PRESTRESSED QUESTION

Q1. Answer any five from the following questions: (2x10)

- ***a)*** **Define tendon?**
- ***b)*** **What is the difference between pre-tensioning and post-tensioning?**
- ***c)*** **Write the advantages of prestressed concrete?**
- ***d)*** **What is the basic principle of prestressed concrete?**
- ***e)*** **What is the necessity of using high strength concrete and high tensile steel in prestressed concrete?**
- ***f)*** **What is the difference between concentric and eccentric prestressing?**
- ***g)*** **List the various type of tensioning devices used in prestressed concrete?**
- ***h)*** **Explain the principle of post-tensioning?**
- ***i)*** **Write down the types of losses in post-tensioning and pre-tensioning members?**
- ***j)*** **How do you compute the loss of stress due to elastic deformation of concrete?**
- ***k)*** **What are the factors influencing the loss of stress due to creep of concrete?**
- **l)** $P = P_0\, e^{-(\mu\alpha + kx)}$ **Derive this expression**

Q2. An unsymmetrical I-section beam is used to support an imposed load of 2kN/m over a span of 8m. The sectional details are top flange, 300 mm wide and 60 mm thick; bottom flange, 100 mm wide and 60 mm thick; thickness of the web = 80 mm; overall depth of the beam = 400 mm. At the centre of the span, the effective prestressing force of 100kN is located at 50 mm from the soffit of the beam. Estimate the stresses at the centre of span section of the beam for the following load condition: a) Prestress + Self-weight b) Prestress + self weight + live load? (10)

Q3. A prestressed concrete beam of section 120 mm wide by 300 mm deep is used over an effective span of 6m to support a u.d.l of 4 kN/m, which includes the self-weight of the beam. The beam is prestressed by a straight cable carrying a force of 180 kN and located at an eccentricity of 50 mm. Determine the location of the thrust-line in the beam and plot its position at quarter and central span section? (10)

Q4. A post-tensioned concrete beam, 100 mm wide and 300 mm deep spanning over 10m is stressed by successive tensioning and anchoring of three cables 1, 2 and 3 respectively. The cross sectional area of each cable is 200 mm^2 and the initial stress in the cable is 1200 N/mm^2, α_e = 6. The first cable is parabolic with an eccentricity of 50mm below the centrodial axis at the centre of span and 50 mm above the centrodial axis at the support sections. The second cable is parabolic with zero eccentricity at the supports and an eccentricity of 50 mm at the centre of the span. The third cable is straight with uniform eccentricity of 50 mm below the centrodial axis. Estimate the percentage loss of stress in each of the cables, if they are successively tensioned and anchored? (10)

Q5. A prestressed concrete beam 200 mm wide and 300 mm deep, is prestressed with wires (area = 320 mm^2) located at a constant eccentricity of 50 mm and carrying an initial stress of 1000 N/mm^2 . The span of the beam is 10 m. Calculate the percentage loss of stress in wires if (a) the beam is pre- tensioned and (b) the beam is post-tensioned, using the following data: (10)

E_s = 210 kN/mm^2 and E_c = 35 kN/mm^2

Relaxation of steel stress = 5 percent of initial stress

Shrinkage of concrete = 300 X 10^{-6} for pretensioning 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.