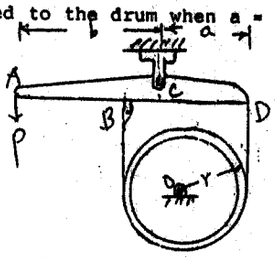
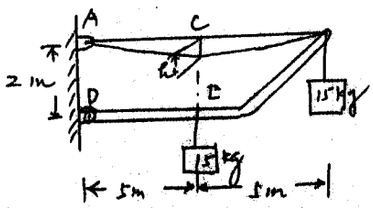
part I (40%)

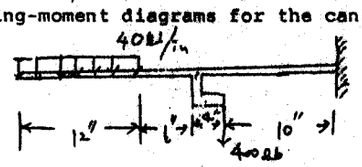
1. A brake drum of radius r = 175 mm is rotating counterclockwise when a force P of magnitude 70N is applied at A. Knowing that the coefficient of kinetic friction is 0.4, determine the moment about O of the friction forces applied to the drum when a = 250 mm and b =350 mm. (15%)



2. The total mass of cable ACB is 10 kg. Assume that the mass of the cable is distributed uniformly along the horizontal. Determine (a) the sag h, (b) the slope of the cable at A. (10%)



3. Sketch the shear and bending-moment diagrams for the cantilever beam shown. (15%)



(背面仍有題目,請繼續作答)

Part II (60%)

1. Collar A starts from rest at t = 0 and moves upward with a constant acceleration of 3.6 in./s^2, Knowing that collar B moves downward with a constant velocity of 16 in./s, determine (a) the time at which the velocity of block C iszero, (b) the corresponding position of block C. (20 %)

2. A uniform sphere of radius r and mass m is placed with no initial velocity on a belt which moves to the right with a constant velocity v_1, Denoting by μ_k the coefficient of kinetic friction between the sphere and the belt, determine (a) the time t_1 at which the sphere will start rolling without sliding,(b) the linear velocity and the angular velocity of the sphere at time t_1. (20 %)

3. The slender homogeneous rod AB of mass m and length L is free to rotate about a horizontal axle through its mass center G. The axle is supported by a frame of negligible mass which is free to rotate about the vertical CD. Knowing that, initially, $\theta = \theta_0$, $\dot{\theta} = 0$, and $\dot{\phi} = \dot{\phi}_0$, show that the rod will oscillate about the horizontal axle and determine (a) the range of values of angle θ during this motion, (b) the maximum value of $\dot{\theta}$, (c) the minimum value of $\dot{\phi}$. (20 %)

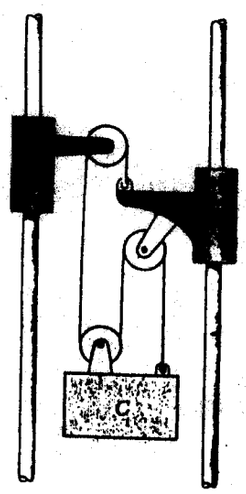


Fig 1

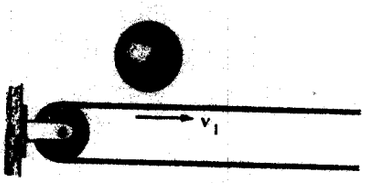


Fig 2.

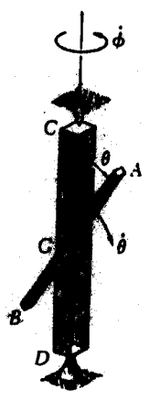


Fig 3.