B.E. Eighth Semester (Civil Engineering) (C.B.S.)

# Elective - II : Pre-Stressed Concrete

P. Pages : 3 **NKT/KS/17/7531**

Time : Three Hours * 0 8 5 4 * Max. Marks : 80

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Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Assume suitable data whenever necessary.
9. Illustrate your answers whenever necessary with the help of neat sketches.
10. Use of non programmable calculator is permitted.
11. Use of IS 1343 & IS 3370 is permitted.

**1.** a) Explain in brief the losses of prestress. **6**

b) A pre tension concrete beam 100mm wide & 300mm deep is prestressed by a straight wires carrying on initial force of 200 kN at an eccentricity of 50 mm. The modulus of elasticity of steel & concrete are 210 and 35 kN/mm$^2$ respectively. Estimate the percentage loss of stress in steel due to elastic deformation of concrete if the area of steel wires is 188 mm$^2$. **7**

**OR**

**2.** a) Explain the process of transmission of prestressing force in pre tensioned members. **6**

b) The end block of post tensioned prestressed concrete beam, rectangular in section is 100 mm wide & 200 mm deep. The prestressing force of 100 kN is transmitted to concrete by a distribution plate, 100 mm wide and 50 mm deep, concentrically located at ends. Calculate the position & magnitude of maximum tensile stress on horizontal section through the centre and edge of the anchor plate. Calculate the bursting tension on these horizontal planes. **7**

**3.** a) Distinguish between short term and long term deflection of prestressed concrete beam. **6**

b) A pre tensioned pre stressed concrete beam of rectangular section is required to support a design ultimate moment of 150 kNm. Design the section if fek is 50 N/mm$^2$ & $f_p$ = 1600 N/mm$^2$. If 'b' and 'd' are the breadth & effective depth of the section respectively, assuming the ratio $\frac{x_u}{d} = 0.5$ **7**

**OR**

**4.** a) Distinguish between bounded and unbounded prestressed concrete beams. **3**

b) A prestressed concrete beam of span 8 m having a rectangular section of 150 mm x 300 mm, the beam is prestressed by a parabolic cable having on eccentricity of 75 mm below the centroidal axis at the centre of span and eccentricity of 25 mm above the centroidal axis at support sections. The initial force in cable is 350 kN. The beam supports three concentrated loads of 10 kN each at intervals of 2 m. $E_c = 38$ kN/mm$^2$. **10**

i) Neglect the losses of prestress, estimate the short term deflection due to (prestress + self weight)

ii) Allowing for 20% loss in prestress estimate long term deflection under (prestress + self weight + live laod) assume creep coefficient as1.8.

**5.** a) Distinguish between web shear, flexural & flexural shear cracks in concrete beams with sketches. **7**

b) How do you estimate the ultimate shear strength of prestressed concrete sections with web shear cracks. **7**

**OR**

**6.** a) What are the advantages of using precast prestressed units in association with the in situ concrete. **4**

b) A percent pretensioned beam of rectangular section has a breadth of 100 mm & 200 mm deep. The beam with an effective span of 5 m is prestressed by tendons with their centroid coinciding with the bottom kern. The initial force in tendons is 150 kN. The loss of prestress may be assumed to be 15%. The beam is incorporated in composite T beam by casting a top flange of breadth 400 mm & thickness 50 mm. If the composite beam supports a live load of 8 kN/m$^2$, calculate the resultant stresses developed in the precast and insitu cast concrete assuming the pretensioned beam as unsupported and propped during the casting of slab. Assume the same modulus of elasticity of concrete in precast beam and insitu cast slab. **10**

**7.** A continuous beam ABC, AB = BC = 12 m has a uniform rectangular section with a width of 150 mm & depth of 300 mm. The cable carrying effective prestressing force of 420 kN parallel to axis of the beam located at 125 mm from the soffit. **14**

a) Determine the secondary & resultant moment at central support B.

b) If the supports and imposed load of 1.5 kN/m, calculate the resultant stresses at top and bottom of beam at B.

c) Locate the resultant line of thrust through beam AB.

**OR**

**8.** A prestressed concrete portal frame ABCD is fixed at A & D has column AB = CD = 4m and the beam BC = 12 m. The member has cross section 150 mm wide and 300 mm deep throughout. The columns are prestressed by a straight cable with an eccentricity of 50 mm towards the outer sides of the frame at B and C. The beam BC is prestressed by a parabolic cable having an eccentricity of 50 mm above the centroid at B & C and 100 mm below the centroid at the centre of BC. The prestressing force in all cables is 200 kN. Calculate the secondary moments developed in A and B using the flexibility coefficients. **14**

**9.** A cylindrical prestressed concrete water tank of internal diameter 30 m is required to store water over a depth of 8m. The permissible compressive stress in concrete at transfer is 14 $N/mm^2$ & the minimum comp. stress under working pressure is 1 $N/mm^2$. **13**
The loss ratio is 6.75. Wires of 5 mm diameter with an initial stress of 1000 $N/mm^2$ and available for circumferential winding and treyssinet cables made up of 12 wires of 8 mm diameter stressed to 1250 $N/mm^2$ are to be used for vertical prestressing. Design the tanks walls assuming the base as fixed. The cube strength of concrete is 40 $N/mm^2$.

**OR**

**10.** A prestressed concrete cylinder pipe is formed by lining a steel cylinder of diameter 700 mm and thickness 2.5 mm with a layer of spun concrete 25 mm thick. **13**
If the pipe is required to with stand a hydraulic pressure of 0.85 MPa without developing any tensile stresses in concrete, calculate -

i) The required pitch of 4 mm wires, wound round the cylinder at tensile stress of 1.4 MPa in the concrete immediately after the winding and

ii) The approximate bursting pressure modular ratio = 6.
Tensile strength of wire = 1700 MPa
Yield stress of cylinder = 280 MPa
Loss Ratio = 0.85.

**11.** Explain **any three** of the following. **13**

i) Prestressed concrete elements under fatigue loads.

ii) Behaviour of prestressed concrete elements under fire.

iii) Effect of corrosion on prestressed concrete elements.

iv) Explain in brief the behavior of prestressed concrete elements under dynamic loads.

**OR**

**12.** a) What are the salient design features of prestressed concrete one way & two way slab panels ? **7**

b) What are the advantages of prestressing flat slab floor panels ? Sketch the cross section of a simple flat slab showing the typical cable profile. **6**

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