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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017

Seventh Semester

Civil Engineering

CE 6702 – PRESTRESSED CONCRETE STRUCTURES

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

Use of IS 1343 and IS 456 is permitted.
Assume suitable data if necessary.

PART – A (10×2=20 Marks)

1. What are the advantages of prestressed concrete construction ?
2. Define pressure line.
3. What are the stages to be considered in the design of pestressed concrete section under flexure ?
4. What is effective reinforcement ratio ?
5. List the various factors influencing the effective moment of inertia of cracked concrete sections.
6. Define Bursting tension.
7. What are the effects of differential shrinkage in composite beams ?
8. Name the commonly used methods to analyse the secondary moments in prestressed concrete continuous members.
9. What are the stresses induced in concrete during circular prestressing ?
10. Define partial prestressing.

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PART – B (5×16=80 Marks)

11. a) A prestressed concrete beam of 230 mm wide and 450 mm deep is used over an span of 4m and is prestressed by a cable carrying a force of 650 kN and located at an eccentricity of 75 mm. The beam supports three concentrated loads of 25 kN at each quarter span points. Determine the location of the pressure line in beam at centre, quarter and support sections. Neglect the moment due to self weight of the beam.

(OR)

b) A prestressed concrete beam with rectangular section, 150 mm wide and 300 mm deep is prestressed by three cables each carrying a effective prestress of 200kN. The span of the beam is 12 m. The first cable is parabolic with an eccentricity of 50 mm above the centroidal axis at the supports. The second cable is parabolic with an eccentricity of 50 mm at the centre of the span and zero eccentricity at the supports. The third cable is straight with an eccentricity of 50 mm below the centroidal axis. If the beam supports an UDL of 6 kN/m and $E_c = 38$ kN/mm^2. Estimate the instantaneous deflection

i) Prestress + self weight of the beam

ii) Prestress + self weight of the beam + live load

12. a) A pretensioned T section has a flange width of 1200 mm and 150 mm thick. The width and depth of the rib are 300 mm and 1500 mm respectively. The high tension 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 the tensile strength of steel are 40 and 1600 MPa respectively, calculate the flexural strength of the section.

(OR)

b) The support section of a prestressed concrete beam, 100 mm × 250 mm, is required to support an ultimate shear force of 60 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 tensile strength of steel in stirrups is 250 N/mm^2, design suitable shear reinforcement.

13. a) A simply supported beam of 6 m span and rectangular section 125 mm × 250 mm, is prestressed by a cable in which the total tensile force is 220 kN. The cable is located at a constant eccentricity of 75 mm above the soffit at the middle third of the beam and the cable is curved towards the extreme ends and the eccentricity of the cable at both ends are 50 mm above the centre line. Consider concrete weight 24 kN/m^3 and E_c = 40 kN/mm^2 . Calculate the deflection of the beam i) when it is supporting its own weight ii) when the beam carries an imposed load of 4.5 kN/m.

(OR)

b) The end block of a prestressed concrete beam, rectangular in section, is 100 mm × 200 mm. The prestressing force of 100 kN is transmitted by a distribution plate, 100 mm × 50 mm, concentrically located at the ends. Calculate the position and magnitude of the maximum tensile stress and the horizontal section through the centre and edge of anchor plate. Compute the bursting tension on these horizontal planes.

14. a) A precast pretensioned beam of rectangular section has a breadth of 100 mm and depth of 200 mm. The beam with an effective span of 5m is prestressed by the tendons with their centroids coinciding with the bottom kern. The initial force in the tendons is 150 kN. The loss of prestress is 15%. The top flange width is 400 mm with the thickness of 40 mm. If the composite beam supports a live load of 7 kN/m^2, calculate the resultant stresses developed if the section is unpropped. M40 and M20 concrete are used for pretensioned and in-situ concrete.

(OR)

b) Explain the various methods of achieving continuity in prestressed concrete members.

15. a) Design a prestressed concrete pipe of internal diameter 900 mm to withstand the internal pressure of 0.8 N/mm^2. The maximum permissible compressive stress in concrete is 18 N/mm^2 and no tensile stress is to be permitted. Modular ratio between steel and concrete is 5.8. Adopt 5mm diameter high tensile wires which can be stressed to 1100 N/mm^2. Expected loss of prestress is 25%.

(OR)

b) Discuss in detail about the methods of achieving partial prestressing.