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

Elective-II : Pre-Stressed Concrete

P. Pages : 3 **NRJ/KW/17/4669**

Time : Three Hours * 0 2 3 3 * Max. Marks : 80

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. Use I.S. Code 800/1962 or 1994 is 456 (Revised) I.S. 875 may be consulted.

1. a) Explain in Brief about the Losses of Prestress. **6**

b) A Post tensioned concrete beam of rectangular cross section 150m mm wide and 400 mm deep is stressed by a parabolic cable with zero eccentricity at supports and an eccentricity of 60 mm at the centre of span. The area of cable is 250 mm2 and the initial stress in the cable is 1200N/mm2. If the ultimate creep strain is $30x10^{-6}$ mm/mm per N/mm2 of stress and the modulus of elasticity of steel is 2.1x105 N/mm2 compute the loss due to creep of concrete. **8**

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 100mm wide and 200 mm deep. The prestressing force of 100kN is transmitted to concrete by a distribution plate, 100 mm wide and 50 mm deep, concentrically located at the ends. Calculate the position and magnitude of maximum tensile stress on horizontal section through the centre and edge of the anchor p late. Compute the bursting tension on these horizontal planes. **8**

3. a) What is kern distance. **3**

b) A post-tensioned prestressed beam of rectangular section 250mm wide is to be designed for an imposed load of 12 kN/m, uniformly distributed on a span of 12m. The stress in the concrete must not exceed 17 MPa in compression and 1 MPa in tension at any time and the loss of prestress may be assumed to be 15% **10**

i) Calculate the minimum possible depth of beams and

ii) For the section provide, calculate the minimum prestressing force and the corresponding eccentricity.

OR

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

b) A pre-stressed concrete beam of span 8m having a rectangular section of 150mm x 300mm the beam is pre-stressed by a parabolic cable having an eccentricity of 75mm below the centroidal axis at the centre of span and eccentricity of 25mm above the centroidal axis at support sections. The initial force in the cable is 350 kN. The beam supports three. Concentrated loads of 10 kN each at intervals of 2m. Ec = 38 kN/mm2. **10**

i) Neglect the losses of presses, 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 load) assume creep coefficient as 1.8

5. a) What the requirements of longitudinal and Transverse reinforcement requirements if the prestressed beam is subjected to combined bending, shear and torsional stresses. **6**

b) The cross section of a prestressed concrete beam is rectangular with a width of 350mm and a overall depth of 700mm. The prestressing force of 180 kN acts at an eccentricity of 190mm. If the bending and twisting moments at the section are 80 and 20 kNm respectively, calculate the maximum principle stress in the section. **8**

OR

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

b) A precast pre-tensioned beam of rectangular section has a breadth of 100 mm and 200 mm deep. The beam with an effective span of 5m, is prestressed by tendons with their centroid coinciding with the bottom kern. The initial force in tendons is 150kN. 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 and thickness 50 mm. If the composite beam supports a live load of 8 kN/m2, calculate the resultant stresses developed in the precast and insitu cast concrete assuming the pre-tensioned beam as unsupported and propped during the casting of slab. Assume the same modulus of elasticity for concrete in precast beam and in situ cast slab. **10**

7. A continuous beam ABC, AB=BC=12m has a uniform rectangular section with a width of 150 mm and depth of 300m. The cable carrying effective presetressing force of 420kN parallel to axis of the beam located at 125 mm from the soffit. **13**

a) Determine the secondary and 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 and D has colums AB = CD = 4m and the beam BC = 12m. **13**

The members have 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 and C and 100 mm below the centroid at the centre of BC. The; presressing force in all the cables is 200 kN. Calculate the secondary moments developed in A and B using the flexibility coefficients.

9. A prestressed concrete circular cylinder tank is required to store 25400 million liters of water. The permissible compressive stresses in concrete at transfer should not exceed 13 MPa and the minimum compressive stress under working pressure not less than 1 MPA. The loss ratio is 0.7. High tensile wires of 7 mm diameter with an initial stress of 1000n/mm2 are available for winding round the tank. Freyssynet cable of 12mm wires of 8mm diameter which are stressed to 1000 N/mm2 are available for vertical prestressing. The cube strength of concrete is 40 MPs. Design the tank walls supported on elastometric pads. Assume the coefficient of friction as 0.5. **13**

OR

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

i) The required pitch of 4mm wires, wound round the cylinder at tensile stress of 1000 MPa

ii) The test pressure to produce a tensile stress of 1.4 MPa in the concrete immediately after the winding, and

iii) The approximate bursting pressure Modular ratio = 6
Tensile strength of wire = m 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. Design a post-tensioned prestressed concrete slab bridge deck for a highway crossing to suit the following data: **13**
Clear span : 8m
Width of bearing = 350mm
Clear width of road = 7m
Foot path = 1.0 m on either side
Thickness of wearing coat = 70m
Live load : IRC class AA tracked vehicle
Type of structure; Class I type
Materials: M-40 grade concrete and 7mm diameter
high tensile wires with and ultimate tensile strength of
1500 MPa housed in cables with 12 wires and
anchored by Freyzzinet anchorages of 150mm diameter. For supplementary reinforcement adopt Fe 415 grade.
Compressive strength at transfer fcr = 35 MPa
Loss Ratio = 0.8

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