Code No: 156CN

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, July - 2023

PRESTRESSED CONCRETE

(Civil Engineering)

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

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.
iv) **IS 1343-2012** is permitted.

PART – A

(25 Marks)

1.a) State two advantages of prestressed concrete. [2]
b) Differentiate between pretensioning and post-tensioning in prestressed concrete. [3]
c) What are the components of loss of prestress due to friction? [2]
d) What are the common causes of prestress loss in prestressed concrete members? [3]
e) What are the different modes of shear failure in prestressed concrete? [2]
f) Explain the strain-compatibility method. [3]
g) Define the term end block. [2]
h) Explain Hoyer effect with a neat sketch. [3]
i) List out the types of composite beams. [2]
j) Distinguish between short-term and long-term deflection. [3]

PART – B

(50 Marks)

2. Explain the general principles of prestressed concrete and its application in structural engineering. [10]

OR

3. Describe the advantages and limitations of prestressed concrete as a structural material compared to reinforced concrete. [10]

4. Compare and contrast the Magnel, Freyssinet, Gifford-Udall, and Lee McCall system in terms of their principles and applications in prestressing. [10]

OR

5. A pre-tensioned concrete member of length 12 m and having a cross-section of 300 mm by 600 mm is concentrically prestressed with 4 Nos of steel tendons of cross-sectional area 788 mm^2. The grade of concrete is M45. The tendons are anchored to the bulk heads at the prestressing bed with initial prestress of 1000 MPa. Calculate the loss of prestress as per IS 1343-2012 due to shrinkage of concrete after 1 year form the time of casting concrete and for the whole service life shrinkage. Assume the relative humidity as 50 percent and all faces of the beam is exposed to atmosphere. Take Es = 200 GPa. [10]

6. An unsymmetrical I-section bridge girder has the following sectional properties: area of cross-section = 777×10^3 mm^2, moment of inertia = 22×10^{10} mm^4, width and thickness of top flange = 1200 mm and 360 mm, respectively, and the thickness of web = 240 mm. The centroid of the section is located at 580 mm from the top. The girder is used over a span of 40 m. The tendons with a cross-section of 700 mm^2 are parabolic with an eccentricity of 1220 mm at the centre of span and zero at supports. The effective prestress in the wires is 800 N/mm^2. If the tensile strength of concrete is 4.5 MPa, estimate the ultimate shear resistance of the section, assuming the failure to take place when the principal tensile stress reaches a value equal to the tensile strength of concrete. Overall depth of the section is 2000 mm. [10]

OR

7. A prestressed concrete beam 200 mm wide and 300 mm deep, is used over an effective span of 6 m to support an imposed load of 4 kN/m. At the quarter-span section of the beam, find the magnitude of the concentric prestressing force necessary for zero fibre stress at the soffit when the beam is fully loaded, and the eccentric prestressing force located 100 mm from the bottom of the beam which would nullify the bottom fibre stress due to loading. Assume the density of concrete is 24 kN/m^3. [10]

8. The end block of a post-tensioned concrete beam is square size 400 mm and is subjected to a concentric force of 1200 kN with an anchorage system having an area of 1200 mm^2. Determine the bursting force, amount of reinforcement and its distribution in the anchorage block using IS 1343-2012.Use Fe 500 grade of steel. [10]

OR

9. Explain the relationship between development length, transfer length and flexural bond length. [10]

10. Elaborate the differential shrinkage in composite beams, including its causes, effects on the overall behavior of the structure, and the measures taken to mitigate its impact on the performance of composite beams. [10]

OR

11. A prestressed concrete beam, 150 mm wide and 300 mm deep is simply supported over span of 8 m, prestressed by a parabolic cable having an eccentricity of 25 mm towards the top at support and 75 mm from the soffit at midspan. If the prestressing force is 350 kN, calculate the midspan deflection supporting its own weight and the concentrated load which must be applied at mid-span to restore it to the level of supports. [10]

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