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

Question Paper Code: 47103

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

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. Prestressing is economical for members of

   (a) Long span (b) Medium span (c) Short span (d) All the above

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

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

3. Prestressed concrete beam fails suddenly without warning due to
   (a) Failure of concrete in compression zone
   (b) Failure of concrete in tension zone
   (c) Failure of steel in tension
   (d) Failure of concrete in shearzone

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. Maximum permissible final deflection of a beam should not exceed

(a) Span/350 (b) Span/250 (c) Span/480 (d) Span/500

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. In composite construction, prestressed construction, prestressed elements are used advantageously in the

(a) Compression zone (b) shear zone

(c) Tension zone (d) Neutral axis zone

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. Failure of non-cylinder pipes is due to

(a)Bursting (b) compression of concrete

(c) Excessive cracking of concrete (d) Flexural cracking of concrete

PART - B (5 x 2 = 10 Marks)

11. List the grade of concrete and steel used for prestressed concrete..

12. Illustrate the different types of flexural failure.

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 rectangular prestressed concrete beam 150 mm wide and 300 mm deep is used over an effective span of 10m. The cable with zero eccentricity at the supports and linearly varying to 50 mm at the centre, carries an effective prestressing force of 500 kN. Find the magnitude of the concentrated load Q located at the centre of the span for the following conditions at the centre-of-span section:

(i) If the load counteracts the bending effect of the prestressing force (neglecting self weight of beam), and

(ii)If the pressure line passes through the upper kern of the section under the action of the external load, self-weight and prestress. (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 pretensioned T-section has a flange which is 300 mm wide and 200 mm thick. The rib is 150 mm wide by 350 mm deep. The effective depth of cross section is 500 mm. Given A_p = 200 mm^2, f_{ck} = 50 N/mm^2 and f_p = 1600 N/mm^2, estimate the ultimate moment capacity of the T-section using the IS: 1343 code regulations. (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 girder is 200 mm wide by 600 mm deep. The girder is prestressed by a concentric cable carrying an effective force of 800 kN. The cable has to be anchored against the end block using an anchor plate at the centre of the girder. If the cube strength of concrete at transfer is 30 N/mm^2 and the permissible shear stress in steel is 100 N/mm^2, design the size and thickness of the steel anchor plate. . (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) (i) Explain the applications of partial prestressing. (10)

(ii) List out the advantages of partial prestressing. (6)

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)