Q.P. Code : 26138

(3 Hours) **[Total Marks : 80**

N.B. : (1) **Q.No.1** is **compulsory**. Attempt **any three** out of remaining **five** questions.
(2) Use of **IS 1343:2012** is **permitted** in the examination.
(3) Assume suitable **data** if **required** and mention it **clearly**.
(4) Support **answers** and **solutions** with **suitable sketches**.

1. All questions are compulsory : **20**
   (A) Explain the various factors affecting the deflection of prestressed concrete beam.
   (B) Enlist and explain various losses in prestressed concrete.
   (C) Why there is need of high tensile steel and high strength concrete for the prestressed concrete structures?
   (D) What arc the various failure modes of prestressed clement under flexure?

2. (A) A prestressed concrete beam of section 120 mm wide and 300 mm deep is used over an effective span of 6m to support a uniformly distributed load of 4kN/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 eccentricity of 50 mm. Determine the location of the thrust line in the beam and plot its position at quarter and central span section. **08**

   (B) A prestressed concrete beam of size 220 mm × 460 mm is prestressed with wires (area 300 mm^2) located at a constant eccentricity of 50 mm and carrying an initial stress of 1200 N/mm^2, the span of beam is 10m. Calculate the percentage loss of stress in wires. if : **12**
   (i) The beam is pretensioned, (ii) The beam is post tensioned.
   Use the following data : E_s = 210 kN/mnm^2 and E_c = 35kN/mm^2, relaxation of steel stress = 5% of initial stress, shrinkage of concrete = 300x × 10^{-6} for pretensioning and 200 × 10^{-6} for post-tensioning, Creep co-efficient = 1.6, slip at anchorage = 1 mm, co-efficient of friction = 0.25, co-efficient for wave effect = 0.0015/m.

3. (A) A pre tensioned T-Section has a flange width 1200 mm and thickness 150 mm. The width and depth of the rib are 300 mm and 1500 mm respectively. The high tensile steel has an area of 4700 mm^2 is located at an effective depth of 1600 mm. If the characteristic cube strength of the concrete and the tensile strength of steel are 50 N/mm^2 and 1600 N/mm^2 respectively, Calculate the ultimate flexural strength of the T-Seetion. **08**

TURN OVER

(B) A concrete beam having a rectangular section, 250 mm wide and 500 mm deep is prestressed by a parabolic cable carrying an effective prestressing force of 250kN. The cable has an eccentricity of 75 mm at the centre of span and is concentric at ends. The span of beam is 9.5m and it is subjected to a live load of 2.5kN/m. Estimate the short term and long term deflection of the beam at the centre of span assuming that the dead load and live load are applied simultaneously after the release of prestress. Take modulus of elasticity of concrete as 35kN/mm^2, creep coefficient 2.0 and loss of prestress as 18%. **12**

4. (A) The end block of a post tensioned concrete beam 300 mm wide and 500 mm deep supports a prestressing force of 210 kN at an eccentricity which coincides with the bottom kern of the section. The anchor plate is 60 mm wide and 60 mm deep. M 45 concrete is used. Transfer is at 28 days. Check safety of end block and design it. **10**

(B) A cantilever 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 (ultimate) from suspended span at the free end together with an uniformly distributed load (ultimate) of 60kN/m (inclusive of self weight). The beam is prestressed by 7 cables, each carrying a force of 1000kN, of which 3 are located at 150 mm, 3 are located at 400 mm and 1 at 750 mm from top edge. Cables are straight. Calculate principal tensile stress and compare with permissible limits. Assume M50 concrete. **10**

5. (A) Explain Freyssinet system of post tensioning. **05**

(B) A prestressed concrete beam of rectangular section, 200 mm wide and 450 mm deep, is to be designed to support two imposed loads of 35 kN, each located at one third points over a span of 3m. If there is to be no tensile stress in the concrete at transfer and service loads, verify safety of section in limit state of serviceability of cracking. Modify the section if unsafe. Also calculate the minimum prestressing force and the corresponding eccentricity. **15**
Consider Dc = 24 kN/m^3, $f_{ck} = f_{ci}$ = 50MPa and loss ratio = 0.8.

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6. (A) What are the advantages of providing a continuous prestressed concrete element in flexure? Explain in detail how this continuity is achieved? **05**

(B) A continuous beam ABC [AB = BC = 20m] with an overall depth 1m is prestressed by a cable carrying prestressing force of 3000kN. The cable profile is parabolic between the supports with zero eccentricity at the end supports A and C. The cable has an eccentricity of 150 mm towards the soffit at centre of spans and 300 mm towards the top at mid support B. Show that cable is concordant and locate the pressure line at service stage when the beam supports a udl of 10kN/m which is exclusive of self weight. Assume width 400mm. **15**
