Code No: **RT41012** **R13** **Set No. 1**

IV B.Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2018

PRESTRESSED CONCRETE

(Civil Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B
Provide Code Book IS:1343

*****

PART–A *(22 Marks)*

1. a) Write the advantages of prestressed concrete. [3]
   b) List out the basic assumptions in analysis of prestress design. [3]
   c) What are the factors influencing the loss of stress due to creep of concrete? [4]
   d) What are the different types of flexural failure modes observed in prestressed concrete beams? [4]
   e) Distinguish between web-shear, flexural and flexure shear cracks in concrete beams with sketches. [4]
   f) Explain with sketches the variation of bond stress, stress in steel and concrete in the transmission zone of pretensioned members. [4]

PART–B *(3x16 = 48 Marks)*

2. a) What is the necessity of using high-strength concrete and high tensile steel in prestressed concrete? [8]
   b) What is the basic principle of prestressed concrete? Explain the application of prestressed concrete. [8]

3. a) Write about pressure line concept. [4]
   b) Explain with sketches Freyssinet system of post-tensioning. [12]

4. A pretensioned beam, 200 mm wide and 300 mm deep, is prestressed by 10 wires of 7 mm diameter initially stressed to 1200 N/mm^2, with their centroids located 100 mm from the soffit. Find the maximum stress in concrete immediately after transfer, allowing only for elastic shortening of concrete. If the concrete undergoes a further shortening due to creep and shrinkage while there is a relaxation of five percent of steel stress, estimate the final percentage loss of stress in the wires using the Indian standard code IS: 1343 regulations, and the following data:
   Es = 210 kN/mm^2; Ec = 5700 (fcu)$^{0.5}$; fcu = 42 N/mm^2; Creep coefficient (ϕ) = 1.6; Total residual shrinkage strain = 3 x 10^4. [16]

5. a) What are the factors influencing the short term and long term deflection. [8]
   b) A pretensioned T-section has a flange which is 300 mm wide 200 mm thick. The rib is 150 mm wide by 350 mm deep. The effective depth of the cross section is 500 mm. Given Ap = 200 mm^2, fck = 50 N/mm^2 and fp = 1600 N/mm^2, estimate the ultimate moment capacity of the T-section using the Indian standard code regulations. [8]

6. a) A prestressed girder of rectangular section 150 mm wide by 300 mm deep is to be designed to support an ultimate shear force of 130 kN. The uniform prestress across the section is 5 N/mm^2. Given the characteristic cube strength of concrete as 40 N/mm^2 and Fe-415 HYSD bars of 8 mm diameter, design suitable spacing for the stirrups conforming to the Indian standard code IS: 1343 recommendations. Assume cover to the reinforcement as 50 mm. [8]

   b) A pretensioned girder having a T-section is made up of a flange 200 mm wide and 60 mm thick. The overall depth of the girder is 600 mm. The thickness of the web is 60 mm. The horizontal prestress at a point 300 mm from the soffit is 10 N/mm^2. The shear stress due to transverse load acting at the same point is 2.5 N/mm^2. Determine the increase in the principal tensile stress at this point if the T-section is subjected to a torque of 2 kN-m. [8]

7. a) Estimate the transmission length at the ends of a pretensioned beam prestressed by 7-mm diameter wires. Assume the cube strength of concrete at transfer as 42 N/mm^2. [8]

   b) A pretensioned beam is prestressed using 5 mm diameter wires with an initial stress of 80 percent of the ultimate tensile strength of steel (fpu = 1600 N/mm^2). The cube strength of concrete at transfer is 30 N/mm^2. (a) Calculate the transmission length (b) compute the bond stress at ¼ and ½ the transmission length from the end and (c) Calculate the overall average bond stress. [8]

Code No: **RT41012** **R13** **Set No. 2**

IV B.Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2018

PRESTRESSED CONCRETE

(Civil Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B
Provide Code Book IS:1343

*****

PART–A *(22 Marks)*

1. a) Write a short note on applications of prestressed concrete. [3]
   b) Distinguish between pretensioned and post-tensioned members. [4]
   c) What are the types of losses of prestress? [3]
   d) Explain with sketches the IS: 1343 code method of computing the moment of resistance of rectangular section. [4]
   e) Explain the various modes of failure encountered in prestressed concrete beams subjected to bending moment, shear and torsion. [4]
   f) What is transmission length? List the various factors influencing transmission length. [4]

PART–B *(3x16 = 48 Marks)*

2. a) Explain the terms (i) Uniaxial (ii) Biaxial (iii) Triaxial prestressing and (iv) Circular prestressing. [8]
   b) Distinguish between creep and shrinkage. What are the factors influencing the creep and shrinkage of concrete? [8]

3. a) Explain the principle of post-tensioning. What are post tensioning anchorages? [8]
   b) Explain mechanical, hydraulic and electrical tensioning devices with neat sketches. [8]

4. a) What is a thrust line? [2]
   b) The cross section of a pre stressed concrete beam used over a span of 10m is 200m wide and 400mm deep. The initial stress in the tendons located at a constant eccentricity of 50mm is 1000N/mm^2.Find the percentage increase in stress in the wires when the beam supports a live load of 10kN/m. The density of concrete is 24kN/m^3. Modulus of elasticity of concrete = 36 N/mm^2, Modulus of elasticity of steel = 210kN/mm^2. [14]

5. A pre-tensioned T-section has a flange 1200 mm wide and 150 mm thick. The width and depth of the rib are 300 and 1500 mm respectively. The high tensile steel has an area of 4700 mm^2 and is located at an effective depth of 1600 mm. If the characteristic cube strength of the concrete and the tensile strength of steel are 40 and 1600 N/mm^2, respectively, calculate the flexural strength of the T-section. [16]

6. a) A prestressed concrete beam of span 10 m of rectangular section, 120 mm wide and 300 mm deep, is axially prestressed by a cable carrying an effective force of 180 kN. The beam supports a total uniformly distributed load of 5 kN/m which includes the self-weight of the member. Compare the magnitude of the principal tension developed in the beam with and without the axial prestress. [8]

   b) Discuss briefly the basis of Indian standard IS: 1343 code recommendations regarding the design of reinforcements in prestressed sections subjected to moment, shear and torsion. [8]

7. a) A pretensioned beam, 160 mm wide by 320 mm deep, is prestressed by four plain wires of 7 mm diameter at an eccentricity of 100 mm. If the cube strength of concrete at transfer is 40 n/mm^2, estimate the transmission length at the ends of the pretensioned units using IS: 1343 code provisions. [8]

   b) Explain with neat sketch, end block stress distribution in post tensioned members. [8]

Code No: **RT41012** **R13** **Set No. 3**

IV B.Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2018

PRESTRESSED CONCRETE

(Civil Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B
Provide Code Book IS:1343

*****

PART–A *(22 Marks)*

1. a) Write the need of high strength steel in prestressed concrete. [3]
   b) Explain the principles of post tensioning. [3]
   c) What is relaxation of stress in steel? How do you account for it in prestressed members? [4]
   d) Explain with sketches the method of estimating the ultimate flexural strength of flanged prestressed concrete sections according to IS: 1343 code specifications. [4]
   e) What are the different ways of improving the shear resistance of structural concrete members by prestressing techniques? [4]
   f) Explain the terms: (i) End block (ii) anchorage zone and (iii) Bursting tension. [4]

PART–B *(3x16 = 48 Marks)*

2. a) What are the main factors influencing the design of high strength concrete mixes? [8]
   b) Explain the terms: (i) Pretensioning (ii) Post-Tensioning (iii) Full prestressing and (iv) Post prestressing. [8]

3. A rectangular concrete beam of cross section 30 cm deep and 20 cm wide is prestressed by means of 15 wires of 5 mm diameter located 6.5 cm from the bottom of the beam and 3 wires of diameter of 5 mm, 2.5 cm from the top. Assuming the prestress in the steel as 840 N.mm^2, calculate the stresses at the extreme fibres of the mid span section when the beam is supporting its own weight over a span of 6 m. If a uniformly distributed live load of 6 kN/m is imposed, evaluate the maximum working stress in concrete. The density of concrete is 24 kN/m^3. [16]

4. a) A pretensioned concrete beam of rectangular cross section, 150 mm wide and, 300 mm deep, is prestressed by eight high tensile wires of 7 mm diameter located at 100 mm from the soffit of the beam. If the wires are tensioned to a stress of 1100 N/mm^2, calculate the percentage loss of stress due to elastic deformation assuming the modulus of elasticity of concrete and steel as 31.5 and 210 kN/mm^2. [8]
   b) A post-tensioned concrete beam of rectangular section, 100 mm wide and 300 mm deep, is stressed by a parabolic cable with zero eccentricity at the supports and an eccentricity of 50 mm at the centre of span. The area of the cable is 200 mm^2 and initial stress in the cable is 1200 N/mm^2. If the ultimate creep strain is 30 x 10^{-6} mm/mm per N/mm^2 of stress and modulus of elasticity of steel is 210 mm^2, compute the loss of stress in steel only due to creep of concrete. [8]

5. The cross section of a symmetrical I-section prestressed beam is 300 mm by 750 mm (overall) with flanges and web 100 mm thick. The beam is post-tensioned by cables containing 48 wires of 5 mm diameter high tensile steel wires at an eccentricity of 250 mm. The 28-day strength of concrete in compression is 40 N/mm^2 and the ultimate tensile strength of wires is 1700 N/mm^2. Assuming that the grouting of the tendons is 100% effective, determine the ultimate moment of the section. [16]

6. The support section of a prestressed concrete beam, 100 mm wide by 250 mm deep, is required to support an ultimate shear force of 80 kN. The compressive prestress at the centroidal axis is 5 N/mm^2. The characteristic cube strength of concrete is 40 N/mm^2. The cover to the tension reinforcement is 50 mm. If the characteristic tensile strength of stirrups is 415 N/mm^2, design suitable shear reinforcements in the section using IS code recommendations. [16]

7. a) The end block of a prestressed concrete girder is 200 mm wide by 300 mm deep. The beam is post-tensioned by two Freyssinet anchorages each of 100 mm diameter with their centres located at 75 mm from the top and bottom of the beam. The force transmitted by each anchorage being 200 kN. Compute the bursting force and design suitable reinforcement according to the Indian standards code IS: 1343 code provisions. [8]

   b) Explain with sketches the effect of varying the ratio of depth anchorage to the depth of end block on the distribution of bursting tension. [8]

Code No: **RT41012** **R13** **Set No. 4**

IV B.Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2018

PRESTRESSED CONCRETE

(Civil Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B
Provide Code Book IS:1343

*****

PART–A *(22 Marks)*

1. a) Distinguish between creep and shrinkage. [3]
   b) Explain the terms prestress, dead load stress, live load stress and resultant stress. [3]
   c) Explain the loss of stress caused due to friction. [4]
   d) Explain in brief the failure in under reinforced section and over reinforced section. [4]
   e) Discuss briefly the basis of Indian standard IS: 1343 code recommendations regarding the design of reinforcements in prestressed sections subjected to moment, shear and torsion. [4]
   f) What are the various methods generally used for the investigation of anchorage zone stresses? [4]

PART–B *(3x16 = 48 Marks)*

2. a) Mention the basic difference between mild steel, high yield strength deformed steel and high-tensile steel. [8]
   b) Distinguish between proof stress and ultimate tensile stress of high tensile steel. What is the practical significance of proof stress? [8]

3. A rectangular concrete beam, 100 mm wide by 250 mm deep, spanning over 80 m is prestressed by a straight cable carrying an effective prestressing force of 250 kN located at an eccentricity of 40 mm. The beam supports a live load of 1.2 kN/m.
   (a) Calculate the resultant stress distribution for the central cross section of the beam. The density of concrete is 24 kN/m^2.
   (b) Find the magnitude of the prestressing force with an eccentricity of 40 mm which can balance the stresses due to dead and live loads at the bottom fibre of the central section of the beam. [16]

4. a) A post-tensioned concrete beam, 200 mm wide and 450 mm deep, is prestressed by a circular cable with total area of 800 mm^2 with zero eccentricity at the ends and 150 mm at the centre. The span of the beam is 10 m. The cable is to be stressed from one end such that an initial stress of 840 N/mm^2 is available in the un-jacked end immediately after anchoring. Determine the stress in the wires at the jacketing end and the percentage loss of stress due to friction. [8]
   b) A concrete beam is post-tensioned by a cable carrying an initial stress of 1000 N/mm^2. The slip at the jacketing end was observed to be 5 mm. The modulus of elasticity of steel is 210 kN/mm^2. Estimate the percentage loss of stress due to anchorage slip if the length of the beam is (a) 30 m and (b) 3 m. [8]

5. A double T-section having a flange 1200 mm wide and 150 mm thick is prestressed by 4700 mm^2 of high tensile steel located at an effective depth of 1600 mm. The ribs have a thickness of 150 mm each. If the cube strength of concrete is 40 N/mm^2 and tensile strength of steel is 1600 N/mm^2, determine the flexural strength of the double T-girder using IS: 1343 provisions. Sketch the details. [16]

6. A post tensioned bonded prestressed concrete beam of rectangular section, 350 mm wide by 700 mm deep is prestressed by an effective force of 180 kN acting at an eccentricity of 190 mm. At service load conditions, a section of the beam is subjected to a bending moment of 250 kN-m, a torsional moment of 100 kN-m and a transverse shear force of 100 kN. If fck = 40 N/mm^2, fy = 415 N/mm^2, fp = 1600 N/mm^2, design suitable longitudinal and transverse reinforcements in the section using IS: 1343 code recommendations. Sketch the details. [16]

7. a) A high tensile cable comprising 12 strands of 15 mm diameter (12 K15 of PSC Freyssinet system) with an effective force of 2500 kN is anchored concentrically in an end block of a post tensioned beam. The end block is 400 mm wide by 800 mm deep and the anchor plate is 200 mm wide by 260 mm deep. Design suitable anchorage zone reinforcements using Fe-415 grade HYSD bars using IS: 1343 code provisions. [8]

   b) Explain with sketches the effect of varying the ratio of depth anchorage to the depth of end block on the distribution of bursting tension. [8]