CSM : 15

CIVIL ENGINEERING

PAPER - I

Time Allowed : 3 hours Full Marks : 100

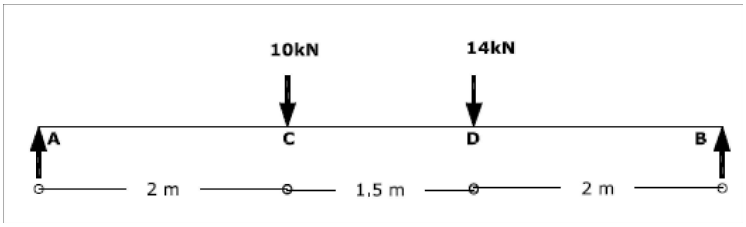
Figures in the margin indicate full marks for the questions.

Attempt any 5 (five) questions taking not more than 3 (three) questions from each Part.

PART A

1. Using the principle of virtual work, determine the reactions of a beam AB of span 10 m. The beam carries a point load of 3 N at C which is at a distance of 4 m from hinged point A. **(20)**

2. A horizontal girder having uniform cross-section is 5.5 meter long and is simply supported at its ends. It carries two concentrated loads as shown in the figure.Calculate the deflections of the beam under loads C and D. Take $I = 1.4 \times 10^8 \text{ mm}^4$ and $E = 2.1 \times 10^5 \text{ N/mm}^2$. **(20)**



3. A three hinged parabolic arch of span 20 meter and rise 4.5 meter carries a uniformly distributed load of 30 kN per meter on the whole span and a point load of 20 kN at a distance of 4 meter from the right end. Find the horizontal thrust. Also find the Bending Moment, Normal thrust and Radial Shear at a section 6 meter and 8 meter from the left end. **(20)**

4. Explain the essential requirements of steel and concrete for prestressed concrete. What are the advantages of prestressed concrete over reinforced concrete? **(20)**

PART B

5. The discharge Q over a V-shaped notch is known to depend on the angle θ of the notch, the head H of the water surface, the velocity approach V_o and the gravity g. Determine the dimensionless form of the discharge equation. **(20)**

6. Prove that the displacement thickness for a boundary layer flow is given by $\delta^* = \int_0^{\delta} \left(1 - \frac{u}{U}\right) dy$ with usual notations. **(20)**

7. Mention the broad steps involved in planning of a hydropower project. What are the different types of investigations that are required for this purpose? **(20)**

8. For a normally consolidated clay layer in the field, the following values are given: **(20)**

(1) Thickness of clay layer = 3 m

(2) Void ratio (e_0) = 0.8

(3) Compression Index (C_c) = 0.28

(4) Average effective pressure on the clay layer $\left(\sigma_0^{/}\right) = 130\text{kN/m}^2$

(5) $\Delta_\sigma^{/} = 50\text{kN/m}^2$

(6) Secondary compression index $\left(C_\alpha\right) = 0.02$

What is the total consolidation settlement of the clay layer after the completion of primary consolidation settlement? The time for completion of primary settlement = 1.5 years.

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