#1 a) Write the statement of the principle of virtual work. (8%)

b) Apply the principle of virtual work to find the horizontal reaction Q at point B of the vise system shown in Figure 1. (12%)

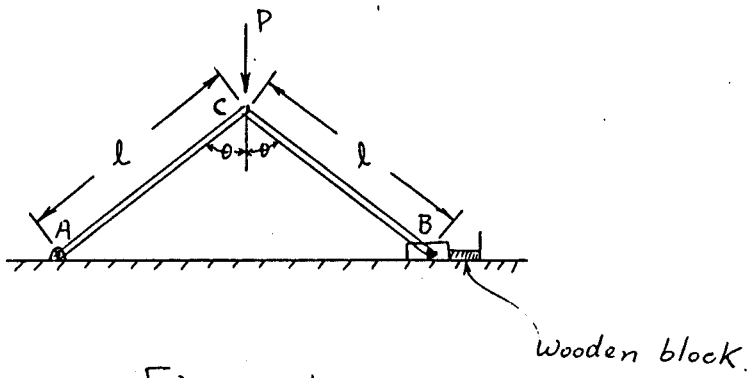


Figure 1.

#2 a) At the instant $\theta = 60°$, the rod in Figure 2 has an angular velocity of 3 rad/s and an angular acceleration of 2 rad/s². At this same instant the collar C is traveling outward along the rod such that when $x = 0.2$ m the velocity is 2 m/s and the acceleration is 3 m/s², both measured relative to the rod. Determine the Coriolis acceleration, the velocity, and the acceleration of the collar at this instant. (25%)

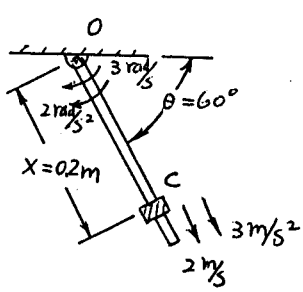


Figure 2

b) Give another example of a dynamic system which has Coriolis effect. (5%)

#3 The 100 Kg beam BD shown in Figure 3 is supported by two rods having negligible mass. Determine the force created in each rod if at the instant $\theta = 30°$ the rods are both rotating with an angular velocity of $\omega = 6$ rad/s. (25%)

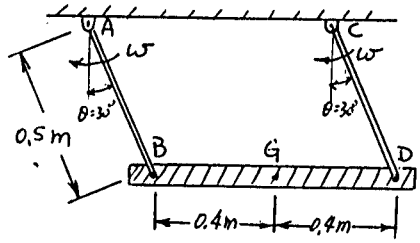
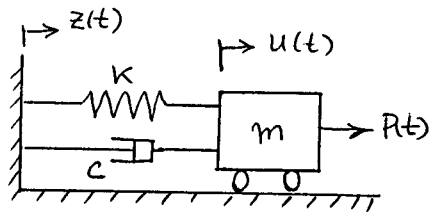


Figure 3

#4 a) Determine the equation of motion of the mass m. Assume that the damping and spring constants of the linear system are c and K shown in Figure 4, respectively. Assume that the support excitation, z(t), is known and the spring is unstreched when $u = z = 0$. (10%)



b) If there is no support excitation, i.e. $z(t)=0$, and $p(t) = P_0 \cos \Omega t$, solve the dynamic system and give a simple discussion on the solution of the system. (15%)