Date: 11/07/2012

**Total Marks: 70** 

# **GUJARAT TECHNOLOGICAL UNIVERSITY**

## M.E –I<sup>st</sup> SEMESTER–EXAMINATION – JULY- 2012

Subject code: 711508N

Subject Name: Pre stressed Concrete

Time: 2:30 pm – 05:00 pm

## **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 post tensioned symmetric I- section beam having effective span 15m carries a uniformly distributed load of intensity 40kN/m. The cube strength at transfer is 40MPa and at service loads is 45MPa. The beam is prestressed by steel having characteristic strength 1800MPa. Assume parabolic cable profile and losses in prestress as 16%. Design suitable cross section, cable locations and amount of prestressing steel for flexure at the center of span. The structure is a class-I structure.
- Q.2 (a) A rectangular beam of span 8.0m and cross-section 350x600mm is prestressed 07 by a parabolic cable with zero eccentricity at end and 150mm eccentricity at center by a prestressing force 1500kN. The beam carries a live load 100kN at the center of its span. Calculate top and bottom fiber stress at center of span.
  - (b) How the cable profile affects the stress distribution across the depth of beam? 07 Explain with example. Neglect self weight of beam.

#### OR

- (b) Explain various anchorage systems for post-tensioned beams.
- **Q.3** (a) Differentiate between pre-tensioned and post tensioned concrete.
  - (b) A liquid with density 900kg/cum is stored in a cylindrical tank. The diameter 08 of tank is 15m and its height is 10m. Assuming flexible base, design the wall of water tank which is prestressed along its periphery. Use M40 grade of concrete and steel having characteristic strength 1650MPa.

#### OR

- Q.3 (a) A simply supported prestressed concrete beam having rectangular section 07 300x700mm, spans over 9m. The beam is prestressed by a straight cable at eccentricity 150mm. The beam is loaded by a UDL of intensity 30kN/m. A prestressing force of magnitude 300kN is applied. The characteristic strength of cube is 45MPa. Determine central deflection of beam.
  - (b) Design a cylindrical pipe of 750mm diameter for water supply at working pressure 1.50N/mm<sup>2</sup>. Find the pitch of 2mm diameter wires if prestress is to be limited to 1200N/mm<sup>2</sup>. Take cube strength at transfer is 40N/mm<sup>2</sup>. Find safety factor against cracking at working stage if residual compression in concrete is required to be 2N/mm<sup>2</sup>.

### **Q.4** (a) Explain vertical prestressing and it accounts shear resistance of a beam.

(b) A post-tensioned concrete beam 300x1000mm and length 15m is prestressed 10 with three cables of 200mm<sup>2</sup> prestressing wires each. All the cables are straight with central eccentricity 200mm. At ends, cable-1 is 75mm above center line of section, cable-2 is at center whereas cable-3 is at 150mm below center line of section. Cables carry an initial prestress of 1400MPa. The strength of concrete is 40 MPa whereas ultimate strength of steel is 1800 MPa. Assume 5% relaxation of steel and 2.5 mm slippage in steel. Coefficient of

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shrinkage, creep, friction and wave effect can be taken from IS 1343. Assuming other suitable data. Calculate the percentage loss of stress when cable is stressed in stages from cable 1 to 3.

#### OR

- Q.4 (a) Design the section for shear for beam given in Q.1
  - (b) A post tensioned I girder has flanges 500x200mm and web 200x800mm. The 07 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 40MPa and 1600MPa respectively. Calculate moment of resistance of the section.
- Q.5 (a) A post tensioned beam having cross sectional dimensions 500x500mm, is 07 prestressed by a cable containing 7 wires of 8mm diameter. The cables are stressed to 1200MPa and are anchored through a plate 100x100mm placed at the center of cross section. If the permissible bending stress in plate is 165MPa, determine its thickness. The characteristic strength of concrete and steel is 45MPa and 1650MPa respectively.
  - (b) A prestressed rectangular concrete beam having dimension 300x600mm is 07 prestressed with 200mm<sup>2</sup> prestressing wires. The wires are placed at eccentricity of 125mm at center of span and zero eccentricity at ends, in parabolic profile. The cables carry final prestress of 1400MPa. The beam has simply supported span 8m. Design required shear reinforcement if beam carries a UDL 30kN/m.

#### OR

- Q.5 (a) What are bursting stresses in anchorage zone? Draw and explain the stress 08 contours in anchorage zone.
  - (b) Write a short note on
    - (i) Usage of prestressed concrete in structural field
    - (ii) Comparison of reinforced concrete and prestressed concrete
    - (iii) Load balancing concept in beams

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