(1) The 8-ft rod AB and the 6-ft rod BC are hinged at B and supported by the cable DE and by ball-and-socket joints at A and C. Knowing that h = 3 ft, determine the tension in the cable for the loading shown in Figure 1. (15%)

(2) A pipe of diameter 50 mm is gripped by the Stillson wrench. Portions AB and DE of the wrench are rigidly attached to each other and portion CF is connected by a pin at D. Assuming that no slipping occurs between the pipe and the wrench, determine the components of the forces exerted on the pipe at A and at C (Figure 2). (15%)

(3) A 2-kg block is at rest on a spring of constant 400 N/m. A 4-kg block is held above the 2-kg block so that it just touches it, and released. Determine (a) the maximum velocity attained by the blocks, (b) the maximum force exerted on the blocks (Figure 3). (20%)

(4) It is desired to drive the 400-lb pile into the ground until the resistance to its penetration is 24,000 lb. Each blow of the 1500-lb hammer is the result of a 4-ft free fall onto the top of the pile. Determine how far the pile will be driven into the ground by a single blow when the 24,000-lb resistance is achieved. Assume that the impact is perfectly plastic (Figure 4). (15%)

(5) A tension member is composed of two pieces of material that are glued together along the line mn. For practical reasons the angle θ is limited to the range from 0° to 60°. The allowable stress on the glued joint in shear (τ_w) is 3/4 of the allowable stress in tension (σ_w). What should be the value of the angle θ in order that the bar will carry the greatest load P? Also find the greatest load P (Figure 5). (20%)

(6) A thin circular ring of radius R is subjected to the action of two equal and opposite forces P acting along a diameter as shown in Figure 6. Find the bending moments in the ring at points A and B, considering only the effects of flexural deformations. (15%)

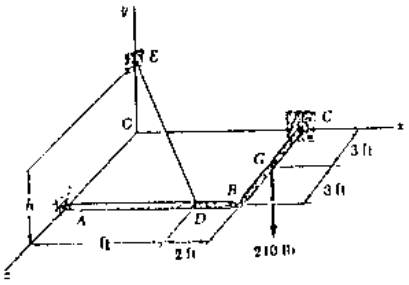

Figure 1

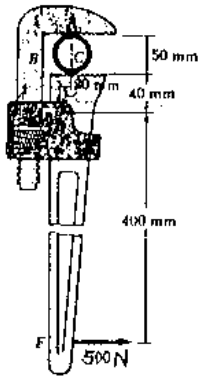

Figure 2

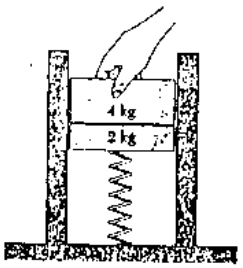

Figure 3

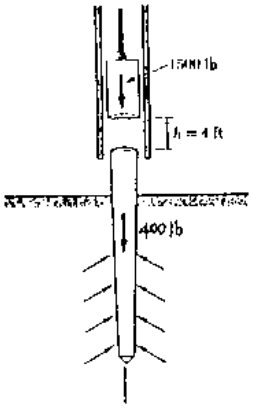

Figure 4

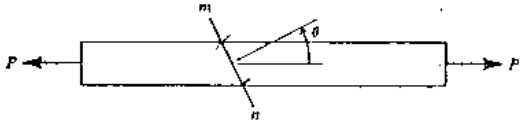

Figure 5

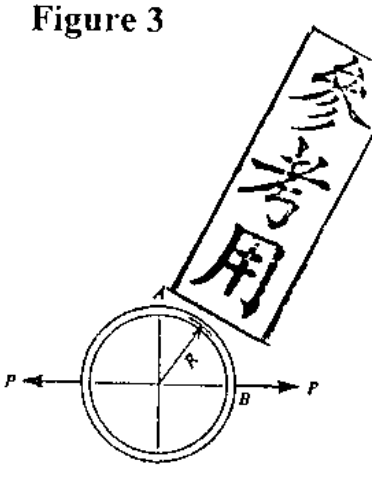

Figure 6