Code No:**R1642013** **R16** **Set No. 1**

IV B.Tech II Semester Regular/Supplementary Examinations, July - 2021

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 FOUR questions from Part-B
(Provide Code Book IS-1343)
****

PART–A *(14 Marks)*

1. a) What is pretensioning and post-tensioning? [2]
   b) List out the various types of tensioning device used in PSC. [2]
   c) What is differential shrinkage? [2]
   d) List the various factors influencing the deflections of prestressed concrete members. [2]
   e) Distinguish between web-shear, flexural and flexure shear cracks in concrete beams with sketches. [3]
   f) What is transmission length? List the various factors influencing transmission length. [3]

PART–B *(4x14 = 56 Marks)*

2. a) Discuss the advantages and applications of prestressed concrete. [7]
   b) Differentiate between creep and shrinkage. What are the factors influencing the creep and shrinkage of concrete? [7]

3. a) Explain with sketches Freyssinet system of post-tensioning. [7]
   b) A prestressed concrete beam of rectangular cross section 300mm by 600mm is 12m long supports a live load 12kN/m in addition to its own self-weight. The beam is prestressed by a cable having high-tensile wires of 2000mm^2area stressed to 800N/mm^2. The cable is straight and located at a distance 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 loads. [7]

4. a) What are the measures to be adopted for counteracting elastic loss and friction loss in case of post tensioned members [4]
   b) A prestressed concrete beam, 200mm wide and 300mm deep, is prestressed with wires (area = 320mm^2) located at a constant eccentricity of 50 mm and carrying an initial stress of 1000N/mm^2. The span of the beam is 10m. Calculate the percentage loss of stress in wires if (a) the beam is pretensioned, and (b) the beam is post-tensioned, using the following data :Es=210$kN/mm^2$and Ec = 35kN/mm^2 ,Relaxation of steel stress =5 per cent of the initial stress, Shrinkage of concrete = 300 X $10^{-6}$for pre-tensioning and 200 X $10^{-6}$for post-tensioning. Creep coefficient=1.6 ,Slip at anchorage = 1mm, Frictional coefficient for wave effect = 0.0015 per m. [10]

5. a) A prestressed concrete beam of rectangular section 120 mm wide by 300 mm deep, spans over 6 m. The beam is prestressed by a straight cable carrying an effective force of 200 kN at an eccentricity of 50mm. The modulus of elasticity of concrte is 38kN/m^2. Compute the deflection at centre of span for the following cases:
   (i) Deflection under (prestress + self-weight)
   (ii) Find the magnitude of the uniformly distributed live load which will nullify the deflection due to prestress and self-weight. [7]

   b) A pretensioned T-section has a flange 1200mm 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 4700mm^2 and is located at an effective depth of 1600mm. 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. [7]

6. a) A prestressed concrete tee beam has a flange 1000mm wide and 200mm thick. The web is 200mm thick and 1000 mm deep. At a particular section the beam is subjected to an ultimate moment and shear force of 2000 kN.m and 250 kN, respectively. Calculate the flexure-shear resistance and design suitable shear reinforcements at the section using the following data:
   Effective depth = 1100mm, Cube strength of concrete = 40N/mm^2
   Effective prestress at the extreme tensile face of beam = 19.3 40N/mm^2
   Second moment of area of cross section = 7.533 X 10^{10} mm^4
   Area of prestressing steel = 2310mm^2
   Tensile strength of tendons = 1500 N/mm^2
   Effective stress in tensons after all losses = 900 N/mm^2 [7]

   b) A cantilevered portion of a prestressed concrete bridge with a rectangular cross section, 600mm wide and 1650 mm deep, is 8m long and carries a reaction of 350kN from the suspended span at the free end, together with a uniformly distributed load of 60 kN/m inclusive of tis own weight. The beam is prestressed by seven cables each carrying a force of 1000kN, of which three are located a t 150mm, three at 400 mm and one at 750mm from the top edge.
   Calculate the magnitude of the principal stresses at a point 550 mm from the top of cantilever at the support section. [7]

7. a) Explain with sketches the variation of bond stress, stress in steel and concrete in the transmission zone of pretensioned members. [7]

   b) Explain in detail about the Guyon's method for end blocks. [7]