Register Number: ………………..

M.E. DEGREE EXAMINATIONS: APRIL/MAY 2010

Second Semester

STRUCTURAL ENGINEERING

SEE562: Prestresseed Concrete

(Use of IS 1343, IS 3370 Part I, III, IV, IS 784, IS 3935 and all relevant codes permitted)

Time: Three Hours **Maximum Marks: 100**

Answer All Questions:-

PART A (10x 2 = 20 Marks)

1. Why did the early attempts in prestressing using ordinary mild steel fail?
2. What is Load balancing concept?
3. What are the three classes of prestressed concrete structures?
4. Compare the loss of prestress due to elastic shortening in pretensioned and post tensioned members.
5. What is the effect of shear on prestressed concrete sections?
6. What are the merits and demerits of partial prestressing?
7. What do you mean by unpropped construction?
8. How continuity is achieved in prestressed concrete continuous beam construction?
9. When a cable profile is considered to be concordant?
10. What are the advantages of prestressing concrete poles?

PART B (5 x 16 = 80 Marks)

11. a) (i) Explain different methods of post tensioning systems. (6)

(ii) A rectangular concrete beam,100mm wide by 250mm deep, spanning over 8m is prestressed by a straight cable carrying an effective prestressing force of 250kn located at an eccentricity of 40mm. The beam supports a live load of 1.2kn/m.

Calculate the resultant stress distribution for the central cross section of the beam. The density of concrete is 24kn/m3.

Find the magnitude of the prestressing force with an eccentricity of 40mm which can balance the stresses due to dead and live loads at the bottom fibre of the central section of the beam. (10)

(OR)

b) (i) What are the different types of losses of prestress in post tensioned prestressed concrete elements? (4)

(ii) A pretensioned beam 200 mm wide and 350 mm deep is prestressed with 12 wires of 7 mm diameter, initially stressed to 1200 N/mm^2. The centroid of the prestressing wires is located at 100 mm above the soffit. Assuming the loss due to relaxation as 5%, calculate the total loss of prestress as per IS 1343-1980. (12)

E_s = 210 KN/mm2, E_c = 35 KN/mm^2

Relaxation of steel stress = 5% of the initial stress

Shrinkage of concrete = 300 x 10^{-6}

Creep coefficient = 1.6

12. a) (i) What are the various types of flexural failures in prestressed concrete members? (4)

(ii) A pretensioned beam of rectangular section 200 mm wide and 450 mm deep. The section is prestressed by 500 mm^2 of high-tensile steel located at an effective depth of 400 mm. The effective stress in the tendons after all losses is 800 N/mm^2. Estimate the ultimate flexural strength of the section according to Indian code regulations. Assume the characteristic cube strength of concrete as 40 N/mm^2. (12)

(OR)

b) (i) Write the assumptions made in the analysis of prestressed concrete members. (4)

(ii) Design a pre-tensioned beam for an effective span of 6m, LL = 6 kN/m. Load factors for DL = 1.4 & LL = 1.6. (364). (12)

Type of structure		=	Class I
Cube strength of concrete	f_{cu}	=	45 N/mm^2
Cube strength at transfer	f_{ci}	=	30 N/mm^2
Tensile strength of concrete	f_t	=	1.7 N/mm^2

Modulus of elasticity of concrete E_c = 35 N/mm^2

Modulus of elasticity of HTS wires = 200 kN/mm^2

Loss ratio η = 0.85

Use 8 mm dia HTS wires having a characteristic tensile strength fpu = 1500 N/mm^2.

13. a) (i) Write the maximum shear stress value for circle, rectangle and box sections subjected to torsion. (6)

(ii) A post tensioned beam of rectangular section 200 x 400 mm deep is 10 m long and carries an applied load of 8 kn/m,udl on the beam. The effective prestressing force in the cable is 500 Kn. The cable is parabolic with zero eccentricity at the support and 140 mm at the mid span.

(i) Calculate the principal stresses at the supports

(ii) What will be the magnitude of the principal stresses at the support in the absence of prestress. (10)

(OR)

b) (i) Explain the Indian Code recommendations for the design of reinforcements considering shear, bending and torsion (4)

(ii) A post tensioned prestressed beam 300 x 500 mm is subjected to an ultimate shear force of 100 kN, bending moment of 200 kN and a torsional moment of 75 kNm. The section is Prestressed with 12 nos. of 8mm dia. HTS wires with an effective prestressing force of 500 kN at an eccentricity of 150 mm. (12)

Cube strength of concrete f_{cu} = 40 N/mm^2

HTS wires having an ultimate tensile strength fp = 1820 N/mm^2

Design suitable longitudinal and transverse reinforcements in the beam using IS 1343

14. a) (i) What are cap cables? Where are they used? (4)

(ii) A post-tensioned prestressed beam with a rectangular cross section is to be designed for an imposed load of 12 kN/m over a span of 10 m. the stress in concrete shouldn't exceed 17 N/mm^2 in compression and 1.4 N/mm^2 in tension. The loss of prestress is approximately 15%. Calculate (12)

(i) the depth of the section

(ii) Magnitude of the minimum prestressing force

(iii) Eccentricity of the prestressing force

(OR)

b) (i) Explain Magnel's Investigations on anchorage zone stresses. (4)

(ii) The end block of a prestressed concrete beam, rectangular in sec-150 mm wide and 250 mm deep. The prestressing force of 100 kN is transmitted to concrete by a distribution plate, 100 mm wide and 50 mm deep, concentrically at the ends. Calculate the position and magnitude of the maximum tensile on the horizontal section through the centre and edge of the anchor plate. Compute the position and magnitude of maximum tensile stress and bursting tension for the end block and design the reinforcements. (12)

15. a) (i) A two span continuous prestressed concrete beam, each span being 8 m. The cross section is rectangle 150 x 300 mm. The prestressing cable is parallel to the axis of the beam, located at 100 mm from the soffit. It carries an effective prestressing force of 400 kN. Locate the pressure line. (6)

(ii) Design a prestressed concrete pile, carrying an axial load of 3000 kN. The length of the pile is 10m. The specified cube strength of concrete f_{cy} = 40 N/mm^2. The permissible effective prestress shouldn't exceed 5 N/mm^2 (10)

(OR)

b) (i) Write the procedure for design of prestressed cylinder pipes. (6)

(ii) Design a non cylinder prestressed concrete pipe of 600mm internal diameter to withstand working hydrostatic pressure of 1.0 N/mm2 using 2.5 mm high tensile wire stressed to 1000 N/mm2 at transfer. Permissible max and min stresses in concrete at transfer and service loads are 14 N/mm2 and 0.7 N/mm2.loss ratio is 0.8.Calculate also the test pressure required to produce a tensile stress of 0.7 N/mm2 in concrete when applied immediately after tensioning and also the winding stress in steel if Es = 210 Kn/mm2 and Ec = 35 N/mm2. (10)

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