1. (20%) Calculate the resultant force Fr of the distributed load acting on the surface of the plate and specify its x and y coordinates measured from point O in Figure 1.
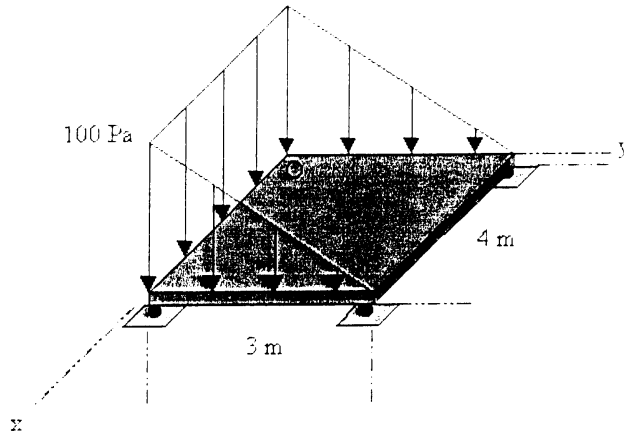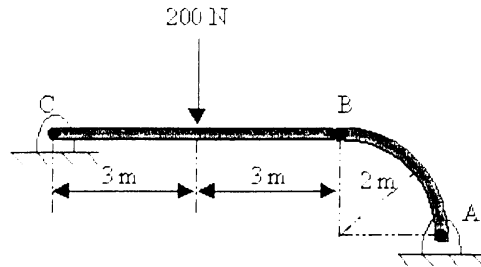

Fig. 1

Fig. 2

2. (20%) Draw the free-body diagram of member BC, then specify the single equation of equilibrium that should be applied to determine the resultant force acting at the ends of the two-force member AB (Figure 2).

3. (20%) Block A has mass m_A and is attached to a spring having a stiffness k and unstretched length l_0. If another block B, having mass m_B is pressed against A so that the spring deforms a distance d, determine the distance both blocks slide on the smooth surface before they begin to separate. What is their velocity at this instant (Figure 3)?
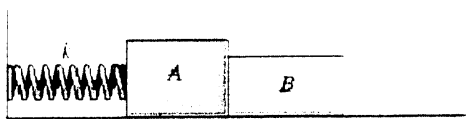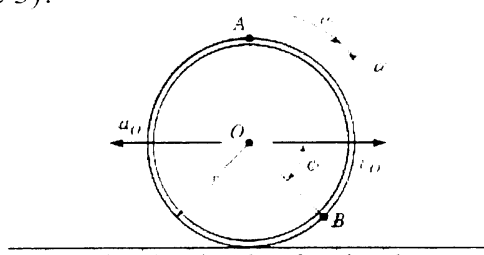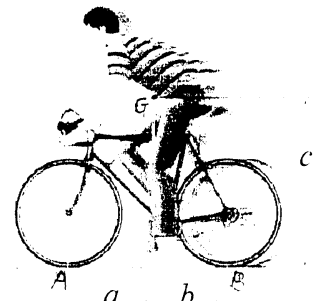

Fig. 3

Fig. 4

Fig. 5

4. (20%) The hoop is cast on the rough surface such that it has angular velocity ω and angular acceleration α (Figure 4). Also, its center has a velocity v_0 and a deceleration a_0. Determine the acceleration of point A at this instant. Given: $\omega = 4$ rad/s, $a_0 = 2$ m/s^2, $\alpha = 5$ rad/s^2, r = 0.3 m, $v_0 = 5$ m/s, $\phi = 45$ deg

5. (20%) The bicycle and rider have a mass M with center of mass located at G (Figure 5). If the coefficient of kinetic friction at the rear tire is μ_B, determine the normal reactions at the tires A and B, and the deceleration of the rider, when the rear wheel locks for braking. What is the normal reaction at the rear wheel when the bicycle is traveling at constant velocity and the brakes arenot applied? Neglect the mass of the wheels. Given: $M = 80$ kg, $\mu_B = 0.8$, $a = 0.55$ m, $b = 0.4$ m, $c = 1.2$ m