Code :R7420105 **1**

IV B.Tech II Semester(R07) Regular Examinations, April 2011
PRESTRESSED CONCRETE
(Civil Engineering)

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

Answer any FIVE questions
All questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) What are the principles of prestressing in pretensioning and post tensioning?
   (b) What are the various states of loading stages to be considered in the design of prestressed concrete structures?
2. (a) Explain with neat sketch Magnel Blaton system of Prestressing.
   (b) Explain bonded and unbounded tendons
   (c) Creep and shrinkage losses in prestress.
3. A straight post tensioned concrete member is 15 m long with a cross-section of 400mm x 400 mm is prestressed with 900 mm^2 of steel wires. This steel is made of four tendons with $225mm^2$ per tendon. The tendons are tensioned to a stress of 1050 N/mm^2.Determine the loss of prestress in each tendon due to elastic shortening of concrete. Find also the average percentage loss of prestress. If it is desired that after the last tendon is tightened a stress of $1050N/mm^2$ be maintained in each tendon, compute the actual stresses to which the individual tendons should be tightened. Take modular ratio =6.
4. A pretensioned beam of rectangular section,80mm wide x 120mm deep is to be designed to support concentrated loads of 4 kN each at one-third span points over an effective span of 3m. the permissible stresses in concrete are limited to zero and 1.4 N/mm^2 in tension at transfer and working load respectively. If 3mm diameter wires initially stressed to $1400N/mm^2$ is used, find the number of wires required and the eccentricity of the prestressing force assuming 20% loss in prestress. Weight of concrete is $25kN/m^3$.
5. A post tensioned concrete beam of rectangular section 250mm wide and 500mm deep has a span of 12.5m and carries a superimposed load of 5kN/m. The tendon is provided with a parabolic profile with a central dip of 180mm and with no eccentricity at the ends. The effective prestressing force in the tendon is 750kN. Determine:
   (a) The principal stresses at the supports.
   (b) The principal stresses at the supports without prestress. Take weight of concrete as $24kN/m^3$.
6. A prestressed concrete beam is of rectangular section 400mm wide and 800mm deep. Determine the horizontal, vertical and shear stresses at point "Q" which is at a distance of 600mm from the end face of the beam and 200mm from the top edge of the beam. The tendons are placed at an eccentricity of 100mm. The anchor plate is 300mm wide and 200mm deep. Prestressing force in the tendons is 1000kN. Use Magnel's method. Take the shear stress factor as 0.251 and vertical stress factor as -2.47.
7. The cross section of a composite beam consists of 300mm x 900mm deep precast stem and cast in situ flange of 900mm x 150mm thick. The stem is a post tensioned unit with an initial prestressing force of 2500kN. The effective prestress available after making deduction for losses is 2200kN. The dead load moment at mid span due to the weight of precast section is 250kNm. The dead load moment due to weight of flange is 125kNm. After the hardening of flange concrete, the composite section has to carry a live load moment of 700kNm. The cable is placed at 200mm from the soffit of the beam. Determine the stress distribution at various stages of loading.
8. A concrete beam with a cross-sectional area of 32 x 10^3 mm^2 and radius of gyration of 72mm is prestressed by a parabolic cable carrying an effective stress of 1000 N/mm^2. The span of the beam is 8m. The cable, composed of 6 wires of 7mm diameter, has an eccentricity of 50mm at the centre and zero at the supports. Neglecting all losses, find the central deflection of the beam as follows:
   (a) Self weight+prestress, and
   (b) Self weight + prestress + live load of 2kN/m. Take density of concrete as 24 kN/m^3 and $E=38kN/mm^2$.

⋆ ⋆ ⋆ ⋆ ⋆

Code :R7420105 **2**

IV B.Tech II Semester(R07) Regular Examinations, April 2011
PRESTRESSED CONCRETE
(Civil Engineering)

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

Answer any FIVE questions
All questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) What is the necessity of using high strength steel and high strength concrete in prestressed concrete ?
   (b) What are the advantages of prestressed concrete members over R.C.C members?
2. (a) Explain with the help of neat sketch the Freyssinet system of post tensioning.
   (b) Distinguish between pretensioned and post tensioned members.
   (c) Discuss length and curvature effect in case of curved cables.
3. A prestressed concrete beam of rectangular section 400mm wide and 600mm deep is provided with an inclined tendon with an eccentricity of 50mm above the centroid at supports and 100mm below the centroidal axis at the centre of span. The span of the beam is 6m. The beam carries a point load of 160kN at the centre. The dead load of the beam is 6kN/m. The prestressing force is 1000kN. Determine the stress distribution for the end section and mid section of the beam by following methods.
   (a) Stress concept method.
   (b) Strength concept method.
   (c) Load balancing method.
4. A pretensioned beam 250mm wide and 300mm deep is prestressed by 12 wires each of 7mm diameter initially stressed to 1200N/mm^2 with their centroid located at 100 mm from the soffit. Estimate the final percentage loss of stress due to elastic deformation, creep, shrinkage and relaxation using IS:1343-80 code and the following data:
   Relaxation of steel stress=90N/mm^2
   E_s=210KN/mm^2
   Creep coefficient (φ) = 1.6
   Residual shrinkage strain=3 x 10^{-4}
5. A post tensioned concrete beam of rectangular section 300mm wide and 500mm deep has a span of 12m and carries a superimposed load of 9kN/m. The tendon is provided with a parabolic profile with a central dip of 150mm and with no eccentricity at the ends. The effective prestressing force is 875kN. Determine:
   (a) The principal stresses at the support section
   (b) The principal stresses at the support section without prestress. Take the weight of concrete as 24kN/m^3.
6. A prestressed concrete beam 250mm wide and 600mm deep is subjected to an axial prestressing force of 1500kN. Design the end block using Guyon's method.
7. The cross section of a composite beam consists of precast stem of 120mm x 240mm and cast insitu slab of 480mm x 50mm. The stem is post tensioned unit which is subjected to an initial prestressing force of 230kN. The loss of prestress is 15%. The tendons are provided such that their centre of gravity is 80mm above the soffit. The composite beam has to support a live load of 4kN/m. Determine the resultant stresses in the stem and flange if the beam is propped. Take the weight of concrete as 25kN/m^3.
8. A concrete beam of rectangular section, 100mm wide and 300mm deep, is stressed by 3 cables, each carrying an effective force of 240kN. The span of the beam is 10m. The first cable is parabolic with an eccentricity of 50mm below the centroidal axis at the centre of span and 50mm above the centroidal axis at the supports. The second cable is parabolic with zero eccentricity at the supports and an eccentricity of 50mm at the centre of span. The third cable is straight with a uniform eccentricity of 50mm below the centroidal axis.
   If the beam supports a UDF live load of 5kN/m and E_c=38kN/mm^2, estimate the instantaneous deflection at the following stages:
   (a) Prestress+self weight of the beam and
   (b) prestress + self weight+live load.

⋆ ⋆ ⋆ ⋆ ⋆

Code :R7420105

3

IV B.Tech II Semester(R07) Regular Examinations, April 2011
PRESTRESSED CONCRETE
(Civil Engineering)

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

Answer any FIVE questions
All questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Define a prestressed concrete member. Explain the advantages and applications of prestressed concrete.
   (b) Explain in detail the Gifford Udal system of prestressing with the help of neat sketch.

2. (a) Differentiate a fully prestressed member and a partially prestressed member
   (b) A prestressed concrete beam of uniform rectangular cross section and span 15m supports a total distributed load of 272kN excluding the weight of the beam. Determine the suitable dimentions of the beam and calculate the area of the tendons and their position. The permissible stresses are $14N/mm^2$ for concrete and $1050N/mm^2$ for the tendons.

3. A prestressed concrete beam section is 250mm x 300mm deep. The initial prestressing force is 470kN at an eccentricity of 65mm. the beam has a span of 6m and has to carry a superimposed load of 7.75kN/m. Analyse the beam section for the stresses produced at midspan before and after the application of live load. Allow a loss of prestress of 18%. Take the weight of concrete as $24kN/m^3$.

4. A straight post tensioned concrete member is 18m long with a cross section of 425mm x 425mm is prestressed with $920mm^2$ of steel wires. This steel is made up of four tendons with $230mm^2$ per tendon. The tendons are tensioned to a stress of 1025 N/mm^2. Determine the loss of prestress in each tendon due to elastic shortening of concerte. Find also the average percentage loss of prestress. If it is desired that after the last tendon is tightened, a stress of $1025N/mm^2$, be maintained in each tendon, calculate the actual stresses to which the individual tendons should be tightened. Take m=6.

5. A prestressed concrete beam of rectangular section is 180mm wide and 400mm deep and is simply supported over a span of 6m. The beam is concentrically prestressed by cable carrying an effective prestressing force of 385kN. The beam supports on all inclusive load of 12kN/m. Compare the principal tensile stress induced in the beam with and without the prestress at the support section.

6. A prestressed concrete beam is 400mm wide and 800mm deep. The cable is placed axially. The anchor plate is 300mm wide and 200mm deep. The prestressing force is 1000kN. Determine the horizontal section through the centre of anchor plate. Take the shear stress factor as 1.25 and vertical stress factor as -5 respectively. Find also the principal stresses. Use Magnel's method.

7. The cross section of a 6m span composite beam consists of a 150mm x 300mm precast stem and a 500mm x 600mm cast insitu flange. The stem is post tensioned unit subjected to an initial prestresssing force of 315kN. The loss of prestress is 18%. The tendons are provided such that their centre of gravity is 100mm from the soffit. The composite beam has to support a live load of 4.5kN/m. Determine the resultant stresses in the stem and the flange. Assume that the beam is an unpropped beam, modulus of elasticity for precast unit and the flange as $30kN/mm^2$ and $24kN/mm^2$ respectively. Weight of flange as well as stem concrete is $25kN/m^3$.

8. A concrete beam having rectangular section 100mm wide and 300mm deep is prestressed by a parabolic cable carrying an initial force of 240kN. The cable has an eccentricity of 50mm at the centre of the span and is concentric at the supports. If the span of the beam is 10m and the live load is 2kN/m, estimate the short term deflection at the centre of span. Assuming $E=38kN/mm^2$ and creep coefficient =2.0 loss of prestress=20% of the initial stress after 6 months, estimate the long term deflection at the centre of the span at this stage, assuming that the dead and live loads are simultaneously applied after the release of prestress.

⋆ ⋆ ⋆ ⋆ ⋆

Code :R7420105

4

IV B.Tech II Semester(R07) Regular Examinations, April 2011
PRESTRESSED CONCRETE
(Civil Engineering)

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

Answer any FIVE questions
All questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Distinguish between pretensioning and post tensioning systems. Discuss the advantages of prestressed concrete members over R.C.C members.
   (b) Explain with the help of neat sketch Lee-Mechall system of post tensioning.

2. A concrete beam of symmetrical I section spanning 8m has a flange width and thickness of 200 and 60mm respectively. The overall depth of the beam is 400mm. The thickness of the web is 80mm. The beam is prestressed by a parabolic cable with an eccentricity of 15mm at the centre and zero at the supports with an effective force of 100kN. The live load on the beam is 2kN/m. Draw the stress distribution diagram at the central section for
   (a) Prestress+Self weight
   (b) Prestress + Self weight + Live load. Take density of concrete as $24kN/m^3$.

3. A prestressed concrete pile is 300mm x 300mm in section and is provided with 40 wires of 3mm diameter distributed uniformly over the section. Initially the wires are tensioned in the Prestressing beds with a total pull of 450kN. Determine the final stress in concrete and the percentage loss of stress in the wires. Take E_s=2.08 x $10^5 N/mm^2$, E_c=3.20 x $10^4 N/mm^2$, creep shortening =32x10^{-6} mm/mm per N/mm^2, total shrinkage strain=200x10^{-6}, Relaxation of stress in steel =4.5% of the initial stress.

4. A prestressed concrete beam of rectangular section 400mm x 600mm is provided with a parabolic tendon with zero eccentricity at supports and an eccentricity of 100mm at the centre of span. The span of the beam is 6m. The total external load on the beam is 35kN/m on the whole span. The tendon carries a prestressing force of 1000kN. Calculate the extreme stresses for the mid span section using the following methods.
   (a) Stress concept method
   (b) Strength concept method
   (c) Load balancing method.

5. A prestressed I section has the following properties.
   Area=55x$10^3 mm^2$,
   Second moment of area =189x$10^7 mm^4$
   Statical moment about the centroid =468 x $10^4 mm^3$
   Thickness of web=50mm.
   It Is prestressed horizontally by 24 wires of 5mm diameter and verfically by similar wires at 150 mm centers. All the wires carry a tensile stress of $900N/mm^2$. Calculate the principal stresses at the centroid when a shearing force of 80kN acts upon this section.

6. A composite T beam is made up of a pre tensioned stem 100mm wide and 200mm deep, and a cast in situ slab 400mm wide and 40mm thick having a modulus of elasticity of $28kN/mm^2$. If the differential shrinkage is 100 x 10^{-6} units, determine the shrinkage stresses developed in the precast and cast in situ units.

7. (a) What are the various methods generally used for the investigation of anchorage zone stresses?
   (b) Briefly outling the Magnel's method of computing the horizontal and transverse stresses in end blocks subjected to concentrated force from the anchorage.

8. A prestressed concrete beam of rectangular section 120mm wide and 250mm deep and has a span of 6m. The beam is provided with a straight tendon at a uniform eccentricity of 45mm, the Prestressing force being 200kN. Find the deflection at the centre.
   (a) Under the action of prestress and dead load of the beam.
   (b) Under the action of prestress, dead load and live load of 4kN/m and including the effect of creep and shrinkage, taking the creep coefficient as 1.70. take the weight of concrete as $24kN/m^3$ and $E_c=35kN/mm^2$. Compare these deflections with the permissible limits.

⋆ ⋆ ⋆ ⋆ ⋆