Register No: ……..

B.E., DEGREE EXAMINATIONS: NOV/DEC 2012

Seventh Semester

CIVIL ENGINEERING

CEE201: Prestressed Concrete

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

(Assume any suitable data necessary for the design)

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

Answer All the Questions

PART A (10 x 1 = 10 Marks)

1. In a post tensioned concrete beam,if all the wires are simultaneously tensioned,there will be
   a) Loss of prestress due to elastic deformation b) Loss due to shrinkage of concrete
   c) No loss of prestress due to elastic deformation d) No loss due to creep of concrete
2. Due to the application of prestressing force, a simply supported beam element having tendons located towards the soffit of the beam
   a) Deflects downwards
   b) Deflects upwards
   c) Doesn't deflect due to prestressing force alone.
   d) Cracks in the tension zone but no deflection occurs
3. The stress distribution in an end block is
   a) Mostly compressive in nature b) Highly tensile in nature
   c) Linear distribution throughout the cross section d) Complex and three dimensional
4. Due to flexural failure, a prestressed concrete element may fail in the following mode
   a) Fracture of steel in tension
   b) Plastic failure of the HSC
   c) Inelastic failure of the HSC
   d) Manual error in the application of the prestressing force.
5. Due to circular prestressing
   a) Compressive stresses are produced in the bottom face of the beam
   b) Hoop compression is induced in concrete
   c) Crack develop in the top face of the continuous supported beams
   d) The flexural strength doesn't increase at all.

6. Circular prestressing is most suitable for
   a) Short span portal frames
   b) Long span continuous beams
   c) Liquid retaining structures like tanks, pressure vessels, pipes
   d) Statically indeterminate structures
7. The phenomenon of differential shrinkage between insitu concrete and the prestressed portion contributes to the
   a) Linear stress strain characters in a composite structure
   b) Nonlinear stress strain characters in a composite structure
   c) Failure of the composite structure as a whole.
   d) Monolithic action of the composite member
8. In a composite structure, prestressed units are used in the
   a) tension zone
   b) compression zone
   c) cast insitu portion of the structure.
   d) foundation portion
9. Post tensioned bridge decks are suitable for spans
   a) Upto 15 m
   b) In the range 200 to 250 m
   c) Exceeding 20 m
   d) Upto 7.5 m to 10 m
10. The area of supplementary reinforcement in a post tensioned prestressed bridge is
   a) In the range 2 to 4 % of the gross cross section
   b) 0.15% of the gross section
   c) 0.75% of the cross sectional area
   d) 6% of the cross sectional area

PART B (10 x 2 = 20 Marks)

11. Compare the loss of prestress due to elastic shortening in pretensioned and post tensioned members.
12. What is Load balancing concept?
13. Briefly explain about anchorage zone reinforcements.
14. What are the merits and demerits of partial prestressing?
15. Explain the concept of circular prestressing.
16. What are the advantages of prestressing concrete poles?
17. What do you mean by unpropped construction?
18. Mention a few advantages of precast prestressed units in association with cast insitu concrete.

19. List three advantages of prestressed concrete bridges when compared with reinforced concrete bridges.
20. What do you think on the suitability of prestressed concrete bridges for short span bridges?

PART C (5 x 14 = 70 Marks)

21. a) Explain the following with necessary sketches
    (i) Difference between pretensioned and post tensioned concrete. (2)
    (ii) Pressure line (2)
    (iii) Various post tensioning systems based on wedge action with sketches. (4)
    (iv) Loss of prestress due to elastic shortening in pretensioned and post tensioned members. (4)

(OR)

b) 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
E_s = 210 KN/mm^2, 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

22. a) 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

(OR)

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

23. a) Explain the step by step design procedure of Prestressed Concrete Circular Water tanks

(OR)

b) A prestressed concrete pipe is to be designed using a steel cylinder 1000 mm diameter and 1.6 mm thick. The circumferential wire winding consists of a 4 mm high tensile wire, initially tensioned to a stress of 1000 N/mm^2. ultimate tensile strength of the wire = 1600 N/mm^2. Yield stress of the steel cylinder = 300 N/mm^2. The maximum permissible compressive stress in concrete at transfer is = 14 N/mm^2 and no tensile stresses are permitted under working pressure of 0.8 N/mm^2. Determine the thickness of the concrete lining required, the number of turns of circumferential wire winding and the factor of safety against bursting. Assume modular ratio as 5.

24. a) (i) Explain the terms propped construction and unpropped construction in composite construction. (8)

(ii) Explain how a precast and a cast insitu element are connected together? (8)

(OR)

b) A precast pre-tensioned beam of rectangular section has a breadth of 100 mm and a depth of 200 mm. The beam, with an effective span of 5 is prestressed by tendons with their centroids coinciding with the bottom kern. The initial force in the tendons is 150 kN. The loss of prestress may be assumed to be 15 cent. The beam is incorporated in a composite T-beam by casting a top flange of breadth 400 mm and thickness 40 mm. If the composite beam supports a live to 8 kN/m2, calculate the resultant stresses developed in the precast and in situ cast crete assuming the pre-tensioned beam as unpropped. Assume the same modulus of elasticity for concrete in pi beam and in situ cast slab.

25. a) Explain the general design procedure for the design of a post tensioned prestressed concrete bridge with sketches

(OR)

b) Draw the typical cross sections of a pretensioned prestressed concrete bridge and explain them?

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