Roll.No

B.E/B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2011

CIVIL ENGINEERING BRANCH

EIGHTH SEMSTER

22

CE 507 – PRESTRESSED CONCRETE STRUCTURES

(REGULATIONS 2004)

Time : 3 Hr Max Mark : 100

(IS 456, IS1343 and IS 3370 are permitted)

Part – A (10 x 2 = 20 Marks)

1. What is the necessity to use high strength concrete and high tensile steel for prestressing concrete construction?
2. What are the various post tensioning systems used in prestressed concrete structures.
3. What are the various flexural failure modes of prestressed concrete beams.
4. Sketch and indicate Hoyer' effect in pretensioned members.
5. What are the advantages of prestressed concrete poles?
6. What are the various forces developed in the walls of the circular prestressed tanks?
7. State the advantages of a composite beam.
8. What is the difference between propped and unpropped composite construction?
9. What is the effect of differential shrinkage in a composite beam?
10. Write short notes on the general aspects of prestressed concrete bridges?

Part – B (5 x 16 = 80 Marks)

11. A pretensioned prestressed concrete Tee section having a flange width of 1200 mm and thickness of flange 150 mm, thickness of web being 300 mm is prestressed by 4700 mm^2 of high tensile steel located at an effective depth of 1600 mm. If f_{ck} = 40 N/mm^2 and f_p = 1600 N/mm^2, estimate the ultimate moment capacity of the pretensioned Tee section.

12(a)A rectangular beam 180 mm wide and 400 mm deep is simply supported over a span of 8 m and is reinforced with 3 wires of 8 mm diameter. The wires are located at a constant eccentricity of 80 mm and are subjected to an initial stress of 1200 N/mm2. Calculate the percentage loss of stress in the wires if the beam is (a) pre tensioned and (b) post tensioned. Given Es = 210 kN/mm^2, modular ratio is 6, slip at anchorage is 0.8mm, friction coefficient = 0.002/m, relaxation of steel stress = 6%. Adopt creep and shrinkage coefficients as per IS 1343.

OR

12(b) A concrete beam having a rectangular section, 250 mm wide and 500 mm deep is prestressed by a parabolic cable having an eccentricity of 75 mm at the centre of span and is concentric at the ends. The effective force in the cable is 250 kN. The beam supports a live load of 2.5 kN/m in addition to the self weight .If the modulus of elasticity of concrete is 38 kN/mm2 and span is 8 m: Calculate (a) Short term deflection at centre of span under prestress, self weight and live load (b) Long term assuming the loss of prestress as 18 % and creep coefficient as 1.6.

13(a) A composite beam consists of an inverted prestressed T section with bottom flange 400 mm × 100 mm thick and web 100 mm × 200 mm deep. The prestressed portion is subjected to a triangular stress distribution across the depth zero at top and 10.5 N/mm^2 at bottom under effective prestress after all losses. The beam is erected on a simple span of 6 m and an in-situ concrete is laid to make the composite section 400 mm × 400 mm overall. Estimate the live load the composite beam can carry, for zero stress at bottom of the mid span section. Assume relevant data.

OR

13(b) A rectangular pretensioned concrete beam has a breadth of 100 mm and a depth of 230 mm, and the prestress after losses is 12 N/mm^2 at the soffit and zero at the top. The beam is incorporated in a composite I beam by casting a top flange of breadth 300 mm and depth 50 mm. Calculate the maximum stresses developed in the precast and in situ cast concrete under an imposed load of 5 kN/m^2. Assume that the beam is simply supported over a span of 4.5 m.

14(a) Design a cylindrical prestressed concrete water tank to suit the following data:
Capacity of the tank = 3.5×10^9 litres. Ratio of diameter to height = 4
Maximum compressive stress in concrete at transfer not to exceed 14 N/mm^2 (compression) and minimum compressive stress under working load to be 1 N/mm^2. The prestress is to be provided by circumferential winding of 5 mm wires and by vertical cables of 12 wires of 7 mm diameter. The stress in wires at transfer is 1000 N/mm^2, Loss ratio = 0.75. Design the walls of the tank if the base is fixed.

OR

14(b) Design a pretensioned prestressed concrete pole of height 10 m above the ground. Wind force on wires acting at a height 8 m from the base is 2 kN and the wind force on pole is 1.6 kN at mid-height of the pole. Permissible compressive stress in concrete is 16 N/mm^2. No tension is permitted under working loads. Loss ratio is 0.8 and high tensile steel of 8mm diameter initially stressed to 1200 N/mm^2 is available for use. Design the suitable section and the number of wires in the section of pole.

15(a) (i) Sketch the typical cross sections of post tensioned prestressed concrete bridge decks. (10 Marks)
(ii) Enumerate the advantages of prestressed concrete bridges. (6 Marks)

OR

15(b) (i) Describe the steps in the design of prestressed concrete bridges. (8 Marks)
(ii) Sketch the different types of pretensioned prestressed concrete bridge decks. (8 Marks)