Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Examination January 2010

Subject code: 712007 **Subject Name: Prestressed Concrete**

Date: 27 / 01 / 2010 **Time: 12.00 – 2.30 pm**

Total Marks: 60

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Assume density of concrete as 24 kN/m^3 until otherwise stated.**
5. **IS 1343 is permitted.**

Q.1 **(a)** The T-section of composite beam having a cross-section is as under. **08**
Pretensioned rib – 90 mm wide and 240 mm deep
Cast in situ slab – 350 mm wide and 90 mm thick
This pretensioned beam is reinforced with 10 wires of 5 mm diameter with an ultimate tensile strength of 1600 MPa, located70 mm from the soffit of the beam. The compressive strength of concrete in the precast elements and in situ cast is 50 and 25 MPa respectively. Estimate the flexural strength of the composite section, by assuming that adequate reinforcements are provided to prevent shear failure at interface.

(b) Explain in short "Concordant Cable Profile" and "Cap Cable" **04**

Q.2 **(a)** Locate the pressure line of thrust for continuous beam ABC (AB = BC = 12 m), having a rectangular cross section with width 120 mm depth 300 mm. The beam is subjected to live load of 1.50 kN/m. The cable carrying an effective prestressing force of 400 kN is parallel to axis of the beam and located at 100 mm from the soffit. **06**

(b) Under which critical load conditions prestressed concrete poles are designed? Draw the various sketches for cross sections of prestressed concrete poles. **06**

OR

(b) Write the advantages of prestressing long span shell structures. **06**

Q.3 **(a)** A prestressed concrete beam of 6 m length having 150 mm width and 320 mm depth, subjected to UDL of 4 kN/m (including the self weight). The beam is prestressed by straight cable carrying a force of 200 kN and located at an eccentricity of 60 mm. Determine the location of thrust line in the beam (shift of central and quarter position). **06**

(b) What are the types of losses of prestress? Explain loss of prestress due to relaxation of stress in steel. **06**

OR

Q.3 **(a)** A post tensioned concrete beam of section 150 x 320 mm is stressed by a parabolic cable with zero eccentricity at support and an eccentricity of 60 mm at the centre of span. The area of cable is 250 mm^2 and initial stress in the cable is 1200 N/mm^2. If ε_{cc} = 30 x 10^{-6} mm/mm per N/mm^2 of stress and E_{steel} = 210 kN/mm^2, Calculate the loss of stress in steel only due to creep in concrete. **06**

(b) Explain the reasons to control the deflection. What are the factors that influence the deflection? **06**

Q.4 **(a)** A post tensioned beam of span 14 m, 450 mm wide and 800 mm of effective depth with unbonded tendons. The cross sectional area of prestressing steel is 2800 mm^2 and effective prestress in the steel after all losses is 900 MPa. If f_{ck} = 40 MPa, Find the ultimate moment of resistance by using IS code provisions. **08**

(b) Write in short "Methods of Pretensioning" with neat sketches. **04**

OR

Q.4 **(a)** A prestressed I section has following properties: **08**
Area = 60 x 10^3 mm^2, MOI = 200 x 10^7 mm^4
Statical moment about centroid = 450 x 10^4 mm^s
Thickness of web = 60 mm
It is prestressed by 20 wires of 5 mm diameter and vertically by similar wires at 150 mm centres. All the wires carry a tensile stress of 900 MPa. Find the principal stresses at the centroid when a shearing force of 100 kN acts upon this section.

(b) Draw the neat sketches for idealized stress path and bursting tension for end block of post tensioned beam. **04**

Q.5 **(a)** Write the steps for the design of prestressed tension members. **04**

(b) A rectangular concrete box section has an overall width of 900 mm and overall depth of 1200 mm. the concrete walls are 150 mm thick on both horizontal and vertical parts of the box. The permissible diagonal tensile stress in concrete is 0.63 MPa. Determine the maximum permissible torque if the section is uniformly prestressed by a force of 450 kN. The permissible tensile stress in steel is 230 MPa. Also determine the amount of non-prestressed reinforcement required for the box section if the torsional resistance moment of the section is to be increased to 345 kN m. Use 50 mm cover. Assume 12 mm diameter of stirrups. **08**

OR

Q.5 **(a)** Explore the concept of load balancing. **04**

(b) Explain the Indian standard recommendations for design of prestressed members subjected to combined shear, torsion and bending. **08**

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