Reg. No. : | | | | | | | | | | |

Question Paper Code: 32963

M.E DEGREE EXAMINATION, NOVEMBER 2015

Elective

Structural Engineering

01PSE510 – PRESTRESSED CONCRETE STRUCTURES

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

(Use of IS 1343, IS 370 tables are permitted)

PART A - (10 x 2 = 20 Marks)

1. List the advantage and disadvantage of prefabricated structures.
2. Mention any four factors affecting the deflection of the prestressed concrete beam?
3. What are the types of flexural failure?
4. What is mean by end block in a post tensioned member?
5. List out the disadvantages of prestressed continuous beams.
6. What is concordant cable?
7. When circular prestressing is done?
8. Write any two general failures of prestressed concrete tanks.
9. What is mean by composite construction in prestressed concrete?
10. Write the advantages of partial prestressing.

PART - B (5 x 14 = 70 Marks)

11. (a) (i) Explain the factor influencing deflections. (7)

(ii) What is anchorage slip? How do you compute the loss of stress due to anchorage slip? (7)

Or

(b) Explain the types of prestressing. (14)

12. (a) Pre-tensioned prestressed concrete beams have a rectangular section, 150*mm* wide and 350*mm* deep has an effective cover of 50*mm*. If f_{ck} = 40N/mm^2, f_p = 1600N/mm^2 and the area of prestressing steel A_p = 461mm^2, calculate the ultimate flexural strength of the section using *IS*: *1343* codal provisions. (14)

Or

(b) A prestressed beam span of 10*m* of rectangular section 120*mm* wide and 300*mm* deep, is axially prestressed by a cable carrying an effective force of 180*kN*. The beam supports a total uniformly distributed load of 5*kN/m* which includes the self weight of the member, compare the magnitude of the principle tension developed in the beam with and without the axial prestress. (14)

13. (a) Design a continuous prestressed beam of two spans *AB*=*BC*=12*m*, to support a uniformly distributed live load of 10*kNm*. Tensile stresses are not permitted in concrete and the compressive stress in concrete is not to exceed 13Nmm^2. Sketch the detail of the cable profile and check for stresses developed at the support and span section. (14)

Or

(b) A continuous beam *ABC* (*AB*=*BC*=20*m*) with an overall depth of 1*m* is prestressed by a continuous cable carrying a force of 300 *kN*. The cable profile is parabolic between the supports, with zero eccentricity at ends *A* and *C*. The cable has an eccentricity of 100*mm* towards the soffit at mid span sections and 200*mm* towards the top fibre at the mid support section. Calculate the reaction developed at the supports due to prestress and show that the cable is concordant. (14)

14. (a) Design the thickness of circumferential reinforcement required for a cylindrical tank wall subjected to a design tensile force of 500*kN/m*, f_{ct} = 16N/mm^2, f_{tw} = -0.8N/mm^2, direct tensile strength of concrete = 2.5N/mm^2 and η = 0.85. High tensile wires of

5*mm* diameter (*UTS* = 1700 N/mm^2) with an initial stress of 1000 N/mm^2 may be used. Desirable load factors against collapse and cracking should not be less than 2 and 1.25, respectively. (14)

Or

(b) A square tied prestressed bonded corner column of a multistory building frame is subjected to an ultimate load p_u =2142 *kN* at an equal eccentricity of 70*mm* along the *x* and *y* axis, respectively f_c =40N/mm^2. Design a suitable column section and reinforcement for the column subjected to biaxial bending moment. (14)

15. (a) Composite *T* beam is made up of a pre-tensioned rib 100*mm* wide and 200*mm* deep, and a cast in situ slab 400*mm* wide and 40*mm* thick having a modulus of elasticity of 28kN/mm^2. If the differential shrinkage is $100x10^{-6}$, determine the shrinkage stresses developed in the precast and cast in situ units. (14)

Or

(b) (i) Discuss about the advantages of composite construction. (7)

(ii) Explain the applications of partial prestressing. (7)

PART - C (1 x 10 = 10 Marks)

16. (a) A pre-tensioned Tee-section has flange 1200*mm* wide and 150*mm* thick the width and depth of the rib 300*mm* and 1500*mm*, represents high tensile steel has an area of 4700mm^2 and located at an effective depth of 1600*mm*. If the characteristic strength of steel and concrete is 16. (10)

Or

(b) Partially prestressed concrete beam having a top flange of 800*mm*, a web of 700*mm* x 250*mm* and a bottom flange of 600*mm* x 400*mm* is prestressed with an effective prestress of 1400 *kN* applied at 0.1*m* from top. It has also un-tensioned reinforcement of 4000mm^2 located at 1.08*m* from top. It is subjected to sagging bending moment of 1800 *kNm*. Assume a modular ratio of 6. Evaluate the stress in concrete at top fiber and stresses in un-tensioned steel. The increase in stress in prestressing steel due to external moment may be assumed as neglible and the initial stress in concrete due to prestress at top = 0. (10)