Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. IST Semester–Remedial Examination – July- 2011

Subject code: 712007N

Subject Name: Prestressed Concrete

Date:12/07/2011 **Time: 10:30 am – 01:00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **IS 1343-1980 is permitted.**

Q.1 **(a)** Define following terms commonly used in the study of prestressed concrete **07**

1) Tendon 2) Axial Prestressing
3) Eccentric Prestressing 4) Concordant Prestressing
5) Circular Prestressing 6) Transmission length
7) Degree of Prestressing

(b) Discuss limitation of Prestress in long spans. Also discuss limiting zone for the prestressing force. **07**

Q.2 **(a)** A prestressed concrete beam of section 150mm wide by 300mm deep is used over an effective span of 6m to support a u.d.l. of 5 kN/m, including self wt. The beam is prestressed by a straight cable carrying a force of 200 kN and located at an eccentricity of 50mm. Determine the location of the thrust line in the beam and plot its position at quarter and central span sections. **07**

(b) A rectangular concrete beam, 200mm wide and 500mm deep, is prestressed by means of 4-12mm diameter high-tensile bars located 150mm from the soffit of the beam. If the effective stress in the wires is 700 N/mm^2, what is the maximum bending moment that can be applied to the section without causing tension at the soffit of the beam? **07**

OR

(b) A rectangular concrete beam, 100mm wide x 250mm deep, spanning 8m is prestressed by straight cable carrying an effective prestressing force of 250kN located at an eccentricity of 40mm. The beam supports a live load of 1.2kN/m. Calculate the resultant stress distribution for the central cross-section of the beam. Density of concrete = 24kN/m^3. **07**

Q.3 **(a)** A concrete beam with a rectangular cross-section 300mm wide x 500mm deep is prestressed by two post-tensioned cables of area 500mm^2 each, Initially stressed to 1500N/mm^2. The cables are located at a constant eccentricity of 100mm throughout the length of the beam having a span of 12m. Take Es = 210GPa and Ec= 40GPa. **07**

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

b) Allowing for 20% loss in prestress, find the final deflection at the centre of span when it carries an imposed load of 20kN/m. Take density of concrete = 24 kN/m^3.

(b) A rectangular concrete beam, 250mm deep and 175mm wide is prestressed by means of 12-5mm diameter wires located 55mm from the bottom of the beam and 3-5mm dia. wires located 25mm from the top of the beam. If the wires are initially tensioned to a stress of 900 N/mm^2, calculate the percentage loss of stress in steel immediately after transfer, allowing for the loss of stress due to elastic deformation of concrete only. **07**

OR

Q.3 **(a)** Sketch beams with different cable profiles and give formula to find deflection in each one of them. **07**

(b) Enlist various types of flexural failures and describe any one. **07**

Q.4 **(a)** A pretensioned T-section has a flange 1000mm wide and 125mm thick. The width and depth of the rib are 240mm and 1250mm respectively. The high-tensile steel has an area of $4000mm^2$ and is located at an effective depth of 1325mm. If the characteristic cube strength of the concrete and the tensile strength of steel are 40 MPa and 1600 MPa respectively, calculate the flexural strength of the T-section. **07**

(b) A prestressed concrete beam having a rectangular cross-section of 300mm(W) x 600mm(D). The section is subjected to torsional moment (twisting) of 20kN-m. Find shear stress due to torsion at the soffit of the beam. Take $\alpha = 0.246$. Also find compressive stress at the soffit of the beam if a prestressing force of 150kN is acting at an eccentricity of 160mm. **07**

OR

Q.4 **(a)** Enlist different types of losses encountered in the pre-tensioning and post-tensioning systems. Explain any one. **07**

(b) Write advantages of prestressed concrete poles. **07**

Q.5 **(a)** A pre-tensioned prestressed concrete beam of rectangular section is required to support a design ultimate moment of 125kN-m. Design the section if $f_{ck} = 50MPa$ and $f_p = 1600$ MPa. Assume width (b) = 0.5 x effective depth(d). **07**

(b) Draw neat sketches of typical cross-sections of poles widely employed. **07**

OR

Q.5 **(a)** A pre-tensioned beam is prestressed using 5mm diameter wires with an initial stress of 80% of the ultimate tensile strength of steel (fpu = 1600MPa). The cube strength of concrete at transfer is 30MPa. Calculate : **07**

a) The transmission length

b) The bond stress at ¼ and ½ the transmission length from the end and,

c) Overall average bond stress.

(b) Write design procedure of prestressed concrete circular tanks to compute minimum wall thickness, circumferential prestressed, spacing of wires and vertical prestressed required. **07**

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