

**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE PILANI  
(Rajasthan)**

**COMPREHENSIVE EXAMINATION-December 7, 2023**

**COURSE NO. CE G 617 (Advance Structural Analysis)**

**OPEN BOOK EXAMINATION [Room no. 1226]**

Time: 2.00-5.00 PM

Max. Marks: 100

Note: Attempt all questions.

- Q.1 Find the joint displacements at Joint 1 and forces in members of the plane frame. Also draw the shear force and bending moment diagram for the frame. Member 1-4 has an internal hinge at joint 1 as shown in Figure 1. Take  $I=2 \times 10^5 \text{ mm}^4$ ;  $E=200 \text{ GPa}$ , and  $A=9000 \text{ mm}^2$  for all members. [30]

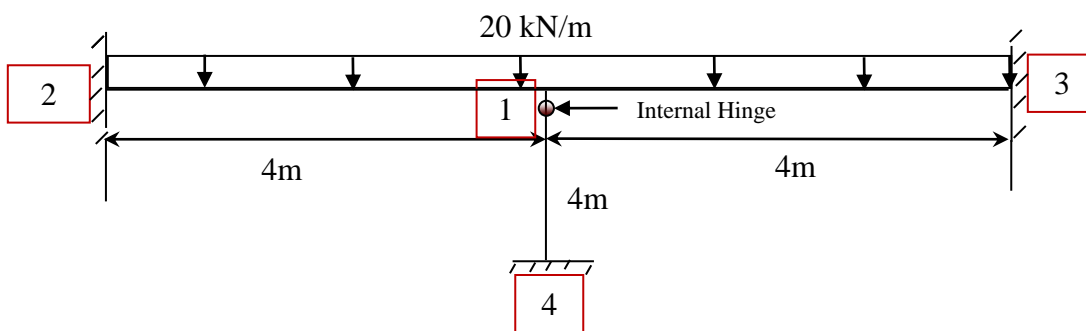


Figure 1

- Q.2 Analyze the plane truss as shown in Figure 2. Find the joint displacements, force in member BC and reactions at C. Assume member AB is 10 mm too short. The cross-sectional area of each bar is  $3000 \text{ mm}^2$  and  $E=200 \text{ GPa}$ . [30]

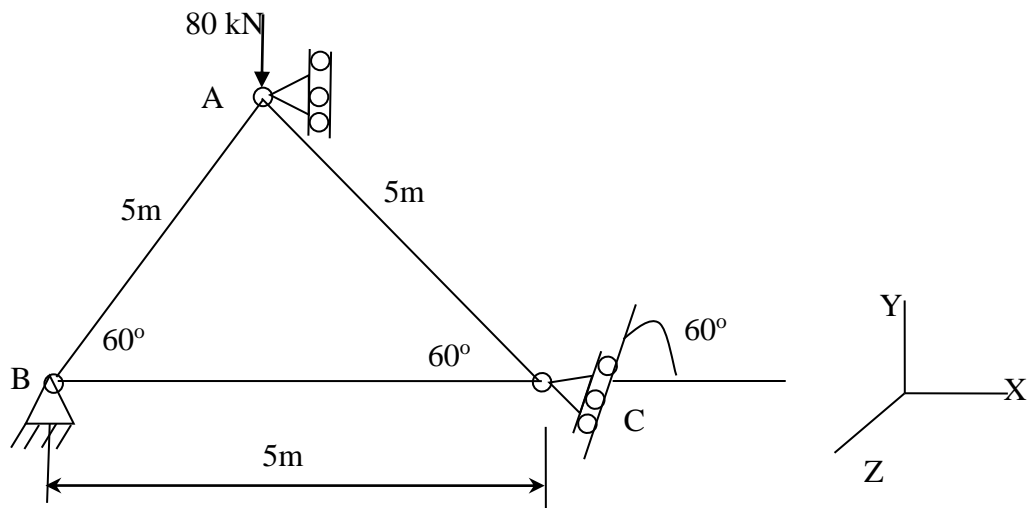
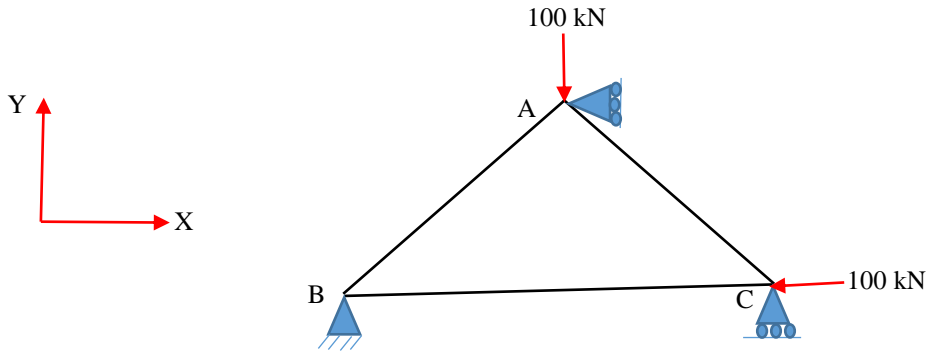


Figure 2

[P.T.O.]

- Q.3** For the given plane truss in Figure 3, using direct stiffness method determine the unknown joint displacements and member force in member AB. Length of each member is 6 m. Take  $E=200$  GPa. The cross-sectional area of each member is  $3000 \text{ mm}^2$ . Comment on the degree of freedom of this structure, if the bar BC is axially rigid. Also find the horizontal reaction at A. [20]



- Q.4** Using direct stiffness method, find the unknown joint displacements and reactions at B of the continuous beam as shown in Figure 4. The beam is loaded with u.d.l. of  $15 \text{ kN/m}$  on both spans along with midspan concentrated loads of  $200 \text{ kN}$ . Take  $E=200$  GPa,  $I=30 \times 10^6 \text{ mm}^4$ . [20]

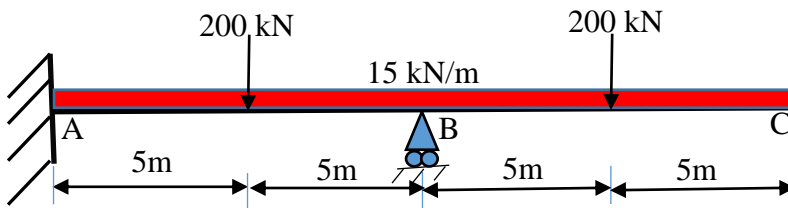


Figure 4