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B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Seventh Semester

Civil Engineering

CE 6702 – PRESTRESSED CONCRETE STRUCTURES

(Regulations 2013)

(Common to PTCE 6702 – Prestressed Concrete Structures for B.E. (Part-Time) – Sixth Semester – Civil Engineering – Regulations 2014)

Time : Three Hours Maximum : 100 Marks

(Use IS 1343 : 2012, IS 456 : 2000)

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. What are the advantages of Prestressed Concrete construction ?
2. Name the factors influencing deflections.
3. List the assumptions made in strain compatibility method.
4. Classify Shear cracks.
5. How do you evaluate the deflection of a concrete member prestressed by a parabolic cable with eccentric tendons.
6. Define anchorage zone.
7. Compare propped and unpropped construction.
8. Name the methods of analysis of secondary moments.
9. What are the different shapes of prestressed concrete tanks ?
10. Define partial prestressing.

PART – B **(5×13=65 Marks)**

11. a) A rectangular prestressed beam 120 mm × 300 mm, have an effective span of 6 m to support an UDL of 4 kN/m, which includes the self weight of the beam. The beam is prestressed by a straight cable carrying a force of 180 kN and located at an eccentricity of 50 mm. Determine the location of thrust line in the beam and plot its position at quarter and central span positions.

(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 stressed to a force of 300 kN. Estimate the final stress and the percentage loss after all losses for the following data : E_s = 210 kN/mm^2, E_c = 35 kN/mm^2, shortening due to creep = 30 × 10^{-6} mm/mm per N/mm^2 of stress. Relaxation of steel = 5% of initial stress. Total shrinkage = 200 × 10^{-6} per unit length.

12. a) A post-tensioned bridge girder with unbonded tendons is of box section of overall dimensions 1200 mm wide and 1800 mm deep, with wall thickness of 150 mm. The high-tensile steel has an area of 4000 mm^2 and is located at an effective depth of 1600 mm,. The effective prestress in steel after all losses is 1000 N/mm^2 and the effective span of the girder is 24 m if f_{ck} = 40 N/mm^2 and f_p = 1600 N/mm^2, estimate the ultimate flexural strength of the section.

(OR)

b) The support section of prestressed concrete beam, 100 mm × 250 mm, is required to support an ultimate shear force of 80 kN. The compressive prestress at the centroidal axis is 5 N/mm^2. The characteristic cube strength of concrete is 40 N/mm^2. The cover to the tension reinforcement is 50 mm. If the characteristic strength of steel in stirrups is 415 N/mm^2, design suitable reinforcements at the section using the IS : 1343 recommendations.

13. a) A concrete beam of span 8 m with the cross-sectional area of 42 × 10^3 mm^2 and the moment of inertia 4.75 × 10^8 mm^2 is prestressed by a parabolic cable carrying a prestressing force of 245 kN. The cable has an eccentricity of 50 mm at the centre and zero at the supports. Neglecting all losses, find the central deflection of the beam (i) self-weight + prestressed, and (ii) self-weight + prestressed + live load of 1.8 kN/m. Consider concrete weight 24 kN/m^3 and E_c = 40 kN/mm^2.

(OR)

b) The end block of a post-tensioned prestressed concrete beam, 250 mm × 250 mm is subjected to a concentrated anchorage force of 800 kN by a Freyssinet anchorage of area 1500 mm^2. Design and detail the anchorage reinforcement for the end block.

14. a) A precast pre-tensioned beam having a span of 5 m and cross section of 100 mm × 200 mm, is prestressed by tendons with their centroid coinciding with the bottom kern. The initial force in the tendons is 150 kN. The loss of prestress may be assumed to be 15%. The beam is incorporated in a composite T-beam by casting a top flange of 400 mm × 40 mm. If the composite beam supports a live load of 8 kN/m^2. Calculate the resultant stresses developed in the precast and in situ cast concrete for (i) unpropped and (ii) propped during the casting of the slab. Assume the same modulus of elasticity for concrete in precast beam in situ cast slab.

(OR)

b) A continuous prestressed concrete beam ABC (AB=BC=10 m) has a uniform rectangular section of 100 mm × 300 mm. The cable carrying an effective prestressing force of 360 kN is parallel to the axis of the beam and located at 100 mm from the soffit. (i) Determine the secondary and resultant moment at central support B. (ii) locate the resultant line of thrust.

15. a) Explain the step by step procedure to design circular water tank.

(OR)

b) Discuss in detail about partial prestressing along with its merits and demerits.

PART – C **(1×15=15 Marks).**

16. a) A PSC beam of rectangular section 350 mm × 700 mm is prestressed by a prestressing force of 180 kN at an eccentricity of 190 mm. If the bending and twisting moments are 80 kNm and 20 kNm respectively, calculate the maximum principal stress at the section.

(OR)

b) A continuous prestressed concrete beam ABC (AB=BC=20 m) with an overall depth of 1m, is prestressed by a continuous cable carrying a force of 300 kN. The cable is parabolic and is concentric at A and C. The cable has an eccentricity of 100 mm towards the soffit at the mid span and 200 mm towards the top fibre at the mid support. Calculate the reactions at the support due to prestress and show that the cable is concordant.