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B.E / B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS, NOV/DEC 2012

CIVIL ENGINEERING BRANCH

EIGHTH SEMESTER

CE 9027 – PRESTRESSED CONCRETE STRUCTURES

(REGULATIONS 2008)

26

Time : Three hours Maximum : 100 Marks

Answer ALL Questions

(IS1343 and IS 3370 are permitted)

Part – A (10 x 2 = 20 Marks)

1. Why it is necessary to use high tensile steel and high strength concrete for pre-stressing concrete structures?
2. What are the various post tensioning systems used in prestressed concrete structures.
3. What are the factors affecting loss of prestress in pre-tensioned and post-tensioned members?
4. Mention the Load- Deflection characteristics of prestressed concrete members.
5. Sketch and indicate Hoyer' effect in pretensioned members.
6. What is partial prestressing?
7. State the advantages of a composite beam.
8. What is the effect of differential shrinkage in a composite beam?
9. What are the various forces developed in the walls of the circular prestressed tanks?
10. What are the advantages of prestressed concrete poles?

Part –B (5 x16 = 80 Marks)

11. A pre-stressed concrete beam supports a live load of 5 kN/m over a simply supported span of 6 m. The beam has an unsymmetrical I section with an overall depth of 600 mm. The thickness of the flanges and web are 70 and 90 mm, respectively. The width of the top flange is 300 mm and bottom flange. If the limitation is in such a way that the resultant stress due to PS and load (DL + LL) at bottom fibre at mid span is zero, find
    a. the suitable eccentricity of the tendon with an effective prestressing force of 235 kN and
    b. find the effective prestressing force required, if the tendon is concentric using stress concept.

12.
    a) A concrete beam of symmetrical I section spanning 6 m has flange width and thickness of 200 mm and 70 mm respectively. The thickness of the web is 80 mm. The overall depth of the beam is 600 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 150 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. Also check for IS limits.

OR

b) 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 8mm diameter. The wires are located at a constant eccentricity of 80 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 prestressed concrete Tee beam with unbounded tendons is made up of a flange 300 mm wide by 150 mm thick and the thickness of rib is 150mm. The overall depth of the beam is 400 mm. The beam is prestressed by 24 high tensile wires of 5 mm diameter with an effective stress of 65 % of the ultimate tensile strength of wires. The wires are located at an effective depth of 320mm. Loss ratio is 0.8. If f_{ck} = 56 N/mm^2 and f_p = 1600 N/mm2, estimate the flexural strength of the section assuming the span /depth ratio of the beam as 20.

OR

b) 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.

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 T beam is made up of a pretensioned rib 200 mm wide and 600mm deep and a cast in situ slab 500 mm wide and 150 mm thick. The compressive strength of concrete in pretensioned rib and cast in situ slab are 40 and 20 N/mm^2, respectively. The pretensioned rib is prestressed by pretensioned wires of area 400 mm^2 located at 100 mm from the soffit and are initially stressed to 1200 N/mm^2. Estimate the ultimate flexural strength of T composite section using IS 1343 code recommendations. Adopt f_p = 1600 N/mm^2.

15.

a) A cylindrical wall of thickness of 100 mm is subjected to a design tensile force of 300 kN/m. If the compressive stress in concrete is limited to 15 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 = 1700 N/mm^2, determine the load factor against collapse.

OR

b) Discuss on the steps involved in the design of pretensioned prestressed concrete bridge deck.