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Question Paper Code: 47103

B.E. / B.Tech. DEGREE EXAMINATION, NOV 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. 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. 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. Prestressed concrete is more desirable in case of

(a) cylindrical pipe subjected to internal fluid pressure

(b) cylindrical pipe subjected to external fluid

(c) cylindrical pipe subjected to equal internal and external fluid pressures

(d) cylindrical pipe subject to end pressures

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

12. Define Pre tensioning and Post tensioning?

13. Illustrate the different types of flexural failure.

14. Enumerate the merits of composite construction.

15. List any two applications of partial prestressing.

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 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 post tensioned unbounded prestressed concrete beam of T section having a flange width of 1200 mm and thickness of flange 150 mm, thickness of web being 300 mm is prestressed by 4700mm^2 of high tensile steel located at an effective depth of 1600 mm . f_{ck} = 40 N/mm^2 and f_p = 1600 N/mm^2 span to effective depth ratio is 1000 N/mm2 estimate the ultimate flexural strength of the unbounded 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 concrete beam 300 mm X 300 mm is subjected to a concentric anchorage force of 832800 N by a Freyssinet anchorage system of area 117200 mm^2. Discuss and detail the anchorage reinforcement for the end block. (16)

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

Or

(b) A two span continuous prestressed concrete beam ABC (AB = BC = 15 m) has a uniform cross-section with a width of 250 mm and a depth of 600 mm. The cable carrying an effective prestressing force of 500 kN is parallel to the axis of the beam and located at an eccentricity of 200 mm.

(a). Determine the secondary and resultant moment developed at mid support section B.

(b) If the beam supports an imposed load of 2.4 kN/m, calculate the resultant stresses developed at the top and bottom of the beam at B. Also calculate the resultant line of hrust through the beam AB. (16)

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

Or

(b) (i) Write short notes on the advantages of prestressed concrete poles. (8)

(ii) List the various design criteria to be considered while designing poles for power transmission lines. (8)