Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –I Examination Feb. - 2012

Subject code: 711508N **Date: 21/02/2012**
Subject Name: Prestressed Concrete
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. **Use of IS 1343, IS 3370 and IS 456 is permitted.**

Q.1 A simply supported post tensioned symmetric I- section beam having effective span 18m is a class-I structure. It carries a uniformly distributed load of intensity 40kN/m. The cube strength at transfer is 35MPa and at service loads is 45MPa. The beam is prestressed by steel having characteristic strength 1600MPa. Assume parabolic cable profile and losses in prestress as 18%. Design suitable cross section, cable locations and amount of prestressing steel for flexure. Check suitability of section at mid span and support. **14**

Q.2 **(a)** Design the prestressed wall of a cylindrical tank used in storing a liquid having density 0.9gm/cc. The diameter and height of tank is 15m and 10m respectively. The base of water tank is flexible. Use M40 grade of concrete and steel having characteristic strength 1600MPa. Check the safety under tank empty and tank full conditions. **07**

(b) Explain load balancing concept with respect to a simply supported beam of span L carrying (i) eccentric point load (ii) Uniformly distributed load. Neglect self weight of beam. **07**

OR

(b) (i) How a prestressed concrete is different then a partially prestressed concrete? Which is better and why? **07**
(ii) What is circular prestressing? Write its advantages and disadvantages.

Q.3 **(a)** Enlist various prestressing systems and explain any one which is used in post-tensioned beams. **04**

(b) A post-tensioned concrete beam 200x550mm and length 12m is prestressed with three cables of 220mm^2 prestressing wires each. All the cables are parabolic with central eccentricity 225mm. At ends, cable-1 is 100mm above center line of section, cable-2 is at center whereas cable-3 is at 100mm below center line of section. Cables carry an initial prestress of 1100MPa.. Calculate the percentage loss of stress when cable is stressed **10**
(a) Simultaneously (b) In stages from cable 1 to 3
Concrete f_{ck}= 40 MPa Steel grade : f_p = 1650 MPa
Relaxation of steel = 4% Slippage of steel = 2.5 mm
Use coefficient of shrinkage, creep, friction and wave effect as per IS 1343 assuming suitable data.

OR

Q.3 **(a)** A rectangular beam of span 8.0m and cross-section 300x500mm is prestressed by a parabolic cable with zero eccentricity at end and 100mm eccentricity at center by a prestressing force 1000kN. The beam carries a live load 40kN/m all over its span. Calculate top and bottom fiber stress at center of span. **07**

(b) A cylindrical pipe of diameter 600mm carries pressurized water supply at working pressure 1.5N/mm^2. If the wall is to be prestressed then find the pitch of 2.5mm diameter wires if initial prestress is be limited to 1000N/mm^2. Take cube strength at transfer is 35N/mm^2. Find safety factor against cracking at working stage if residual compression in concrete is required to be 2N/mm^2. Assume prestress losses as 18 % and cube strength at working stage as 40 N/mm^2. Check the safety under pipe empty and full conditions. **07**

Q.4 **(a)** Derive expression for contribution of prestressing force in resisting shear force when cable profile is (i) Parabolic (ii) Linear with zero eccentricity at end and eccentricity 'e' at center. **04**

(b) A simply supported prestressed concrete beam having rectangular section 250x500mm, spans over 8m. The beam is prestressed by a straight cable at eccentricity 125mm. Working load over beam is 12kN/m. **10**

Determine central deflection of beam at

(i) Transfer stage: Prestressing force 200kN and characteristic cube strength 35MPa.

(ii) Final stage: Prestressing force 275kN and characteristic cube strength 45MPa.

OR

Q.4 **(a)** A rectangular beam cross section BxD has a prestressing cable at eccentricity 'e', carries bending moment M and shear force S. If effective prestress force at section is P, find expression for maximum shear stress at mid section and soffit section. **07**

(b) A post tensioned beam is prestressed by a cable containing 7 wires of 6mm diameter which are stressed to 1200MPa. These wires are to be anchored through a plate 100x100mm placed at the center of section having dimensions 200x200mm. If the permissible bending stress in steel plate is 165MPa, determine its thickness. The characteristic strength of concrete and steel is 40MPa and 1600MPa respectively **07**

Q.5 **(a)** A post tensioned T-Section girder having top flange 1000mm wide and 200mm depth and web 200mm width and 900mm depth. The girder is prestressed by 12 nos. 7 ply-8mm strands situated in bottom flange at 75mm from bottom. The characteristic strength of concrete and steel is 45MPa and 1600MPa respectively. Calculate moment of resistance of the section. **07**

(b) A prestressed I – section concrete beam with flanges 250x75mm and web 500x75mm is prestressed with 250mm^2 prestressing wires. The wires are placed at eccentricity of 200mm at center of span and zero eccentricity at ends, in parabolic profile. It carries final prestress of 1250MPa. The beam has simply supported span 12m and carries a UDL 12kN/m and central point load 50kN. Design required shear reinforcement. **07**

OR

Q.5 **(a)** What do you understand by concordant profile of a prestressing cable? Why and in which condition such profiles are adopted? Explain with an example. **07**

(b) Write a short note on **07**

(i) Anchorage zone

(ii) Use of prestressed concrete in construction world

(iii) Bonded and unbonded prestressed concrete

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