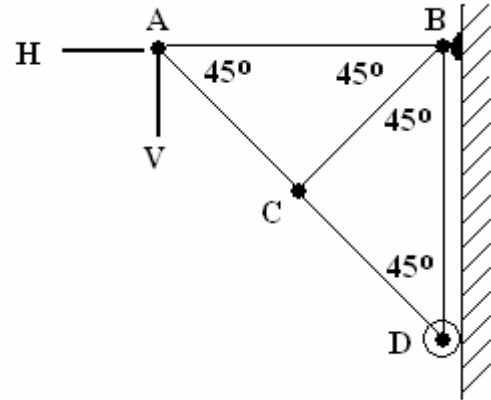


MECHANICAL AND STRUCTURAL ENGINEERING C105
EXAM QUESTIONS 2005 Q3

The plane pinned frame shown below is pinned to the support B and is supported on rollers at D such that AB is horizontal and BD is vertical. The frame carries a horizontal load H and vertical load V at point A.



From strain measurements taken on the frame it was found that members AB, AC and BD were experiencing the following forces from the loading.

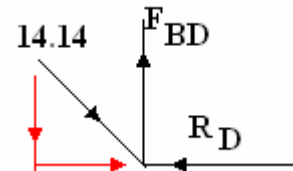
AN 15 kN (tension), AC 14.14 kN (compression) BD 10.61 kN (tension)

Determine the nature and magnitude of the loads H and V and the reactions at B and D.

NB It is apparent that there is an error in the data as the load in BD must be 10 kN

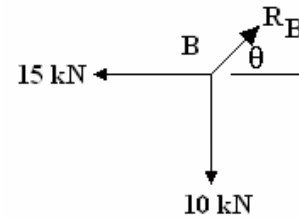
Point D The load in CD must be the same as in AC

Resolving $R_D = 14.14 \sin 45 = 10$ kN and this can only be horizontal because of the roller. $F_{BD} = 14.14 \cos 45 = 10$ kN



The force in BC must be zero as the pin joint at C cannot resist rotation.

Point B $R_B = \sqrt{(15^2 + 10^2)} = 18.03$ kN
 $\theta = \tan^{-1} (10/15) = 33.7^\circ$



Vertical force balance $V = R_B \sin 33.7^\circ = 10$ kN (down)

Horizontal force balance $H = R_B \cos 33.7^\circ + R_D = 15 - 10 = 5$ kN (to left)