

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E Sem-I Examination January 2010****Subject code: 711508****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. Use of IS 1343, IS 3370 and IS 456 is permitted.

Q.1 A simply supported post tensioned I- section beam having effective span 28m is a class-I structure. It carries a uniformly distributed load of intensity 20kN/m. The cube strength at transfer is 30MPa 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 16%. Design suitable cross section, cable locations and amount of prestressing steel for flexure. Check suitability of section at mid span, quarter span and support. **18**

Q.2 Explain reasons of prestress loss in a prestressing beam. How does it differ in case of pre-tensioned and post- tensioned beams? **06**

OR

Explain load balancing concept in a prestressed beam. How does the cable profile vary in a simply supported beam with type of loading for (i) Central point load (ii) Two point loading (iii) Uniformly distributed load **06**

Q.3 (a) Explain any two types of post tensioning systems. **04**
(b) A simply supported prestressed concrete beam having rectangular section 150x400mm, spans over 8m. The beam is prestressed by a straight cable at eccentricity 100mm. Working load over beam is 10kN/m. Check the deflection of beam at
(i) Transfer stage: Prestressing force 150kN and characteristic cube strength 30MPa.
(ii) Final stage: Prestressing force 250kN and characteristic cube strength 40MPa. **08**

OR

Q.3 (a) Derive expression for moment of resistance of a prestressed beam using first principle. **04**
(b) A post tensioned box section girder has overall dimensions 1000x 500mm with wall thickness 125mm. The girder is prestressed by 12 nos. 7 ply-8mm strands with effective cover 75mm at bottom. The characteristic strength of concrete and steel is 45MPa and 1600MPa respectively. Calculate moment of resistance of the section. **08**

Q.4 (a) Derive expression to fix the limiting zone for the prestressing force in vertical plane of given cross-section for given loading and, sectional and material properties. **04**

- (b) A post-tensioned concrete beam 250x500mm and length 15m is prestressed with three cables of 200mm² prestressing wires each. All the cables are parabolic with central eccentricity 200mm. 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 1200MPa. Calculate the percentage loss of stress when cable is stressed
 (a) Simultaneously (b) In stages from cable 1 to 3
 Concrete f_{ck} = 40 MPa Steel grade : f_p = 1600 MPa
 Relaxation of steel = 5% Slippage of steel = 1.5mm
 Use coefficient of shrinkage, creep, friction and wave effect as per IS 1343 assuming suitable data.

OR

- Q.4** (a) Design a non cylindrical pipe of 700mm diameter for water supply at working pressure 1.25N/mm². Find the pitch of 2mm diameter wires if initial prestress is to be limited to 1250N/mm². Take cube strength at transfer = 25N/mm². Residual compression in concrete is required to be 2N/mm². Find safety factor against cracking at working stage. Losses are 15 %. The cube strength at working stage is 40 N/mm² **06**
- (b) A cylindrical tank having diameter 20m and height 10m is used to store water. The base of water tank is flexible. Design the wall of water tank which is prestressed along its periphery. Use M40 grade of concrete and steel having characteristic strength 1500MPa. **06**
- Q.5** (a) A post tensioned beam is prestressed by a cable containing 7 wires of 6mm diameter which are stressed to 800MPa. These wires are to be anchored through a plate 75x75mm at the center of section having dimensions 100x150mm. If the permissible bending stress in plate is 165MPa, determine its thickness. The characteristic strength of concrete and steel is 45MPa and 1600MPa respectively **06**
- (b) A prestressed I – section concrete beam with flanges 150x50mm and web 300x50mm is prestressed with 200mm² prestressing wires. The wires are placed at eccentricity of 125mm at center of span and zero eccentricity at ends, in parabolic profile. It carries final prestress of 1200MPa. The beam has simply supported span 10m and carries a UDL 10kN/m and central point load 40kN. It carries a constant torsional moment 25kNm along its length. Design required shear reinforcement. **06**

OR

- Q.5** (a) Calculate principal stresses at center and bottom of section at end span, central span and quarter span of beam described in problem 5(b). **06**
- (b) Write a short note on **06**
 (i) Concordant cable
 (ii) Partial prestressing
 (iii) Need of high strength materials for prestressed concrete
