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

M 0667

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2011

SEVENTH SEMESTER

CIVIL ENGINEERING

CE1402 PRESTRESSED CONCRETE STRUCTURES

(REGULATION 2008)

(Use of IS 1343 - 1980 code is permitted)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between pre tensioning and post tensioning.

2. Mention the various losses in prestress.

3. What is meant by end block in a post tensioned member?

4. List any two applications of partial prestressing.

5. State the principle involved in circular prestressing.

6. Write the various types of loadings that act on prestressed concrete poles.

7. List two advantages of composite prestressed concrete beams.

8. Name the loadings to be considered for computing short time deflection.

9. List any four mechanical prestressing systems adopted for bridges in India.

10. What is meant by kern distance in a prestressed concrete bridge?

PART B — (5 × 16 = 80 marks)

11. A prestressed concrete beam of rectangular section 375mm wide and 750mm deep has a span of 12.50m. The effective prestressing force is 1520 kN at an eccentricity of 150mm. The dead load of the beam is 7 kN/m and the beam has to carry a live load of 12.50 kN/m. Determine the extreme stresses in concrete

(a) At the end section.

(b) At the mid section without the action of the live load.

(c) At the mid section with the action of the live load.

Or

12. A prestressed concrete beam of span 8m has a section of area 42×10^3 mm^2 the moment of inertia of the section being 1.75×10^8 mm^4. The beam is prestressed with a parabolic cable providing a prestressing force of 245 kN. The cable has an eccentricity of 50mm at the centre and zero eccentricity at the ends. Ignoring all losses, find the deflection at the centre when

(a) The beam carries its own weight and prestress.

(b) The beam carries in addition to its own weight and prestress, a super imposed load of 1.80 kN/m. Take weight of concrete equal to 24 kN/m^3 and the modulus of elasticity of concrete equal to 40 kN/mm^2.

13. A prestressed concrete beam 250mm wide and 650mm deep is subjected to an effective prestressing force of 1360 kN along the longitudinal centroidal axis. The cables are placed symmetrically over mild steel anchor plate of area 150mm × 350mm. Design the end block. Take the characteristic strength of concrete and its cube strength at transfer as 30 N/mm^2. Assume initial prestressing force = 1.2 times the effective prestressing force.

Or

14. (a) What is meant by partial prestressing? Discuss the advantages and disadvantages when partial prestressing is done. (6)

(b) Discuss the difference in load deflection behaviour of under prestressed, partially prestressed and over prestressed cases. Why partial prestressing is preferred in design? (10)

15. Design a free edge water tank of diameter 36 m to store water to a depth of 5 m. Assume ultimate stress in steel = 1500 N/mm^2. Stress in steel at transfer = 70% of the ultimate stress. Safe stress in concrete in compression at transfer = 0.5 f_{ck}. Compressive stress in concrete at service condition = 0.1 f_{ck}. Final stress in steel = 0.8 × stress in steel at transfer. Modular ratio = 5.5, f_{ck} = 45 N/mm^2.

Or

16. Design an electric pole 12 m high to support wires at its top which can exert a reversible horizontal force of 3000 N. The tendons are initially stressed to 1000 N/mm^2 and the loss of stress due to shrinkage and creep is 15%. Maximum compressive stress in concrete shall be limited to 12 N/mm^2. Take m = 6 and ϕ = 300. Soil weighs 18000 N/m^3.

17. The cross-section of a composite beam consists of a 300mm × 900mm precast stem and cast-in-situ flange 900mm × 150mm. The stem is a post-tensioned unit with an initial prestressing force of 2500 kN. The effective prestress available after making deduction for losses is 2200 kN. The dead load moment at midspan due to the weight of the precast section is 250 kNm. The dead load moment due to the weight of the flange is 125 kNm. After the hardening of the flange concrete, the composite section has to carry a live load which produces a bending moment of 700 kNm. Determine the stress distribution in concrete at the various stages of the loading.

Or

18. A composite prestressed concrete beam section consists of a prefabricated stem of 300mm × 800mm and a cast - in-situ slab of 800 mm × 150 mm. If the differential shrinkage is 1.2×10^{-4} mm/mm, find the shrinkage stress at the extreme edges of the slab and stem. Take $E_c = 2.75 \times 10^4 \, N/mm^2$.

19. (a) State the significance of adopting a combination of pre tensioned and post tensioned tendons in bridge construction. (8)

    (b) Explain the methods involved in utilizing precast pre tensioned members in bridge construction. (8)

Or

20. Explain the design principles involved in the construction of post tensioned bridge girders.
