Code No: 07A80105 **R07** **Set No. 2**

**IV B.Tech II Semester Examinations,APRIL 2011**
**PRESTRESSED CONCRETE**
**Civil Engineering**

**Time: 3 hours** **Max Marks: 80**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. Briefly explain the importance of creep of concrete in long term deflections of prestressed members. [16]

2. A rectangular pre-tensioned concrete beam has a breadth of 100 mm and depth of 230 mm, and the prestress after all losses have occurred is 12 N/ $mm^2$ at the soffit and zero at the top. The beam is incorporated in a composite T-beam by casting a top flange of breadth 300 mm and depth 50 mm. Calculate the maximum uniformly distributed live load that can be supported on a simply supported span of 4.5 m, without any tensile stresses occurring, if the pre-tensioned beam supports the weight of the slab while casting. Assume any other missing data. [16]

3. Explain the following with respect to high strength concrete
   (a) Indian standard method
   (b) Permissible stress in concrete. [8+8]

4. A beam of symmetrical I - section spanning 8 m has a flange width of 250 mm and a flange thickness of 80 mm respectively. The overall depth of the beam is 450 mm. Thickness of the web is 80 mm. The beam is prestressed by a parabolic cable with an eccentricity of 150 mm at the centre of the span and zero at supports. The live load on the beam is 2.5 kN/m.
   (a) Determine the effective force in the cable for balancing the dead and live loads on the beam.
   (b) Sketch the distribution of resultant stress at the centre - of - span section for the above case.
   (c) Calculate the shift of the pressure line from the tendon - centre - line. (Assume any other missing data) [16]

5. A post - tensioned prestressed concrete beam has a parabolic cable profile with zero eccentricity at end and an eccentricity of 400 mm at the centre, with respect to fross centroid of the section. If covers a span of 25m and a prestressing force of 400kN is applied from one end A. Determine the loss in prestressing due to friction at the farther end B and hence evaluate the force at B. $\mu = 0.30$, wobble effect = 0.25% unit length of span. Assume any other missing data. [16]

6. The end block of a prestressed concrete beam, rectangular in section, is 120 mm wide and 300 mm deep. The prestressing force of 250 kN is transmitted to concrete by a distribution plate, 120 mm wide and 75 mm deep, concentrically located at the

ends. Calcualte the postion and magnitude of the maximum tensile stress on the horizontal section through the centre of the end block using the Rowe and Magnel methods. Design the reinforcement for the end block for the maximum transverse tension. Yield stress in steel = $260N/mm^2$. Assume any other missing data. [16]

7. (a) Write down what type of cable duct is used in the following post tensioning systems
   i. Freyssinet
   ii. Gifford - udall
   iii. Magnel - Blaton
   iv. Anderson

   (b) Write down the type of method of tensioning is used in the following post tensioning systems
   i. Freyssinet
   ii. Gifford - udall
   iii. Magnel - Blaton
   iv. Anderson [16]

8. A post-tensioned bonded prestressed concrete beam is of rectangular section 200 mm wide by 400 mm deep. The beam is prestressed by $300mm^2$ of high tensile steel located at an eccentricity of 100 mm. The effective prestress after all losses is $800N/mm^2$. The characteristic tensile strength of prestressing steel is $1600N/mm^2$ and the characteristic cube compressive strength of concrete is $40N/mm^2$. The ratio of yield to ultimate tensile stress of steel is 0.90. Estimate the ultimate moment capacity of the section using Indian code regulations. Assume any other missing data. [16]

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Code No: 07A80105 **R07** **Set No. 4**

**IV B.Tech II Semester Examinations,APRIL 2011**
**PRESTRESSED CONCRETE**
**Civil Engineering**

**Time: 3 hours** **Max Marks: 80**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. (a) Distinguish between propped and unpropped construction methods in composite construction using stress diagrams at various stages of construction.
   (b) Briefly outline the method of estimating the deflection of composite members in cases of
      i. Unpropped construction and
      ii. Propped construction. [8+8]

2. (a) What are the different ways of improving the sheer resistance of structural concrete members by prestressing techniques?
   (b) Distinguish between web sheer flexural and flexure-sheer cracks in concrete beams with sketches. [8+8]

3. (a) Briefly outline the Magnel's method of computing the horizontal and transverse stresses in end blocks subjected to concentrated force from anchorage.
   (b) How do you compute the bursting tension in an end block subjected to evenly distributed forces using Guyon's method? [8+8]

4. (a) Distinguish between low, medium and high strength concrete.
   (b) Explain what are methods used for design of high strength concrete mines. [8+8]

5. A cylindrical concrete tank, 40 m external diameter, is to be prestressed circumferentially by means of a high - strength steel wire ($E_s$ = 210 kN/mm$^2$) jacked at 4 points, 90 degrees apart. If the minimum stress in the wires immediately after tensioning is to be 600 N/mm$^2$ and the coefficient of friction is 0.5, calculate
   (a) The maximum stress to be applied to the wires at the jack, and
   (b) The expected extension at the jack. Assume any other missing data. [16]

6. Explain the following prestressing methods along with neat sketches
   (a) Magnel system
   (b) Freyssit system [16]

7. A prestressed concrete beam with cross section 150 mm × 500 mm is prestressed with a parabolic cable carrying a force of 400 kN. The cable has a dia of 100 mm at centre and 60 mm eccentricity at the support. It spans a distance of 12 m and carries a superimposed load 2kN/m. Calcuate the short term deflection at mid

span. $E_{sp} = 3.6 \times 10^4 N/mm^2$. Creep coefficient = 2.0. Loss in prestress may be assumed as 20 percent after 6 months. Estimate the long-term deflection, if the final prestressing force is 400 kN and the initial prestress is 1.2 times the final prestress. Assume any other missing data. [16]

8. A prestressed concrete bridge deck comprises unsymmetrical I - section beams spanning over 20 m. The cross-section of a typical beam is shown in figure 1. The beam is prestressed by seven Freyssinet cables, each carrying an effective force of 600 kN located 200 mm from the soffit at the centre of span section. If the total maximum bending moment at the centre of span of the grider is 3600 kN m, estimate the resultant stress developed at the section using the internal resisting couple method. (Assume any other missing data) [16]

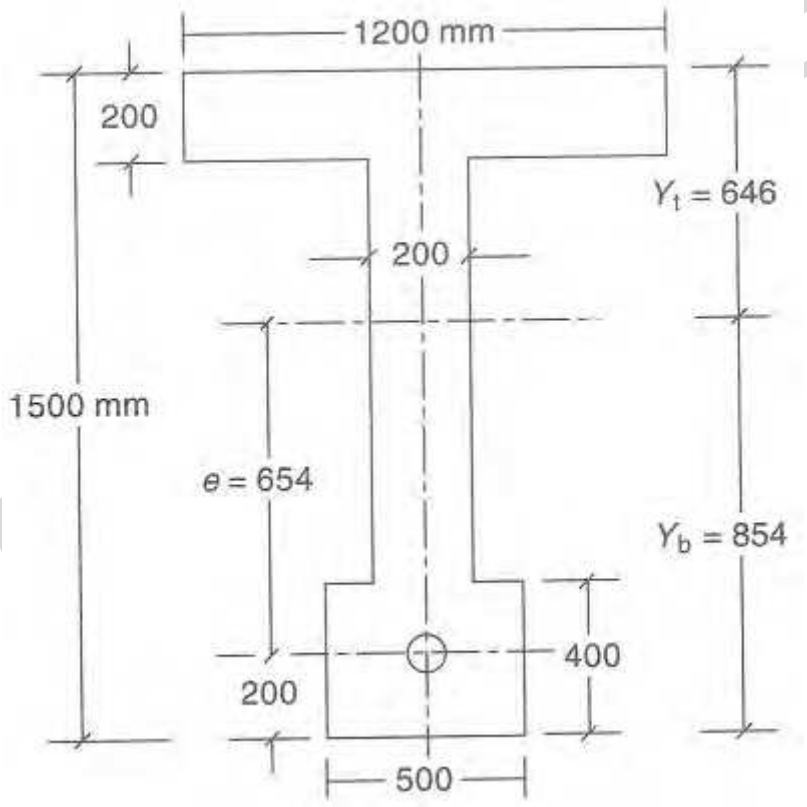


Figure 1:

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Code No: 07A80105 **R07** **Set No. 1**

**IV B.Tech II Semester Examinations,APRIL 2011**
**PRESTRESSED CONCRETE**
**Civil Engineering**

**Time: 3 hours** **Max Marks: 80**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. A concrete beam is prestressed by a cable carrying an initial prestressing force of 300 kN. The cross-sectional area of the wires in the cable is 300 mm$^2$. Calculate the percentage loss of stress in the cable only due to shrinkage of concrete using IS:1343 recommendations assuming the beam to be
   (a) pre - tensioned and
   (b) post - tensioned.

   Assume E = 210 KN/mm$^2$ and age of concrete at transfer = 8 days. Assume any missing data. [16]

2. (a) What is 'Pressure or thrust line'? Explain its significance with sketches.
   (b) Briefly explain the relation between tendon profiles and equivalent loads in prestressed concrete beams with sketches. [8+8]

3. Explain the following:
   (a) Principles of post tensioning
   (b) Post tensioning anchorages
   (c) Applications of post tensioning. [16]

4. (a) Distinguish between the terms:
      i. Uni-axial
      ii. Biaxial
      iii. Tri-axial prestressing.
   (b) What are the advantages of prestressed concrete? [8+8]

5. A precast pretensioned unit of rectangular section of size of 120 mm × 240mm is used a part of a composite beam to span 6m. This unit is prestressed by tendons with their centroid coinciding with the bottom kern point. The initial force in the tendon is 240 kN. The loss of prestress may be assumed to be 15 %. The unit is incorporated as the web of a composite beam by casting a slab of flange width of 480 and a thickness of 40 mm. On the top of the precast unit the composite beam supports a live load 4.0 kN/m. Calculate the resultant stresses developed in the precast and cast insitu concrete assuming the pretensioned unit as unpropped while casting the insitu slab the ratio of modulli of elasticity between the precast unit and cast is situ slab is 1.25. Assume any other missing data. [16]

6. (a) Under what situations and types of structures would you recommend the use of unbonded tensons?

   (b) Explain any four types of flexure failure along with sketches. [8+8]

7. The end block of a prestressed beam, 250 mm wide and 500 mm deep in section, is prestressed by two cables carrying forces of 450 kN each. One of the cables is parabolic, located 125 mm below the centre line at the centre of span (10 m) and anchored at a point 125 mm above the centre line at the ends. The second cable is straight and located 100 mm from the bottom of the beam. The distribution plates for the cables are 100 mm deep and 250 mm wide. Calculate the maximum tensile stress along the axis of the beam using Guyon's method. Also evaluate the maximum tensile stress on horizontal sections passing through the centre of anchor plates using Rowe's method. Assume any other missing data. [16]

8. A prestress concrete beam spanning over 8 m is of rectangular section, 150 mm wide and 300 mm deep. The beam is prestressed by a parabolic cable having an eccentricity of 75 mm below the centroidal axis at the centre of span and an eccentricity of 25 mm above the centroidal axis at the support sections. The initial force in the cables is 350 kN. The beam supports 3 concentrated loads of 10 kN each at intervals of 2m.$E_c = 38kN/mm^2$.

   (a) Neglecting losses of prestress, estimate the short term deflection due to (prestress + self weight ); and

   (b) Allowing for 20 per cent loss in prestress, estimate the long term deflection under (prestress + self weight + live load), assuming creep coefficient as 1.80. Assume any other missing data. [16]

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Code No: 07A80105 **R07** **Set No. 3**

**IV B.Tech II Semester Examinations,APRIL 2011**
**PRESTRESSED CONCRETE**
**Civil Engineering**

**Time: 3 hours** **Max Marks: 80**

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. (a) A precast pre-tensioned rib, 80 mm wide and 240 mm deep, is to be connected to a M-25 grade in situ cast slab, 350 mm wide and 30 mm thick. Estimate the ultimate shearing force which will cause a separation of the two elements for the following case. If the surface is rough tamped and without links to withstand a horizontal shear stress of 0.6 N/ mm$^2$, and
   (b) With nominal links and the contact surfaces are as cast. Assume any other missing data. [8+8]

2. (a) What are the various methods generally used for the investigation of anchorage zone stresses?
   (b) Explain Guyon's method of computing bursting tension in the case of end blocks subjected to forces not evenly distributed with multiple anchorages. [8+8]

3. A prestressed concrete beam of rectangular cross section 300 mm by 600 mm is 12 m long supports a live load 12 kN/m in addition to its own self weight. The beam is prestressed by a cable having high - tensile wires of 2000 m$^2$ area stressed to 800 N/mm$^2$. The cable is straight and located at a disatance of 175 mm from the soffit of the beam. Determine the shift in the pressure line at one quarter span and centre of span, when the beam supports the service load. (Assume any other missing data) [16]

4. (a) What are loop anchorages? Explain with sketches Baurleon hardt system of post tensioning.
   (b) Distinguish between pretensioned and post - tensioned members. [8+8]

5. A pretensioned purlin with a rectangular section of 150 mm width and 350 mm overall depth is stressed by high-tensile steel of area 200 mm $^2$ located at an effective depth of 300 mm. The section is also reinforced with 2 bars of 8 mm diameter, both in the tension and compression faces, at an effective cover of 50 mm. $f_{pu}$=1600 N/mm$^2$, $f_{pe}^{-}$ = 800 N/mm$^2$, $f_y$=40 N/mm$^2$, $E_s$ = 210 N/mm$^2$. Estimate the moment capacity of the section using the strain compatibility method. Assume any other missing data. [16]

6. A prestressed concrete pile of cross - section, 250 mm by 250 mm, contains 60 pre tensioned wires, each of 2 mm diameter, distributed uniformly over the section. The wires are initially tensioned on the prestressing bed with a total force of 300 kN. If $E_s$ = 210 kN/mm$^2$ and $E_c$ = 32 kN/mm$^2$, calculate the respective stresses

in steel and concrete immediately after the transfer of prestress, assuming that up to this point the only loss of stress is that due to elastic shorting.
If the concrete undergoes a further shortening due to shrinkage of $200\times10^{-6}$ per unit length, while there is a relaxation of 5 per cent of steel stress due to creep of steel, find the greatest tensile stress which can occur in a pile 20 m long when lifted at two points 4 m from each end. Assume creep coefficient as 1.6. Assume any other missing data. [16]

7. Design the concrete mix and calculate the batch quantities required for a cubic meter of concrete to suit the following data:
Average 7-day cylinder strength = 35 N/mm$^2$
Degree of workability: Low
Type of cement: Rapid hardening Portland
Type of coarse aggregate: Irregular gravel (20 mm maximum size)
Type of fine aggregate: Natural sand
Specific gravities of cement, sand and gravel are 3, 15, 2.60 and 2.50 respectively.
Fine and coarse aggregates are stock-piled separately at site and have the following gradings: [16]

| IS sieve size | Percentage passing | |
|---|---|---|
| | Coarse aggregate | Fine aggregate |
| 20mm | 100 | - |
| 10mm | 45 | - |
| 4.75mm | - | 100 |
| 2.36mm | - | 77 |
| 1.18mm | - | 53 |
| 600micron | - | 30 |
| 300micron | - | 5 |
| 150micron | - | - |

8. A post tensioned prestressed concrete with rectangular cross section 300 mm $\times$ 400mm is prestressed with 1000 mm$^2$ (2 cables of 500 mm$^2$ each) of high tensile steel wires. The steel is stressed to a level of 1500 N/mm$^2$. The beam is to span 8 m. Calculate the intial deflection of the beam due to prestress and dead load, and a live of 20 kN/m. if the cable profile is parabolic with dip 100 mm at mid section and zero eccentricity at the ends. Assume $E_{up} = 2.1 \times 105N/mm^2$, and $E_c = 3.6\times104N/mm^2$. Assume average friction loss of 5 percent for the mid section of beam in case of parabolic profile. The cable is stretched alternatively from ends. Assume any other missing data. [16]

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