29/9/13

Reg. No.

COLLEGE OF ENGINEERING, ANNA UNIVERSITY

BE DEGREE EXAMINATION, NOVEMBER / DECEMBER 2013

EIGHTH SEMESTER CIVIL ENGINEERING

CE 507 / CE 9027 – PRESTRESSED CONCRETE STRUCTURES

Time : Three Hrs Max Marks : 100

(IS 456, IS1343 and IS 3370 are permitted)

Part A (10 x 2 = 20)

1. What is the need to use high tensile steel and high strength concrete for the prestressed concrete structures?
2. What is the difference between pre-tensioning and post-tensioning in prestressed concrete construction?
3. Is there any difference in load carrying mechanism in flexure under working condition between RCC and PSC?
4. Discuss on "limiting zone" for prestressing force.
5. Discuss about the transfer of pre-stress at the end zone of post-tensioned members.
6. What is the need to provide reinforcement in the anchorage zone in prestressed concrete members?
7. What is the role of differential shrinkage in composite construction of prestressed concrete members?
8. What is the difference between propped and unpropped construction?
9. What are the advantageous of prestressed concrete bridges over the RC bridges?
10. What are loadings to be considered for the design of poles?

Part B (5 x 16 = 80)

11. A concrete beam having a rectangular section, 200mm wide and 400mm deep is prestressed by a parabolic cable having an eccentricity of 100mm at centre of span towards the soffit and an eccentricity of 30mm towards the top at support section. The effective force in the cable is 400 kN. If the modulus of elasticity of concrete is $38kN/m^2$ and span is 8m. Calculate (a) short term deflection at the centre of span under prestress, self weight and live load (b) long term assuming the loss ratio as 0.8 and creep coefficient as 1.6.

12.

a) The composite 'T' beam composed of a cast -in-situ top flange of breadth 500 mm and thickness 50 mm and a precast pretensioned beam of rectangular section has a breadth of 150 mm and depth 300 mm. The effective span of the beam is 6 m. The beam is prestressed with high tensile steel with C.G. coinciding with the bottom kern. The force at transfer in the tendons is 150 kN. Loss of prestress is 10%. The composite beam supports a live load of 8 kN/m^2. Calculate the resultant stresses developed in the precast and in-situ concrete taking the pretensioned beam is unpropped during casting of the slab. M 40 and M 20 concrete are used for pretensioned and in-situ concrete respectively.

OR

b) A composite beam consists of an inverted prestressed T section with bottom flange 400 mm × 150 mm thick and web 150 mm × 250 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 7 m and an in-situ concrete is laid to make the composite section 400 mm × 600 mm overall. Estimate the live load the composite beam can carry, for zero stress at bottom of the mid span section. Assume relevant data.

13.

a) A simply supported beam of 8m span and rectangular section 150mm x 300mm is pre stressed by a cable in which the total tensile force as 300kN. The cable is located at a constant eccentricity of 100mm above the soffit at the middle third of the beam and then the cable is curved towards the extreme ends and the eccentricity of cable at both the ends are 75mm above center line. The modulus of elasticity and density of concrete are 35kN/m^2 and 24kN/m^3, respectively. Determine the deflection of the beam when the beam carries an imposed load of 4.5 kN/m.

OR

b) A rectangular beam 200mm wide and 400mm deep is simply supported over a span of 7m and is reinforced with 3 wires of 8mm diameter. The wires are located at a constant eccentricity of 100mm and are subjected to an initial stress of 1100 N/mm^2. Calculate the percentage loss of stress in the wires if the beam is (a) pre tensioned and (b) post tensioned. E_s = 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.

14.

a) A cylindrical wall of thickness of 150 mm is subjected to a design tensile force of 250 kN/m. If the compressive stress in concrete is limited to 16 N/mm^2 in compression and zero tension, design the pitch of circumferential wire winding using 5 mm diameter high tensile wires initially tensioned to 1200 N/mm^2. Assume a loss ratio of 0.8. If f_p = 1600 N/mm2, determine the load factor against collapse.

OR

b) Design a pretensioned prestressed concrete pole of height 8m above the ground. Wind force on wires acting at a height 6m from the base is 1.5kN and the wind force on pole is 1.2kN at mid-height of the pole. Permissible compressive stress in concrete is 14 N/mm^2. No tension is permitted under working loads. Loss ratio is 0.85 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) What are the various cross sections used for the construction of prestressed concrete bridges? Discuss on the steps involved in the design of pretensioned prestressed concrete bridge deck.

OR

b) Write short notes on

i. Shrinkage induced stress
ii. Deflections of composite structures
iii. Losses of prestress
iv. Strain compatibility method for the estimate of flexural capacity of prestress concrete members