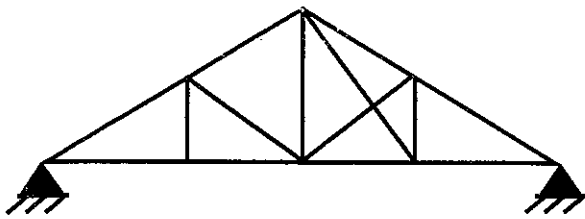


Note: All questions are compulsory. Marks are indicated against each question in square brackets.

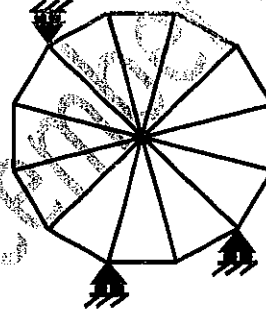
1. Find the Degree of Static and Kinematic Indeterminacy in the following structures:

[5marks, CO-1]

(a) Pin-jointed frame



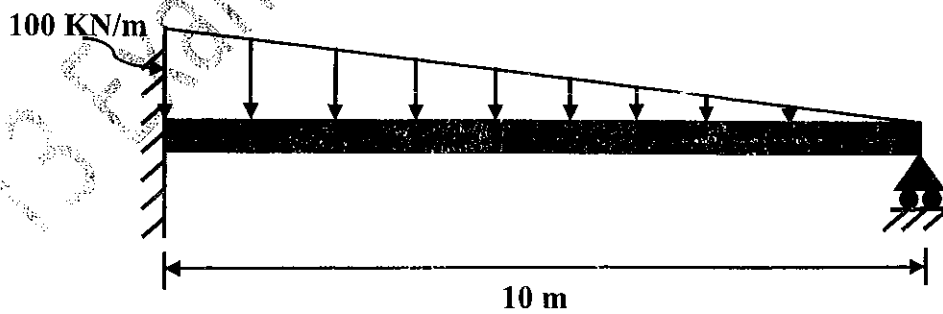
(b) Rigid-jointed frame



2. Find the shape functions for an axial element of length, L ; area of cross-section, A ; and Modulus of Elasticity, E . [5 marks, CO-3]

3. Derive the Element Stiffness matrix for a beam element. [10 marks, CO-4]

4. Calculate the displacements at node 2, and rotations at nodes 2 and 3, for the beam shown below. Nodes 1 and 3 are at the supports, and node 2 is at the center of the beam. Use work equivalence method to calculate nodal forces and moments due to distributed loads, wherever required. Use the shape functions from previous question for work-equivalence method. Assume, $E=2.1 \times 10^{10} \text{ N/m}^2$; $I= 2 \times 10^{-4} \text{ m}^4$ [10 marks, CO-4]



5. What are the differences between Plane Stress and Plane Strain conditions? Write the constitutive matrix for both cases. [5 marks, CO-5]