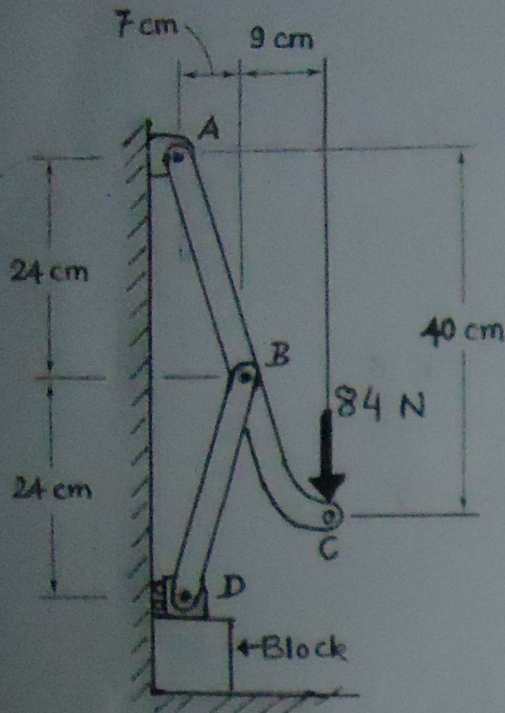


February 14<sup>th</sup>, 2015

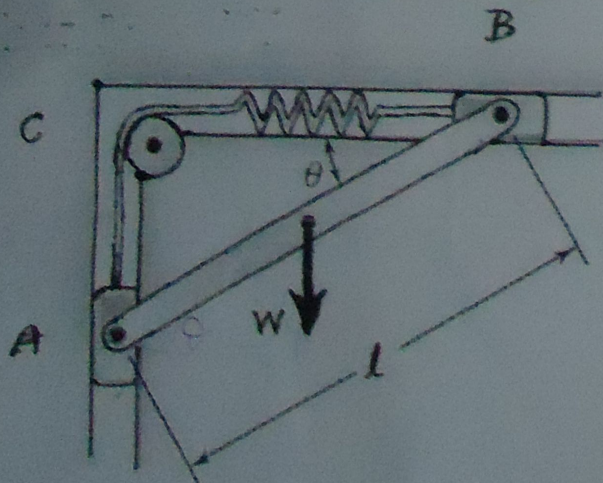
Maximum Time: 60 minutes

Maximum Points: 100 (=25points X 4 questions)

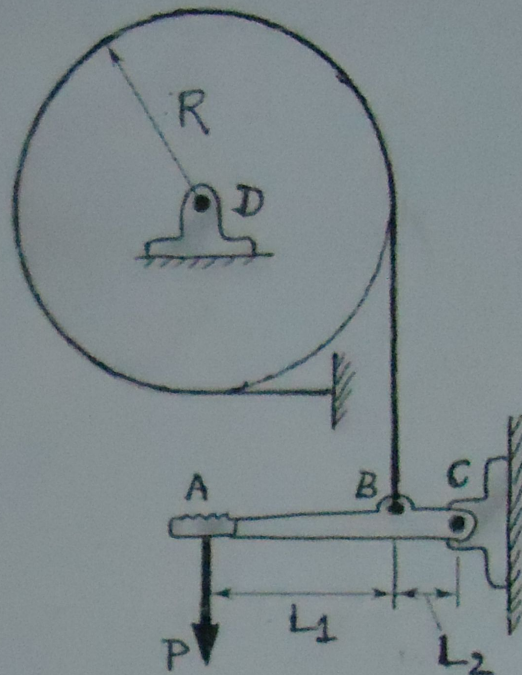
Q1. A 84-N force is applied to the toggle vice at C. Determine (a) the vertical force exerted on the block at D, (b) the force exerted on member ABC at B.



Q2. A slender rod AB, of weight  $W$ , is attached to two blocks A and B that can move freely in the guides shown. The constant of the spring is  $k$ , and the spring is unstretched when AB is horizontal. Neglecting the weight of the blocks, derive an equation in  $\theta$ ,  $W$ ,  $l$  and  $k$  that must be satisfied when the rod is in equilibrium. Use Principle of Virtual Work. Do not solve for  $\theta$ .



Q3. A band brake is used to control the speed of the flywheel as shown. The coefficients of static and kinetic friction are 0.3 and 0.1. Determine the magnitude of the couple being applied to the flywheel knowing that the flywheel is rotating counterclockwise at a constant speed.



Q4. Draw diagrams of shear force and bending moment in beam ACB. Clearly mark the values of shear force and bending moment on these diagrams at relevant intermediate points on the beam.

