web is 60 mm; the total depth of the beam is 400 mm. The beam is subjected to a uniformly distributed live load of 25 kN/m. Determine the stresses at the mid-span section if the effective prestressing force is 600 kN located at 50 mm from the soffit of the beam. [10]

8. A prestressing force of 500 kN is to be transmitted through a distribution plate 150 mm × 150 mm, the centre of which is located at 125 mm from the bottom of an end block of section 150 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. The end block of a post-tensioned concrete member is of size 450 mm × 450 mm. Four cables, each made up of 8 wires of 10 mm diameter strands and carrying a force 1500 kN are anchored by plate anchorages, 200 mm × 200 mm, located with their centres at 150 mm from the edges of the end block. Design suitable anchorages for end block. Assume the grade of concrete is M 45, the strength of concrete at transfer is 25 N/mm^2 and the yield strength of anchorage reinforcement is 500 N/mm^2. [10]

10. Determine the flexural strength of a composite T-beam section consists of a pre-tensioned rectangular beam, 150 mm × 300 mm, with a cast in-situ slab 450 mm wide and 75 mm deep laid over the beam. The beam contains 12 wires of 5 mm diameter located 50 mm from the soffit. The tensile strength of steel is 1600 N/mm^2 and the strength of concrete in the slab is 30 N/mm^2. [10]

OR

11. Calculate the short-term and long-term deflections of a simply supported prestressed concrete beam of rectangular cross-section 300 mm × 500 mm and span 16 m is prestressed by a parabolic cable with an eccentricity of 150 mm above the neutral axis at the supports and 150 mm below the neutral axis at the mid-span. The prestressing force in the steel cable is 1000 kN with an initial stress of 1250 N/mm^2. The beam is subjected to uniformly distributed load of 25 kN/m in addition to a concentrated load of 100 kN at its mid-span. Adopt M40 grade of concrete, loss of prestress is 20% and creep coefficient is 2. [10]

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