GUJARAT TECHNOLOGICAL UNIVERSITY ME - SEMESTER- I • EXAMINATION – WINTER • 2014

Subject Code: 712007N Subject Name: Prestressed Concrete Time: 10:30 am - 01:00 pm Instructions:

Total Marks: 70

Date:05-12-2014

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- 4. Use of IS 1343 and IS 456 are permitted.
- Q.1 (a) Why high strength materials are required in pre-stressed concrete? Write 07 strength requirements of steel and concrete.
 - (b) A rectangular beam of span 8.0 m and cross-section 250mm x 450mm is 07 subjected to UDL of 7.5 kN/m including its self weight. The beam is Prestressed by straight cable carrying a force of 300 kN and located at an eccentricity of 75 mm. Determine the location of the thrust line in the beam.
- Q.2 (a) Enlist different types of losses in prestress in pre-tensioning and post 07 tensioning & its performance on prestress concrete. Also define the transmission length.
 - (b) A rectangular concrete beam, 100mm wide x 300 mm deep, spanning 8m is **07** prestressed by straight cable carrying an effective prestressing force of 250 kN located at an eccentricity of 75 mm from soffit. The beam supports a live load of 2.0 kN/m. Calculate the resultant stress distribution for the central cross-section of the beam. Take density of concrete = 24 kN/m^3

OR

- (b) A pre-stressed beam, 200 mm wide and 300 mm deep, is prestressed by 10 **07** wires of 7 mm diameter initially stressed to 1200 N/mm², with their centroids located 100 mm from the soffit. Find the maximum stress in concrete immediately after transfer, allowing only for elastic shortening of concrete. If the concrete undergoes a further shortening due to creep and shrinkage while there is a relaxation of 5 per cent of steel stress, estimate the final percentage loss of stress in the wires using IS:1343 and following data: $Es = 210 \text{ kN/mm}^2$, $Ec = 5700(fcu)^{\frac{1}{2}}$, $fcu = 45 \text{ N/mm}^2$, creep co-efficient (Φ) = 1.6, Total residual shrinkage strain = 3×10^{-4}
- Q.3 (a) What are the advantages of Partial prestressing? 07
 - (b) Explain the methods of achieving continuity in Prestressed concrete. 07

OR

Q.3 (a) A concrete beam with a rectangular cross-section 300mm wide x 450mm 07 deep is prestressed by two post-tensioned cables of area 600mm² each, initially stressed to 1200 N/mm². The cables are located at a constant eccentricity of 75 mm throughout the length of the beam having a span of 14m. Take Es = 200 GPa and Ec= 35 GPa.
a) Neglecting all losses, find the deflection at the centre of span when it is

a) Neglecting all losses, find the deflection at the centre of span when it is supporting its own weight.

b) Allowing for 15 % loss in prestress, find the final deflection at the centre of span when it carries an imposed load of 15kN/m. Take density of concrete = 24 kN/m³.

(b) A pretensioned T-section has a flange 950 mm wide and 120 mm thick. The 07

width and depth of the rib are 200 mm and 1100 mm respectively. The hightensile steel has an area of 5000 mm² and is located at an effective depth of 1150 mm. If the characteristic cube strength of the concrete and the tensile strength of steel are 40 MPa and 1500 MPa respectively, calculate the flexural strength of the T section.

- Q.4 (a) What do you meant by Prestressed concrete? Differentiate Pre-tensioning 07 and Post-tensioning.
 - (b) A prestressed concrete beam having a rectangular cross-section of 250mm x 07 500mm. The section is subjected to torsional moment (twisting) of 25 kN-m. Find shear stress due to torsion at the soffit of the beam. Take $\alpha = 0.25$. Also find compressive stress at the soffit of the beam if a prestressing force of 175 kN is acting at an eccentricity of 125mm.

OR

Q.4 (a) A prestressed concrete beam 150 mm wide and 320 mm deep is used to **07** support a uniformly distributed live load of 4.5 kN/m over an effective span of 5 m. The beam is prestressed by a straight cable carrying an effective prestressing force of 200 kN at a constant eccentricity of 70mm. Given $E_c = 40 \text{ kN/mm}^2$, the modulus of rupture= 5.5 N/mm², area of the cable = 250mm² and modular ratio = 5, estimate the deflection of the beam at the following stages:

(a) working load (b) cracking load.

- (b) The end block of post tensioned prestressed concrete beam, 500 mm wide 07 and 500mm deep is subjected to a concentric anchorage force of 1500 kN by a circular anchorage area of 17500 mm². Design and detail the anchorage reinforcement for the end block using IS: 1343 codal provisions.
- Q.5 (a) A rectangular pre-tensioned concrete beam has a breadth of 100 mm and 07 depth 230 mm, and the prestress after all losses have occurred is 12 N/mm² at the soffit and zero at the top. The beam is incorporate in a composite T-beam by casting a top flange of breadth 300 mm and depth 50 mm. Calculate the maximum uniformly distributed live load that can be supported on a simply supported span of 4.5 m, without any tensile stresses occurring when the slab is externally supported while casting.
 - (b) A pre-tensioned prestressed concrete beam of rectangular section is required 07 to support a design ultimate moment of 150 kN-m. Design the section if $f_{ck} = 45$ MPa and $f_p = 1500$ MPa.

OR

- Q.5 (a) Design a cylindrical pipe of 1000 mm diameter for water supply at working pressure 1.25 N/mm². Find the pitch of 2.5 mm diameter wires, if initial prestress is to be limited to 1250 N/mm². Take cube strength at transfer is 40 N/mm². Find safety factor against cracking at working stage, if residual compression in concrete is required to be 2.2 N/mm². Assume prestress losses as 15 % and cube strength at working stage as 45 N/mm².
 - (b) A two span continuous beam ABC (AB = BC = 12 m), having a rectangular 07 cross section of width 200 mm and depth 600 mm. A cable carrying an effective prestressing force of 400 kN is parallel to axis of the beam and located at an eccentricity of 150 mm. Determine the secondary and resultant moment developed at the mid-support section B. Also locate the resultant line through beam AB.
