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

Question Paper Code: 47103

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Seventh Semester

Civil Engineering

14UCE703 - PRESTRESSED CONCRETE STRUCTURES

(Regulation 2014)

(IS1343:2012 and IS3370 Part III & IV is permitted)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Tendons in pretensioned concrete are

   (a) bonded to concrete (c) Partially bonded to concrete

   (b) Not bonded to concrete (d) none of above

2. Pre-stressed concrete members usually contain what type of reinforcement?

   (a) Concentric (b) Eccentric (c) Parabolic (d) None of the above

3. Ultimate moment capacity of pre-stressed concrete beam depends on

   (a) amount of tensioning (c) Eccentricity of cables

   (b) Loss in prestress (d) All of the above

4. The moment of resistance of a rectangular section depends upon

   (a) Ultimate strain in concrete (b) Area of high-tensile tendons

   (c) Tensile stress in concrete (d) Shear strain in concrete

5. In post-tensioned system, end block is the region between end of beam and the section where

   (a) no lateral stresses exist (c) shear stress are maximum

   (b) only shear stress exist (d) only longitudinal stresses exist

6. Deflection of prestressed concrete beam is excessive in the

   (a) Precracking stage (b) Elastic stage

   (c) Post-cracking stage (d) None of the above

7. Theorem of three moments is used for analysis of

(a) Indeterminate prestressed structures (c) both type of structures

(b) Determinate prestressed structures (d) All types of structures

8. Composite construction using PSC and cast in situ concrete is adopted in

(a) Water tanks (b) Pipes (c) Bridges (d) Tunnels

9. Circular prestressing of concrete tanks induces

(a) Hoop tension (b) Hoop compression

(c) Flexural compression (d) Flexural tension

10. A partially prestressed member is one in which

(a) tensile stresses and cracking are permitted under service loads

(b) no tensile stresses are permitted under service loads

(c) mild steel is used in addition to prestressing steel

(d) tensile stresses are permitted but not cracking at service loads

PART - B (5 x 2 = 10 Marks)

11. What are the advantages of PSC construction?

12. Define Pre tensioning and Post tensioning?

13. What is meant by end block in a past tensioned member?

14. Enumerate the merits of composite construction.

15. State the applications of prestressed concrete poles.

PART - C (5 x 16 = 80 Marks)

16.(a) A prestressed concrete supports a live load of 4 kN/m over a simply supported span of 8 m. The beam has an I-section with an overall depth of 400 mm. The thickness of flanges and web are 60 and 80 mm respectively. The width of flanges is 200 mm The beam is to be prestressed by an effective prestressing of 235 kN at a suitable eccentricity such that the resultant stresses at the soffit of the beam at the centre of span is zero.

(a) Find the eccentricity required for the force.

(b) If the tendon is concentric, what should be the magnitude of the prestressing force for the resultant stress to zero at the bottom fibre of the central span section.. (16)

Or

(b) A prestressed concrete pile, 250 mm square contains 60 pretensioned wires, each of 2 mm diameter, uniformly distributed over the section. The wires are initially tensioned on the prestressing bed with a 300 kN. Calculate the final stress in concrete and the percentage loss of stress after all losses, given the following data: Es = 210 kN/mm^{2,} Ec = 32 kN/mm^2, Shortening due to creep = 30X10^{-6} per unit length,Total Shrinkage = 200 X 10^{-6} per unit length, Relaxation of steel stress = 5 % of initial stress. (16)

17. (a) (i) A pretnsioned beam of rectangular section 400 mm wide by 1000 mm overall depth is prestressed by 800 mm^2 of high tensile steel wires at an eccentricity of 300 mm. If f_{ck} = 40 N/mm^2, fp = 1600 N/mm^2 estimate the ultimate flexural strength of the section as per IS: 1343 code provisions.. (12)

(ii) Explain the steps to be followed in strain compatibility method. (4)

Or

(b) A pretensioned, T-section has a flange 1200 mm wide and 150 mm thick. The width and depth of 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 tensile strength of steel are 40 and 1600 N/mm^2 respectively, calculate the flexural strength of the T-section. (16)

18. (a) Elaborate the different deflection cases with formulas in prestressing of concrete. (16)

Or

(b) The end block of a post tensioned beam is 300 mm wide by 300 mm deep and is prestressed concentrically by a Freyssinet cylindrical anchorage of 150 mm diameter with a jacking force of 800 kN. Design suitable anchorage zone reinforcement and sketch the details. (16)

19. (a) Describe the methods of computing the ultimate flexural and shear strength of composite sections. (16)

Or

(b) Explain the various steps involved in the design of continuous prestressed concrete beams. (16)

20. (a) Explain the applications of partial prestressing. (16)

Or

(b) Design a non-cylindrical prestressed concrete pipe of internal diameter 500 mm to withstand a working pressure of $1N/mm^2$. High tensile wires of 2mm diameter stressed to 1200 N/mm^2at transfer are available for use .Permissible maximum stresses in concrete at transfer and working load are 13.5 and 0.8 N/mm^2(compression) respectively. Loss ratio = 0.8, Es =210 kN/mm^2 and Ec = 35 kN/mm^2 . Calculate (a) the minimum thickness of concrete for the pipe, (b) number of turns of wire per metre length of the pipe, (c) the test pressure required to produce a tensile stress of 0.7 N/mm^2 in the concrete when applied immediately after tensioning and (d) the winding stress in the steel (16)