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M.Tech (Structural Design) (Sem.-1)
PRE-STRESSED CONCRETE DESIGN
Subject Code : MTSD-103
M.Code : 74244
Date of Examination : 18-01-2023

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.   **Missing data may be assumed suitably.**
4.   **Use of IS : 1343 is permitted.**

1.   Design a prestressed concrete beam of rectangular section for a span of 3 m. It is to be designed to support two imposed loads of 3.5 kN each located at one third points over the span. There is to be no tensile stresses in concrete at transfer and service load conditions.

2.   Design a prestressed concrete column of 4 m high for a combined axial compressive force of 400 kN and a bending moment of 25 kN m. Assume f_{ck} =45 N/ mm^2 and f_p = 1500 N/ mm^2.

3.   a)   What is '*Pressure or Thrust line*'? Explain its significance with sketches.

     b)   What are the advantages of using composite construction with prestressed and insitu concrete in structural members?

4.   a)   A pretensioned beam 250 mm wide and 360 mm deep is prestressed by 10 wires of 8mm dia. Initial stress to 1000N/mm^2. The centroid of the steel wires is located at 105mm from the soffit. Determine the maximum stress in concrete immediately after transfer allowing elastic shortening of concrete only at the level of centroid of the steel. If however, the concrete is subjected to additional shortening due to the creep and shrinkage and the steel is subjected to relaxation of stress of 5% of initial stress. Find the final percentage of loss of stress in steel wires. Take E_s = 210kN/mm^2, E_c = 36.85kN/mm^2, ϕ = 1 .60, take residual shrinkage strain = 3×10^4.

     b)   Explain the methods of pre stressing with diagrams.

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

6. a) Explain shrinkage of concrete in PSC members.

   b) Explain durability, fire resistance and cover requirements for PSC members.

7. a) Explain with neat sketches the IS 1343 code method of computing the moment of resistance of rectangular section.

   b) Discuss the various factors affecting deflections in P.S.C. beams.

8. A prestressed concrete T-beam is to be designed to support a superimposed load of 4.4 KN/m over a span of 5m. The "T" beam is made up of flange 400mm × 40mm thick. The rib is 100mm wide and 200mm deep. The stress in concrete must not exceed 15N/mm^2 at the bottom fibre and zero at the top fibre, due to self weight and prestressing force. Evaluate the prestressing force and its eccentricity. Evaluate the resulting stress after L.L is applied. Assume the density of concrete is 24 KN/m^3 and the loss of prestress at 20%.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.