國立嘉義大學九十五學年度

生物機電工程學系碩士班招生考試（甲組）試題

科目：工程力學

1. A wheel shown in Figure 1 is of weigh W and radius r. The friction coefficient between the wheel and the inclined floor is μ, and the vertical wall is smooth. Determine the minimum couple M required for the wheel to rotate in terms of W, r, μ, and θ. (20%)

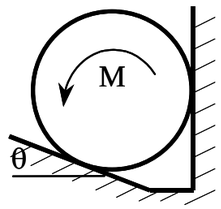

Figure 1.

2. A rigid bar of weight W = 2P hangs from three vertical circular rods that are equally spaced, two of steel and one of aluminum (see Figure 2), the rigid bar supports a load P acting at the midpoint of the bar. The two outer rods are made of steel (the modulus of elasticity E_S = 2E) with diameter d_S = d and length L_S=2L. The inner rod is aluminum (the modulus of elasticity E_A = E) with diameter d_A = 2d and length L_A=3L. Determine
   (a) the load in the steel rods and the aluminum rod, respectively. (10%)
   (b) the downward displacement δ of the rigid bar in terms of P, d and L. (5%)
   (c) the maximum stress σ_{max} in the steel rods and the aluminum rod in terms of P, d and L. (5%)

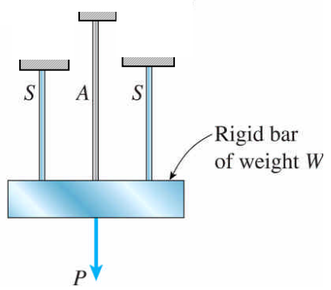

Figure 2.

3. The simple beam shown in the Figure 3 supports a uniform load of intensity 4 kN/m, a clockwise couple of moment 10 kN-m and a concentrate load of magnitude 3 kN. Draw the shear-fore and bending-moment diagram for this beam. (20%)

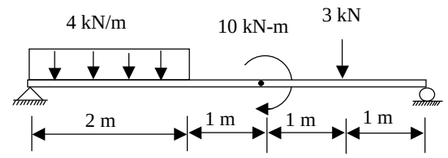

Figure 3.

4. A solid cube of side 2a and mass M is sliding on a friction-less surface with uniform velocity V as Figure 4a. It hits a small obstacle at the end of the table, which causes the cube to tilt as in Figure 4b. Find the minimum value of V such that the cube falls off the table. (Hint: The cube undergoes an in-elastic collision at the edge.) (20%)

Figure 4a.

Figure 4b.

5. A 60-mm-radius disk spins at the constant rate ω_2 =4 rad/s about an axis held by a housing attached to a horizontal rod that rotates at the constant rate ω_1 = 5 rad/s. For the position shown in Figure 5, determine:
   (a) the angular acceleration of the disk. (10%)
   (b) the acceleration of point P on the rim of the disk if θ=0. (10%)

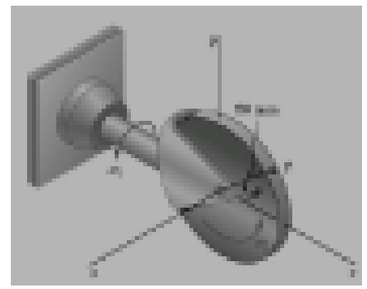

Figure 5.