所別： 機械工程學系 碩士班 固力與設計組(一般生) 共 1 頁 第 1 頁

科目： 動力學 ※計算題需計算過程，無計算過程者不予計分

本科考試可使用計算器，廠牌、功能不拘 ＊請在答案卷(卡)內作答

(1) (Please see Fig. 1) A car passed through a hump which has a circular shape with smooth transitions at either end. The car maintains a constant speed $v = 7$ m/s during the process.

    (a) At an instant after it passes B, the normal force exerted by the road on the car drop to one-third of the normal force at point A. Please determine the θ. (15%)

    (b) If the car speed is variable, what is the minimum speed that will cause the car to lose contact with the road at the highest point C ? (10%)

(2) (Please see Fig. 2) Three identical small spheres, each of mass 1 kg, can slide freely on a horizontal frictionless surface. Spheres B and C are connected by a light rod and are at rest in the position shown when sphere B is struck squarely by sphere A which is moving to the right with a velocity $V_O = 2.4$ m/s. Knowing that $\theta = 45°$ and that the velocities of spheres A and B immediately after the impact are $\vec{V}_A = \vec{0}$ and $\vec{V}_B = (1.8 \text{ m/s}) \vec{i} + (V_{BY}) \vec{j}$, determine (a) V_{BY} (9%); and (b) the velocity of sphere C ($\vec{V}_C$) immediately after impact. (16%)

(3) (Please see Fig. 3) The homogeneous sphere of mass m and radius r is projected along the incline of angle θ with an initial speed v_0 and no angular velocity ($\omega_0 = 0$). If the coefficients of static and kinetic friction are μ_s and μ_k, respectively, determine the time duration t of the period of slipping (10%). In addition, find the velocity v of the mass center G and the angular velocity ω at the end of the period of slipping. (7% and 8%, respectively)

(4) (Please see Fig. 4) As shown in Fig. 4, the crank AB rotates with a constant angular velocity of 600 rpm clockwise. Please determine: (1) the angular velocity of the connecting rod BD (10%); (2) the angular acceleration of the connecting rod BD (10%); (3) the acceleration of point D on the piston. (5%)
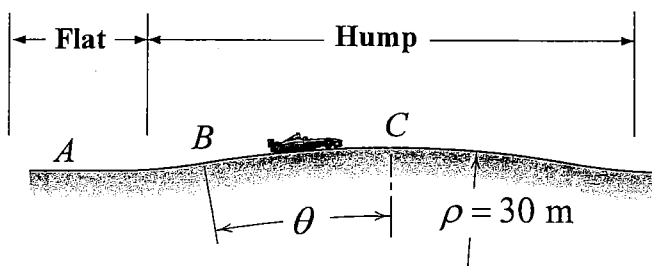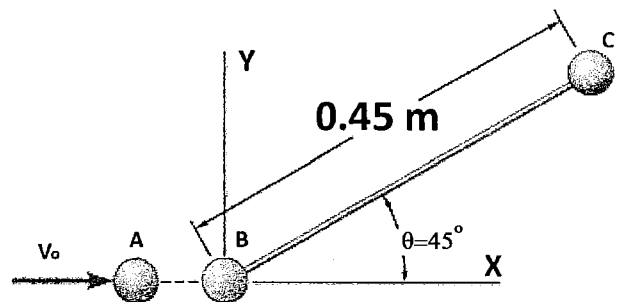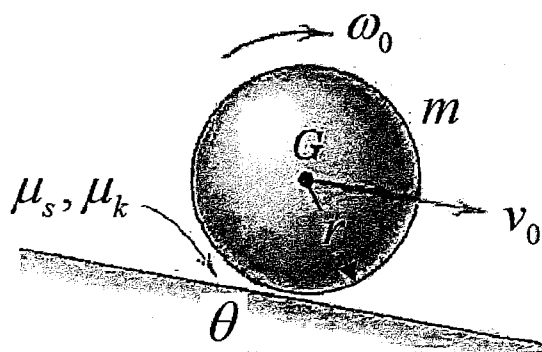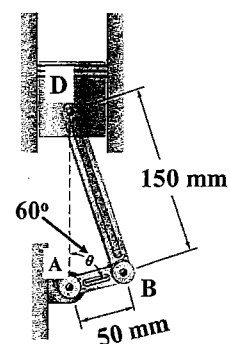

Fig. 1

Fig. 2

Fig. 3

Fig. 4