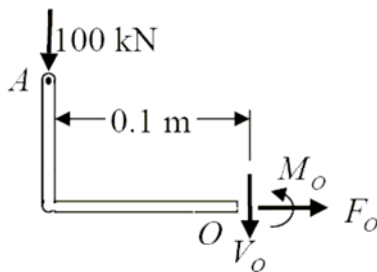
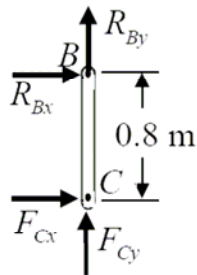
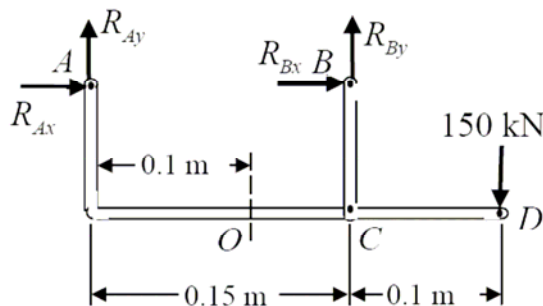


**PROBLEM (1.1)** A frame formed by joining a bent beam  $ACD$  with a bar  $BC$  by a hinge is supported at  $A$  and  $B$  as shown in Fig. P1.1. A vertical load  $P = 150 \text{ kN}$  is applied at point  $D$ . For each member, determine:

- The components of support reactions at  $A$  and  $B$ .
- The axial force, shear force, and bending moment acting on the cross section at point  $O$ .

## SOLUTION



### (a) Free Body: Entire Frame

$$\sum M_B = 0: -R_{Ay}(0.15) - 150(0.1) = 0$$

$$R_{Ay} = -100 \text{ kN} \quad R_{Ay} = 100 \text{ kN} \downarrow \blacktriangleleft$$

$$\sum F_y = 0: -150 + R_{By} - 100 = 0$$

$$R_{By} = 250 \text{ kN} \uparrow \blacktriangleleft$$

$$\sum F_x = 0: R_{Ax} + R_{Bx} = 0 \quad (1)$$

### Free Body: $BC$

$$\sum M_B = 0:$$

$$F_{Cx} = 0, \quad F_{Cy} = 250 \text{ kN} \downarrow, \quad R_{Bx} = 0 \quad \blacktriangleleft$$

Then

$$\text{From Eq.(1): } R_{Ax} = 0$$

### (b) Free Body: Segment $AO$

$$\sum F_x = 0: \quad F_O = 0$$

$$\sum F_y = 0: \quad V_O = 100 \text{ kN} \uparrow \quad \blacktriangleleft$$

$$\sum M_O = 0: \quad M_O = 10 \text{ kN} \cdot \text{m} \curvearrowright$$