

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. IST Semester–Remedial Examination – July- 2011****Subject code:711508N****Subject Name: Prestressed Concrete****Date:12/07/2011****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.

- Q.1** A post-tensioned simply supported girder is to be design with following data: Effective span = 25m, imposed load of 10 kN/m, dead load (excluding self wt)= 2.2 kN/m, Load factor for dead load=1.4, Load factor for live load=1.6, concrete cube strength f_{cu} =50 MPa, cube strength at transfer f_{ci} =35 MPa, tensile strength of concrete f_t =1.7 MPa, f_{ct} =17.5 MPa, f_{tt} = f_{tw} =0, f_{cw} =16.67MPa, E_c =34 GPa, Loss ratio=0.8, 7mm dia. high-tensile steel wires with f_{pu} =1500MPa and E_s =200GPa. 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. **14**
- Q.2 (a)** In continuation of Q.1 carryout check for ultimate flexural strength and check for ultimate shear strength-section at support considering un-cracked in flexure. Use IS:1343. **07**
- (b)** In continuation of Q.1 check for ultimate shear strength- considering section cracked in flexure and designed shear reinforcements. Use IS:1343. **07**
- OR**
- Q.3 (b)** In continuation of Q.1 check for deflection at serviceability limit. Use IS:1343. **07**
- Q.3 (a)** In continuation of Q.1 design anchorage reinforcement. Use IS:1343. **07**
- (b)** A pre-tensioned beam of rectangular cross-section 200mm wide and 450mm deep is pre-stressed by 8mm dia. Wires-10 Nos., located at 100mm from the soffit of the beam. If wires are initially tensioned to stress of 1200 MPa, calculate stress after 1 year considering the all losses as per IS:1343. E_s =210GPa and E_c =35 GPa, f_{pu} =1500 MPa. **07**
- OR**
- Q.3 (a)** A pre-stressed concrete beam of rectangular section 300mm by 600mm is 12m long supports a live load of 12 kN/m in addition to self-weight. The beam is pre-stressed by a cable having high tensile wires of 2000mm² area stressed to 800MPa. The cable is straight and located at a distance of 175mm from the soffit of the beam. Determine the resultant stress at top and bottom level and the shift in the pressure line at one-quarter span and central span, when beam supports service loads. **07**
- (b)** A PSC beam of 12m span, 200mm wide and 450mm deep is prestressed by 3 cables by successive tensioning. The area of each cable is 300mm² and the initial stress in cable is 1200 MPa. The first cable is parabolic with an eccentricity of 100mm above the centroid at the support and 100 below at the center of span. The second cable is parabolic with zero eccentricity at support and 100mm below the centroid at center of span. Third cable is straight with uniform eccentricity of 100mm below the centroid. If the cables are tensioned from one end only, estimate % loss of stress in each cable due to friction and elastic shortening. μ = 0.3, K = 0.0015/m and modular ratio=6. **07**

- Q.4** Design a post-tensioned prestressed concrete two-way slab, 5m x 6m with discontinuous edges, to support imposed load of 4kN/m^2 . Cables of 4-wires of 5mm dia. carrying each an effective force of 52 kN are available. Design the spacing of cables in two directions and checked for the safety of the slab against collapse. Assume $f_{ck}=40\text{MPa}$, $f_p=1600\text{MPa}$ and $E_c=38\text{GPa}$. **14**

OR

- Q.4 (a)** A concrete beam with single overhang is simply supported at A and B over a span of 4m and overhang BC is 1m. The cross-section of beam is rectangular of size 200mm x 450mm and support UDL live load of 3.24 kN/m all over the length in addition to its self weight. Determine the profile of the prestressing cable with effective force of 67.5 kN which can be balanced dead load and live load on the beam. Sketch the cable profile marking the eccentricity of cable at support and mid-span. **06**
- (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 hinged and tentative initial thickness of wall 220mm. Take Maximum ring tension = 1080 N/mm and Maximum moment in tank wall for fixed base condition = 30210 N.mm/mm for design. **08**
- Q.5 (a)** Fill in the blank with complete sentence with answer from the parenthesis. **06**
- 1) _____ (Freyssinet, Gifford-Udall, Lee-McCall) system is *not* transferring prestress by wedge action.
 - 2) Pre-stressed electric poles are generally pre-stressed with _____ (axial, eccentric, transverse) pre-stress.
 - 3) Stressing concordant cables in continuous structures results in _____ (secondary moment, zero redundant reaction, axial thrust).
 - 4) Transmission length according to IS:1343, for strand with dia ϕ is _____ (30,65,100) times ϕ .
 - 5) Circular pre-stressing of pipes induces _____ (hoop tension, hoop compression, flexural tension).
 - 6) In pre-tensioned beam, there will be loss in stress due to _____ (Anchorage slip, friction, elastic deformation)
- (b)** A PSC bonded rectangular beam 200mm x 450mm is pre-stressed by two tendons each made-up of 10 Nos. of 7mm diameter wires encased in a thin metallic hose of 40mm diameter with an effective cover of 75mm. The span of the beam 8m and it is subjected to UDL of 40 kN/m run. If $E_s=210\text{GPa}$ and $E_c=35\text{GPa}$, compute unit bond stress (i) between each wire and grout and (ii) between hose and concrete. **07**

OR

- Q.5 (a)** State whether following statements are either *true* or *false*. If false, make it correct. Give justification for both the cases. **06**
- 1) Curved cables are used only in post-tensioned members.
 - 2) Creep of concrete in structural members is due to elastic strain.
 - 3) In PSC beam subjected to prestressed only, pressure line coincides with cable line.
 - 4) The simplest methods to analyse the busting tension is due to Magnel.
 - 5) Composite construction is economical since the ratio of precast unit to the whole composite section is reduced.
 - 6) The bond in pre-tensioned beam between wires and concrete is the maximum at the distance equal to depth of the beam.

- (b) A continuous pre-stressed beam LMN ($LM=MN=12m$) has a uniform cross section $200mm \times 450mm$. The cable carrying effective prestressing force of $450 kN$ is at parallel to axis of the beam, located at $150mm$ from the soffit. (i) determine the secondary moment at central support M. (ii) If the beam supports imposed load of $2.34 kN/m$ run, calculate resultant stresses at top and bottom of beam at M. (iii) Locate resultant line of thrust through out the beam.
