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M.Tech. (SE) (Sem.–1)

PRE-STRESSED CONCRETE STRUCTURES

Subject Code : CE-504

Paper ID : [E0844]

Time : 3 Hrs. Max. Marks : 100

INSTRUCTIONS TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWENTY marks.
3. Use of BIS 1343 is allowed.
4. Assume suitable data if required.

Q1. (a) A pre-tensioned T-section having a flange width of 1200 mm and thickness of flange is 150 mm. Width and depth of rib is 300 and 1500 mm respectively. The area of high tensile steel is 4700 mm^3 located at an effective depth of 1600 mm. If the characteristic cube strength of concrete and steel are 40 N/mm^2, Calculate the flexural strength of the tee section.

(b) A concrete beam of rectangular section, 200 mm wide and 600 mm deep, is prestressed by a parabolic cable located at an eccentricity of 100 mm at mid-span and zero at the supports. If the beam has a span of 10 m and carries a uniformly distributed live load of 4 kN/m, find the effective force necessary in the cable for zero shear stress at the support section. For this condition, calculate the principal stresses. The density of concrete is 24 kN/m^3.

Q2. The end block of a prestressed beam 250 mm wide and 500 mm deep in section is prestressed by two cables carrying forces of 450 kN each. One of the cable is parabolic, located 125 mm below the centre line at the centre of span (10 m) and anchored at a point 125 mm, above the centre line at the ends. The second cable is straight located 100 mm from the bottom of the beam. The distribution plates for the cables are 100 mm deep and 250 mm wide. Calculate the maximum tensile stress along the axis of the beam using Guyon's method.

Q3. A two-pinned portal frame, 9 m high with a span of 15 m, is to be designed to support a uniformly distributed live load of 14.6 kN/m on the transom. The permissible stresses are not to exceed 14 N/mm^2 in compression with zero tension. Design the frame and sketch the details of the concordant profile in the legs and transom.

Q4. A precast pre-tensioned beam of rectangular section has a breadth of 100 mm and depth of 200 mm. The beam, with an effective span of 5 m, is prestressed by tendons with their centroids coinciding with the bottom kern. The initial force in the tendons is 150 kN. The loss of prestress may be assumed to be 15 per cent. The beam is incorporated in a

composite T beam by casting a top flange of breadth 400 mm and thickness 40 mm. If the composite beam supports a live load of 8 kN/m^2, calculate the resultant stress developed in the precast and *in situ* cast concrete assuming the pre-tensioned beam as : (a) unpropped, and (b) propped during the casting of the slab. Assume the same modulus of elasticity for concrete in precast beam and *in situ* cast slab.

Q5. A non-cylinder prestressed concrete pipe of internal diameter 1000 mm and thickness of concrete shell 75 mm is required to convey water at a working pressure of 1.5 N/mm^2. The length of each pipe is 6 m. The maximum direct compressive stresses in concrete are 15 and 2 N/mm^2. The loss ratio is 0.8.

Q6. (a) What are the advantages of prestressing long span shell structures?

(b) What is the necessity of bent cables?

Q7. Write notes on :

(a) Spatial structures.

(b) Outline the principle of designing end block of a prestressed concrete beam.

Q8. Write short notes on :

(a) Design of prestressed concrete shells.

(b) Crack width calculation.