Code No: 137FY

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, March - 2021
PRESTRESSED CONCRETE
(Civil Engineering)

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

Answer any Five Questions
All Questions Carry Equal Marks

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Note: Use of IS 1343 is permitted.

1.a) Explain the general principles of prestressing.
b) Explain the advantages and limitations of prestressed concrete. [7+8]

2.a) Describe the Magnel-Blaton System of post-tensioning.
b) A simply supported post-tensioned concrete beam of section 230 mm × 350 mm has 8 m span. The beam is subjected to an initial prestressing force of 450 kN by a parabolic cable, concentric at supports and an eccentricity of 60 mm at mid-span. The cable consists of 6 wires each of cross-section 50 mm^2. Assuming $E_S = 2 \times 10^5$ N/mm^2, M45 Grade of concrete, anchorage slip = 2.5 mm, creep coefficient of concrete = 1.6, shrinkage of concrete = 0.00025, relaxation of stress in steel = 3%, the wave effect is 0.002/m length and the coefficient of friction between duct and cable is 0.5, find the percentage loss of prestress. [7+8]

3. Design a symmetrical I-section for a simply supported post-tensioned concrete beam of span 12 m subjected to an imposed load of 20 kN/m over its entire span. The permissible tensile stress in steel is 1200 N/mm^2 and the permissible stresses in concrete are:
At transfer : 15 N/mm^2 (Compression) and 2 N/mm^2 (Tensile)
At working load : 10 N/mm^2 (Compression) and 1 N/mm^2 (Tensile). [15]

4. Design the shear reinforcement for a post-tensioned simply beam of span 18 m. The beam has a symmetrical I-section: Flanges 500 mm wide and 100 mm thick, the thickness of the web is 75 mm and the total depth of the section is 750 mm. The beam is subjected to a dead load of 10 kN/m and a live load of 20 kN/m at working load level. It is subjected to an effective prestressing force of 1200 kN using parabolic tendons with eccentricity is zero at the ends and 200 mm at the mid-span. Adopt, Concrete is of M40 grade, the stress in prestressing steel is 1600 N/mm^2 and the yield stress of stirrup steel is 250 N/mm^2.[15]

5. Explain the anchorage zone stresses in post-tensioned concrete members and describe the Guyon's method of end block design. [15]

6. The end block of a prestressed concrete beam is 150 mm wide and 300 mm deep, supports an eccentric prestressing force of 200 kN, the line of action of which passes at 50 mm from the soffit of the beam section. The depth of the anchor plate is 100 mm. Determine the magnitude and position of the principal tensile stress on a horizontal plane passing through the centre of the anchorage plate. [15]

7. A simply supported precast pre-tensioned concrete beam, cross-section 200 mm× 350 mm and an effective span of 9 m, is prestressed by tendons with their centroid coinciding with the bottom kern. The initial prestressing force in tendons is 300 kN. The beam is incorporated in a composite T-beam by casting a top flange of width 500 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 as unpropped. Adopt the loss of prestress as 15% and the modulus of elasticity of concrete in precast and cast-in-situ is the same. [15]

8. A simply supported prestressed concrete beam of span 12 m has cross-section section 230 mm × 500 mm is prestressed by a parabolic cable with an eccentricity of 60 mm above the neutral axis at the supports and 120 mm below the neutral axis at the mid-span. The beam is subjected to uniformly distributed load of 20 kN/m in addition to two concentrated loads of 25 kN at quarter span points respectively. The prestressing force is 300 kN. Adopt M40 concrete, loss of prestress is 15% and creep coefficient is 1.8. Calculate the short-term and long-term deflections. [15]

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