Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Regular Examination January / February 2011

Subject code: 711508N

Subject Name: Prestressed Concrete

Date: 03 /02 /2011 **Time: 02.30 pm – 05.00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of IS:456, IS:1980, IS:3370-Part-III and IS:784 is permitted.**

Q.1 A pre-tensioned simply supported beam have effective span of 8 m and subjected to imposed load of 4 kN/m. Other necessary data are as follows: Load factor for dead load=1.4, Load factor for live load=1.6, concrete cube strength fcu=50 MPa, cube strength at transfer fci=30 MPa, tensile strength of concrete ft=1.7 MPa, Ec=34 MPa, Loss ratio=0.8,Permissible stresses at transfer fct=15MPa and ftt= -1 MPa, Permissible stress at working load fcw=17 MPa and ftw=0 MPa, 7mm high-tensile steel wires with fpu =1600MPa are available. **14**

Using above data carryout (i) computation of ultimate moments and shears (ii) Fix up dimensions of I-section to resist design forces (iii) calculate minimum section modulus and (iv) compute prestressing force and eccentricity.

Q.2 **(a)** In continuation of Q.1 carryout check for ultimate flexural strength and check for ultimate shear strength-section at support(uncracked in flexure) **07**

(b) In continuation of Q.1 check for ultimate shear strength-section cracked in flexure with maximum shear. **07**

OR

(b) In continuation of Q.1 check beam for limit state of deflection. **07**

Q.3 **(a)** Define and explain in brief following terms used in prestressed concrete: (i)Anchorage (ii) Transmission length (iii) Cap cable. **06**

(b) A concrete beam with double overhang has the middle-span equal to 8m, left overhang 2m and right overhang 3m. The cross-section of beam is rectangular of size 300mm x 900mm. Determine the profile of the prestressing cable with effective force of 250 kN which can be balance a UDL of 4 kN/m on beam, which exclude self weight of the beam. Sketch the cable profile marking the eccentricity of cable at support and midspan. Take unit weight of concrete 25 kN/m^3. **08**

OR

Q.3 **(a)** Define and explain in brief following terms used in prestressed concrete: (i)Tendon(ii) Bonded prestressed concrete (iii) Transfer. **06**

(b) A simply supported prestressed concrete beam has span 9m and rectangular cross-section of 250mm x 400mm. Beam support 50% non-permanent imposed load of 3kN/m. The tendon follows a trapezoidal profile with an eccentricity of 100mm within the middle third of span and zero at the supports. The area of tendons Ap=350mm^2 have effective prestress of 1300 N/mm^2 immediately after transfer. Using following data calculate short term deflections. Take unit weight of concrete 25 kN/m^3, Ec=34GPa, Es= 200 GPa, creep coefficient = 2, concrete shrinkage = 450 x 10^{-6} and relaxation of steel stress = 10%. **08**

Q.4 **(a)** Enlist and explain various methods generally used for the investigation of anchorage zone stresses. Also mention codal provisions in this regards. **05**

(b) A cylindrical prestressed concrete water tank of internal diameter 40m is required to store water over a depth of 8m. The permissible compressive stress in concrete at transfer is 13MPa and minimum compressive stress under working pressure is 1 MPa. The loss ratio is 0.8. Wires of 5mm diameter with an initial stress of 1000MPa are available for circumferential winding and Freyssinet cables made up of 12 wires of 8mm diameter stressed to 1200 MPa are to be used for vertical prestressing. Design tank wall assuming base connection to be fixed and tentative initial thickness of wall 220mm. Take Maximum ring tension = 912 N/mm and Maximum moment in tank wall for fixed base condition = 92160 N.mm/mm for design. **09**

OR

Q.4 **(a)** A prestressed concrete pile, 300mm square, contains 80 pretensioned wires, each of 2mm diameter, uniformly distributed over the section. The wires are initially tensioned on the prestressing bed with a total force of 400kN. Calculate the final stress in the concrete and the percentage loss of stress in steel after all losses. Consider following data: Es=210GPa, Ec=32 GPa, shortening due to creep=30 x 10^{-6} mm/mm per MPa of stress, total shrinkage = 200 x 10^{-6} per unit length, relaxation of steel= 5% of initial stress. **06**

(b) Design a non-cylinder prestressed concrete pipe of 800mm internal diameter to withstand a working hydrostatic pressure of 1.2MPa, using a 3mm high-tensile wires stressed to 1000MPa at transfer. Permissible maximum and minimum stresses in concrete at transfer and service loads are 14 MPa and 0.7 MPa. The loss ratio is 0.75. Calculate also the test pressure required to produce a tensile stress of 0.7 MPa in concrete when applied immediately after tensioning and also winding stress in steel if Es= 210 GPa and Ec= 35 GPa. **08**

Q.5 **(a)** A post tensioned bridge girder with unbounded tendons is of box section of overall dimensions 1400mm wide x 2000mm deep, with wall thickness of 175mm. The high tensile steel has an area of 6000mm^2 and is located at an effective depth of 1800mm. The effective prestress in steel after all losses is 1000 MPa and effective span of the girder is 25m. If fck=40 MPa and fp= 1600 MPa, calculate ultimate flexural strength of the section. **07**

(b) The support section of a prestressed concrete beam, 150mm wide and 300mm deep, is required to support ultimate shear force of 110kN. The compressive prestress at the centroidal axis is 5MPa. The fck=40MPa.The cover to reinforcement is 50mm. If fy=415MPa for steel of stirrups. Design suitable reinforcement at the section as per codal provisions. **07**

OR

Q.5 **(a)** (i) State the advantage of continuous members in prestressed concrete structures. **06**
(ii) Briefly explain the advantage of prestressing long span shell structures.
(iii)Explain with neat sketches the different type of cross-sections generally used for poles.

(b) The deck slab of a road bridge of span 9m is to be designed as a one-way pre stressed concrete slab, with parallel post-tensioned cables in each of which the force transfer is 450 kN. If the deck slab is required to support a uniformly distributed load of 30kN/m^2, with the compressive and tensile stress in concrete at any stage not excceding 14 MPa and 0 MPa respectively, calculate the maximum horizontal spacing of the cables and their positions at the mid-span section. Assume the loss ratio as 0..75. **08**

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