Roll.No.

B.E / B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL/MAY 2014

CIVIL ENGINEERING BRANCH

SEVENTH SEMESTER

CE 9027 – PRESTRESSED CONCRETE STRUCTURES

(REGULATIONS 2008)

Time: Three hours Maximum: 100 Marks

Answer ALL Questions

(IS1343 and IS 3370 are permitted)

Part – A (10 x 2 = 20 Marks)

1. Explain why steel with a low yield stress is not used in prestressed construction?
2. What are the assumptions to be made in analyzing the stresses in prestressed concrete members?
3. What are the types of losses of prestress in pretensioned members?
4. List the factors influencing deflections in prestressed concrete members.
5. What is partial prestressing?
6. What is 'limiting zone' for prestressing force?
7. Differentiate between propped and unpropped construction.
8. What are the advantages of a composite beam?
9. What are the various loads on railway sleepers?
10. What are the advantages of prestressed bridge decks compared to reinforced concrete bridge decks?

Part –B (5 x16 = 80 Marks)

11. A beam of symmetrical I section spanning 8 m has a flange width of 250 mm and flange thickness of 80 mm respectively. The overall depth of the beam is 450 mm. Thickness of the web is 80 mm. The beam is prestressed by a parabolic cable with an eccentricity of 150 mm at the centre of the span and zero at the supports. The live load on the beam is 2.5 kN/m. (a) Determine the effective force in the cable for balancing the dead load and live loads on the beam, (b) Sketch the distribution of resultant stress at the centre of span section for the above case, (c) Calculate the shift of the pressure line from the tendon-centre-line.

12.

a) A concrete beam of symmetrical I section spanning 6 m has flange width of 300 mm and thickness of 75 mm respectively. The thickness of the web is 75 mm. The overall depth of the beam is 750 mm. The beam is prestressed by a parabolic cable with an eccentricity of 200 mm at the centre below the centroid and zero at the supports with an effective force of 170 kN. Effectiveness factor is 0.8. Live load on the beam is 3 kN/m. Determine instantaneous and long-term deflections. Taken density of PSC as 25 kN/m^3 and age at transfer as 28 days.

OR

b) A rectangular beam 150 mm wide and 450 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 75 mm and are subjected to an initial stress of 1200 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 code specifications.

13.

a) A post tensioned concrete beam 400 mm wide and 800 mm deep supports an effective prestressing force of 1100 kN at an eccentricity of 120 mm. The anchor plate is 400 mm wide and 400 mm deep. Calculate the bursting force and design reinforcement to resist this force. Sketch the details of reinforcements.

OR

b) A pre tensioned T section has a flange width 1200 mm and 150 mm thick. The width and depth of the rib are 300 mm and 1500 mm respectively. The high tensile steel has an area of 4700 mm^2 and is located at an effective depth of 1600 mm. If the characteristic cube strength of the concrete and the tensile strength of steel are 40 and 1600 N/mm^2 respectively, Calculate the flexural strength the T section?

14.

a) A precast pretensioned beam of rectangular section has a breadth of 100 mm and depth 200 mm and effective span of 5 m. The beam is prestressed with C.G. of steel coinciding with the bottom kern. The force at transfer in the tendons is 150 kN. Loss of prestress is 15%. The beam is incorporated in a composite 'T' beam by casting a top flange of breadth 400 mm and thickness 40 mm. The composite beam supports a live load of 7 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 x 100 mm thick and web 100 mm x 200 mm deep. The prestressed portion is subjected to a triangular stress distribution across the depth zero at top and 10.25 N/mm^2 at bottom under effective prestress after all losses. The beam is erected on a simple span of 5 m and an in situ concrete is laid to make the composite section 400 mm x 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.

15.

a) (i) Draw the typical cross sections of pre tensioned prestressed concrete bridge decks. (8 Marks)
(ii) Draw the typical cross sections of post tensioned prestressed concrete bridge decks. (8 Marks)

OR

b) Write notes on

i. Advantages of prestressed concrete poles (4 Marks)
ii. Forces developed in Walls of Circular water tank (4 Marks)
iii. Steps in the design of a post tensioned PSC slab bridge deck (8 Marks)