Midterm exam

2019-Nov-10, Sunday, 10:20 – 12:20

1. The bent rod ABDE shown in Fig. 1 is supported by ball-and-socket joints at A and E and by the cable DF. Force P=100N is applied at C. The length unit for the dimensions shown in the figure is dm. Determine: (a) the moment of force **P** about point E in the vector form, (b) the magnitude of the moment of force **P** about line AE. (15')

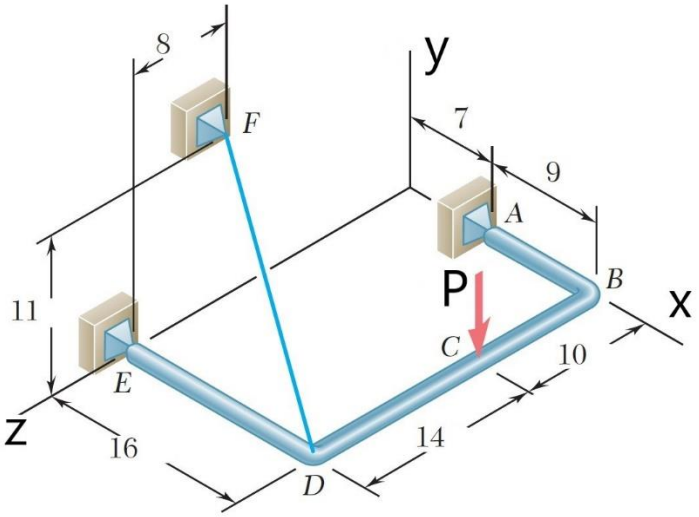

Figure 1

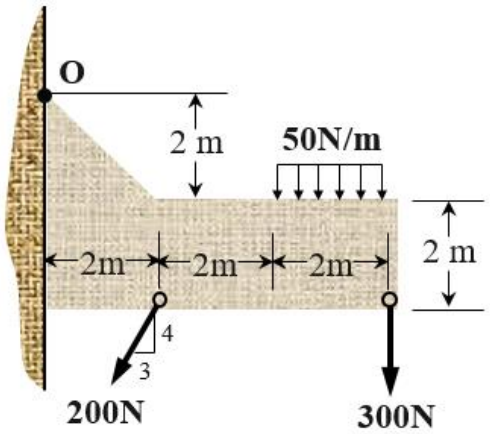

Figure 2

2. Replace the force and couple system shown in figure 2 by an equivalent resultant force and couple moment acting at point O. Indicate the magnitude and direction of the resultant force and couple moment. (15')

3. Determine the force in members BC, BF and GF of the truss shown in figure 3. Indicate whether the members are in tension or compression. (15')

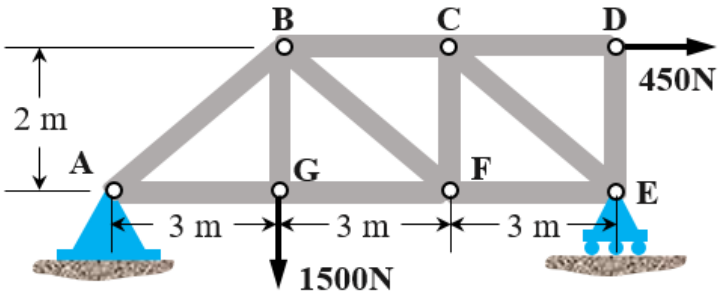

Figure 3

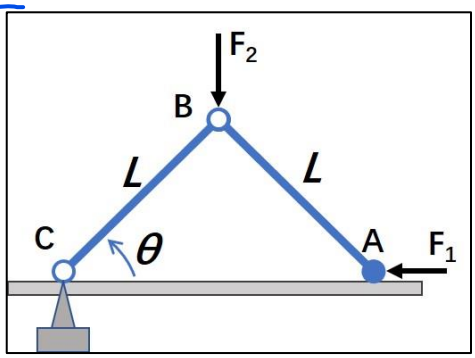

Figure 4

4. Using the principle of virtual work to determine the relation between force F1 and F2 when the two-member linkage is in static equilibrium. Joint C is pin constrained, A is rocker constrained, length of AB and BC is L, as shown in Figure 4. Neglect the weight of the members. (15')

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5. Determine the force in member BD (Indicate whether the member is in tension or compression) and the components of the reaction at C, as shown in Fig. 5. Note that: convert unit of length to meter in your calculation (20')

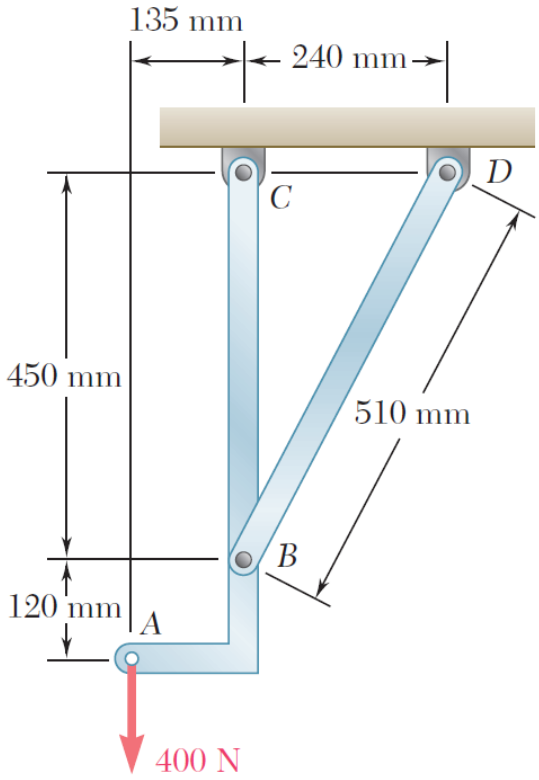

Figure 5

6. Blocks A and B shown in figure 6 have a mass of 5 kg and 10 kg respectively, and are connected to the weightless links. Determine the largest vertical force P (upward) that can be applied at the pin O without causing any movement. The coefficient of static friction between the blocks and the contacting surfaces is $\mu_S = 0.3$. ($g=10 m/s^2$) (20')

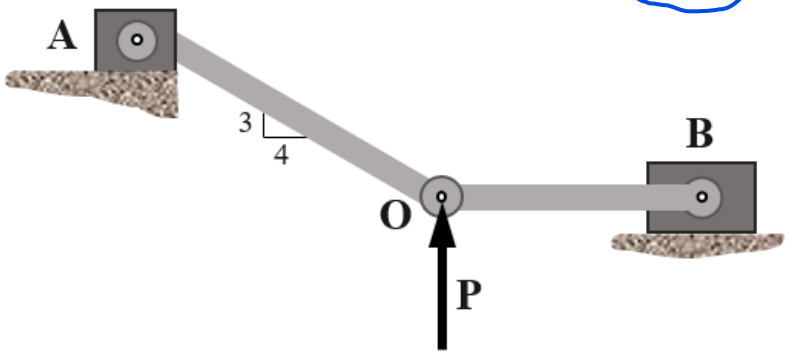

Figure 6