P. 1 (25%) A skeletal diagram of the lower leg is shown in the lower figure. This portion of the leg is lifted by the quadriceps muscle attached to the hip at A and to the patella bone at B. This bone slides freely over cartilage at the knee joint. The quadriceps is further extended and attached to the tibia at C. Using the mechanical model shown in the upper figure, determine the tension T in the quadriceps and the magnitude of the resultant force at the femur (pin), D, in order to hold the lower leg in the position shown. The lower leg has a mass of 3.2 kg and a mass center at G_1, the foot has a mass of 1.6kg and a mass center at G_2.

E E14 4-1
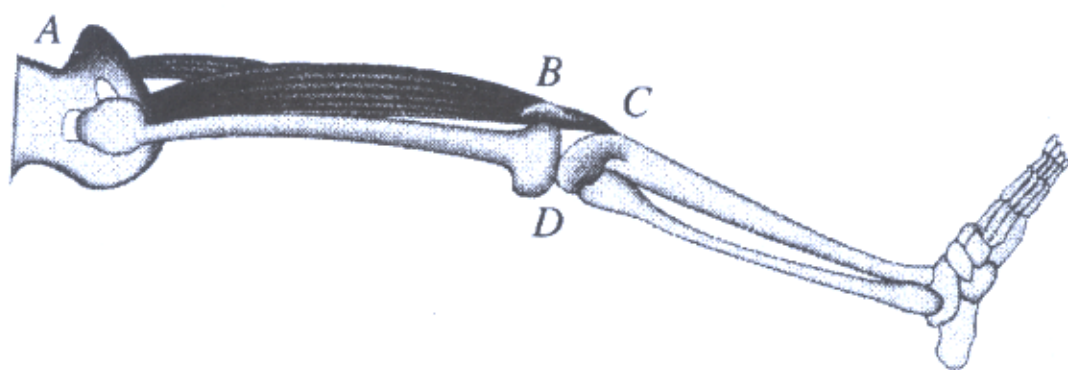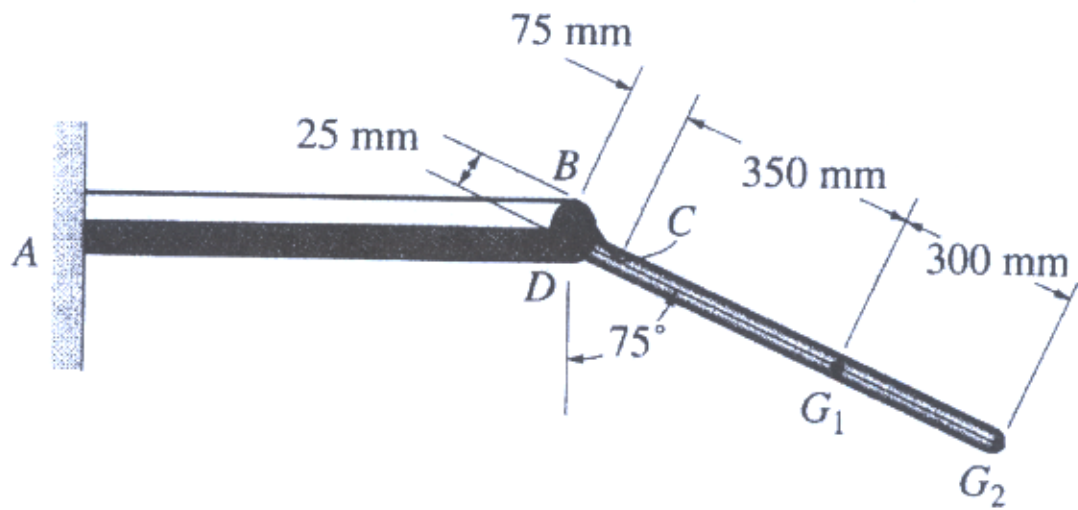
P. 2 (25%) The uniform beam has a weight W. Determine the angle θ for equilibrium. The spring is uncompressed when $\theta = 90$ degree. Neglect the weight of the rollers.
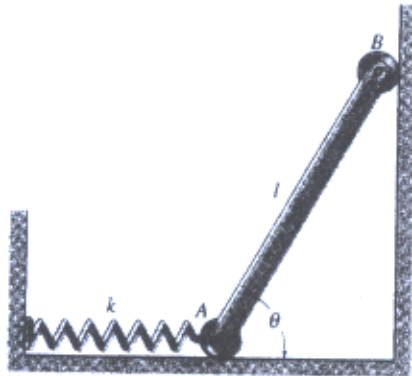
P.3 (25%) The girl has a mass of 40 kg and center of mass at G. If she is swing to a maximum height defined by $\theta = 60$ degree. Determine (a) the tensile force at the string, (b) force developed along each of the four supporting rods such as AB, at the instant $\theta = 0$ degree. The swing is centrally located between the rods.
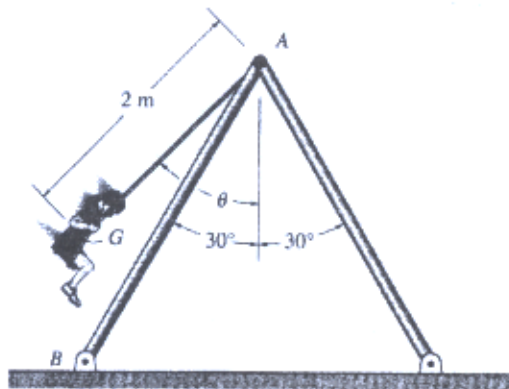
P.4 (25%) The rod AB supports the 10-lb sphere. If the rod is pinned at A to the vertical shaft which is rotating at a constant rate of $\omega = 7$ rad/s, determine the angle θ of the rod during the motion. Neglect the mass of the rod in your calculation.