B.E./B.TECH. Degree Examination, December 2020

Seventh Semester

CE16702 - PRESTRESSED CONCRETE STRUCTURES

(Regulation 2016)

Time: Three hours Maximum:80 Marks

IS1343:1980, IS3370:1967 May be Permitted.

Answer **ALL** questions

PART A - (8 X 2 = 16 marks)

1. The ultimate tensile strength of high tensile steel(N/mm^2) used in prestressed concrete structures is
   a. 250 b. 415 c. 2100 d. 1100
2. The adjacent surface to the anchor plate is subjected to
   a. Compressive forces b. tensile forces c. transverse forces d. torsion
3. When the modulus of elasticity of precast and insitu cast concrete are different, the flexural rigidity is worked out by
   a. First moment of area b. second moment of area
   c. cross sectional area d. self weight
4. The stress block in concrete for the estimate of ultimate strength of a prestressed concrete beam in flexure
   a. Should be parabolic b. Should be parabolic rectangular
   c.Should be rectangular d.Can be of any shape.
5. For a prestressed flexural member, the crack width has to be estimated by same procedure as for RCC member. Justify the statement.
6. Describe the various types of shear cracks in a prestressed concrete member.
7. Different layouts of cables are used to achieve continuity in a prestressed concrete continuous member. What is meant by achieving continuity and what is its significance?
8. What type of prestressing can be employed to construct prestressed circular water tank? Define that type of prestressing.

PART B - (4 X16 = 64 marks)

9. (a) An unsymmetrical I-section concrete beam with top flange 300 x 60 mm, web 80 x 280 mm and bottom flange 100 x 60 mm is used to support a live load of 2 kN/m over a span of 8 m. The effective prestressing force is 100 kN located 50 mm from the soffit of the beam. Compute the stress in concrete in the soffit at the centre of span under working loads. Also find the load factor against cracking if modulus of rupture of concrete is 5 N/mm^2. **(16)**

(OR)

(b) A rectangular beam 180 mm wide by 400 mm deep is simply supported over a span of 8 mm 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/mm^2. Calculate the percentage loss of stress in the wires if the beam is (a) prestensioned and (b) post tensioned. E_s= 210 kN/mm^2, modular ratio = 6, slip at anchorage = 0.8 mm, friction coefficient = 0.002/m, relaxation of steel stress = 6%. Adopt creep and shrinkage coefficients as per IS 1343 code specifications. **(16)**

10. (a) A post tensioned prestressed concrete Tee section having a flange width of 1200 mm and flange thickness of 200 mm, thickness of web being 300 mm is prestressed by 2000 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 unbounded tee section, assuming span to depth ratio as 20 and f_{pe}= 1000 N/mm^2. How much will the ultimate moment capacity vary if the section is bonded? **(16)**

(OR)

(b) A post tensioned prestressed concrete beam of rectangular section 250 mm wide by 580 mm deep is to be designed to support an imposed load of 12 kN/m uniformly distributed over a span of 12 m. The stress in concrete must not exceed 17 N/mm^2 in compression or 1.4 N/mm^2 in tension at any stage and the loss of prestress is 15 %. Determine the minimum prestressing force and the corresponding eccentricity. **(16)**

11. (a) A rectangular pre tensioned concrete beam has a breadth of 100 mm and depth of 230 mm, and the prestress after all losses have occurred 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 of 50 mm. Calculate the maximum udl that can be supported on a simply supported span of 4.5 m, without any tensile stresses occurring (a) if the slab is externally supported while casting and (b) if the pre tensioned beam supports the weight of the slab while casting. **(16)**

(OR)

(b) A composite T girder of span 5 m is made up of a pre-tensioned rib, 100 mm wide by 200 mm deep, with an, in situ cast slab, 400 mm wide and 40 mm thick. The rib is pre-stressed by a straight cable having an eccentricity of 33.33 mm and carrying an initial force of 150 kN. The loss of pre-stress may be assumed to be 15 percent. Check the composite T-beam for the limit state of deflection if it supports an imposed load of 3.2 kN/m for: (a) unpropped construction, and (b) propped construction. Assume a modulus of elasticity of 35 kN/mm^2 for both precast and in situ cast elements. **(16)**

12. (a) Design a cylindrical prestressed concrete water tank to suit the following data: Capacity of the tank = 3.5 x 10^9 litres. Ratio of diameter to height = 4, maximum compressive stress in concrete at transfer not to exceed 14 N/mm^2 (compression). Minimum compressive stress under working load is 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 = 1000 N/mm^2. Loss ratio = 0.75. Design the walls of the tank and details of circumferential wire winding and vertical cables for the fixed joint at base. Assume coefficient of friction as 0.5. **(16)**

(OR)

(b) (i) Explain in detail about partial prestressing. **(8)**

(ii) Can prestressed concrete be used for tension members? Justify your answer in detail. **(8)**