1. A slender rod AB, of weight W, is attached to blocks A and B which may move freely in the guides shown. The constant of the spring is K and the spring is unstretched when AB is horizontal. (a) Neglecting the weight of the blocks, derive an equation in θ, W, L and K which must be satisfied when the rod is in equilibrium. (b) Express W in terms of K and L, knowing that the rod is in equilibrium when $\theta=30°$.

   (25%)
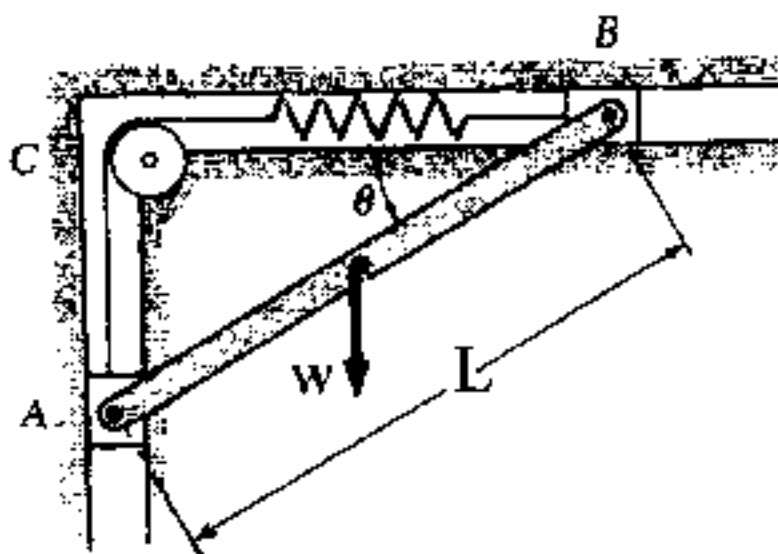
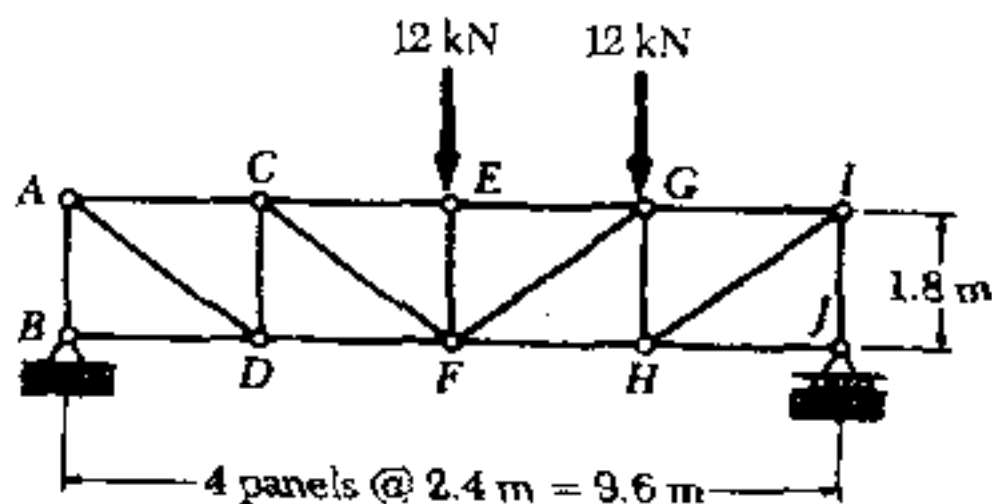2. Draw the shear and bending-moment diagrams for the beam and the loading shown. (25%)
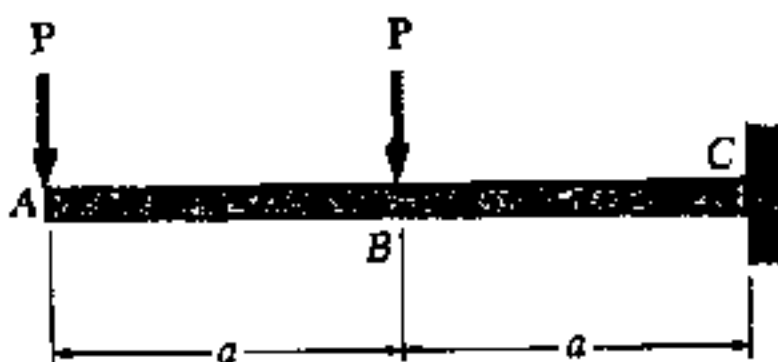
3. Determine the force in members CD and DF of the truss shown.

(25%)

4. A half section of pipe, with mass m and radius R, is to be removed to the right along the floor without tipping. Knowing that the coefficient of friction between the pipe and the floor is μ, determine (a) the largest allowable value of α, (b) the corresponding tension T.

(25%)