## JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

## TEST-3 EXAMINATIONS-2022

B.Tech. – VII Semester (All)

COURSE CODE (CREDITS): 18B1WCE737 (3)

MAX. MARKS: 35

COURSE NAME: Finite Element Method

COURSE INSTRUCTOR: Dr. Sugandha Singh

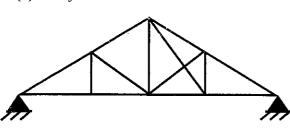
MAX. TIME: 2 Hour

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

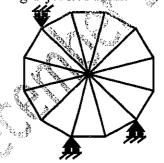
1. Find the Degree of Static and Kinematic Indeterminacy in the following structures:

[5marks, CO-1]

(a) Pin-jointed frame



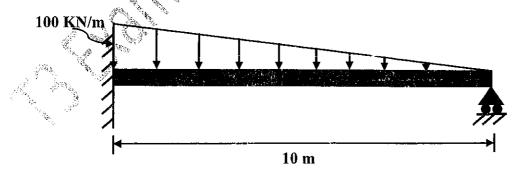
(b) Rigid-jointed frame



- 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,  $E=2.1\times10^{10} \text{ N/m}^2$ ;  $I=2\times10^{-4} \text{ m}^4$  [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]