編號： 72

國立成功大學 109 學年度碩士班招生考試試題

系　　所：機械工程學系

考試科目：動力學

考試日期：0210，節次：2

※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (20%) A bar of length $L = 4$ m is pin-connected to a roller at A as shown in Fig. 1. (a) if the roller is moving along a horizontal rail with a constant speed $v_A = 5$ m/s, and the instance $\theta = 33°$ and $\dot{\theta} = 0.4$ rad/s, please compute the velocity of the bars's midpoint C. (b) if, when $\theta = 0°$, A is accelerating to the right with $a_A = 27$ m/s^2 and $\vec{a}_c = \vec{0}$, determine $\dot{\theta}$ and $\ddot{\theta}$.

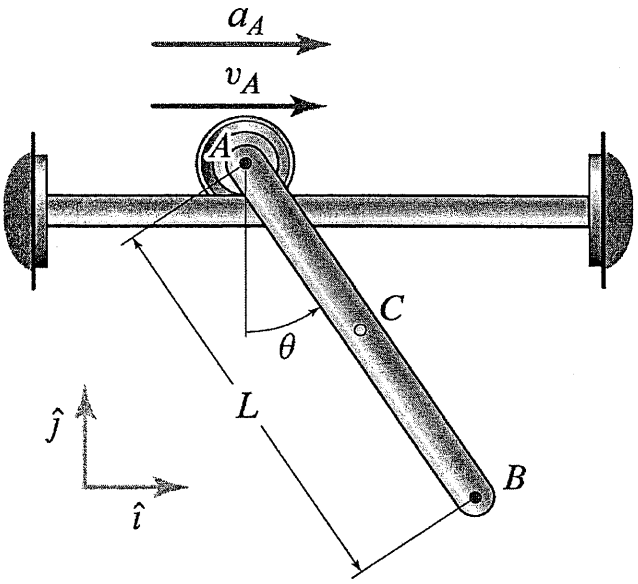

Fig. 1

2. (20%) The end B of a robot arm is moving vertically down with a constant speed $v_0 = 2$ m/s, as shown in Fig. 2. Letting $d = 1.5$ m, please determine the rate at which r and θ are changing when $\theta = 37°$.

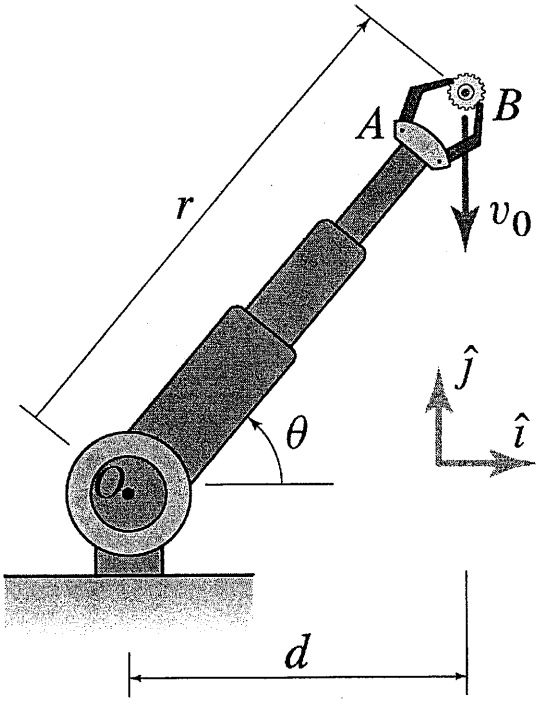

Fig. 2

3. (20%) The uniform slender rod pivoted at point O shown in Fig. 3 has a mass of 10 kg. The rod's end A is attached to a spring with a spring constant k = 5000 N/m and with a unstretched length of 0.1 m. If the end A is pushed upward so that the spring has a compression of 0.01 m and then released from rest, determine: (a) the velocity of the end A when $\theta = 0$; (b) the maximum velocity of the end A during the vibration motion (c) the natural frequency of the vibration.

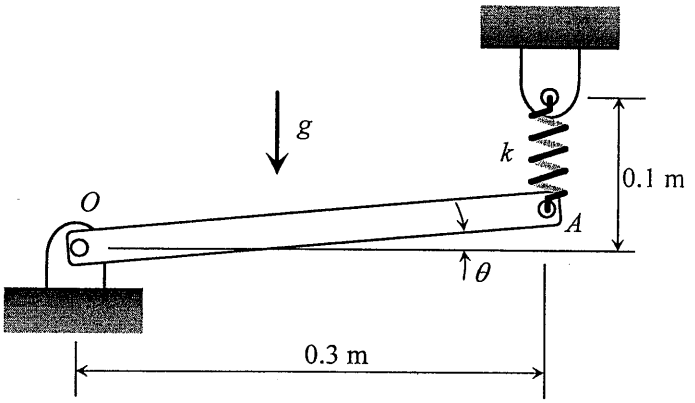

Fig. 3

4. (20%) The hammer consists of an 8-kg solid cylinder C and a 5-kg uniform slender rod AB, as shown in Fig. 4. If the hammer is released from rest when $\theta = 60^\circ$ and strikes the 45-kg block D when $\theta = 0$, determine: (a) the velocity of the block D and the angular velocity of the hammer immediately after the impact; (b) the maximum moving distance of the block D before it stops. The coefficient of restitution between the hammer and the block is e =0.6. The kinetic friction coefficient between the block D and the ground is 0.1.

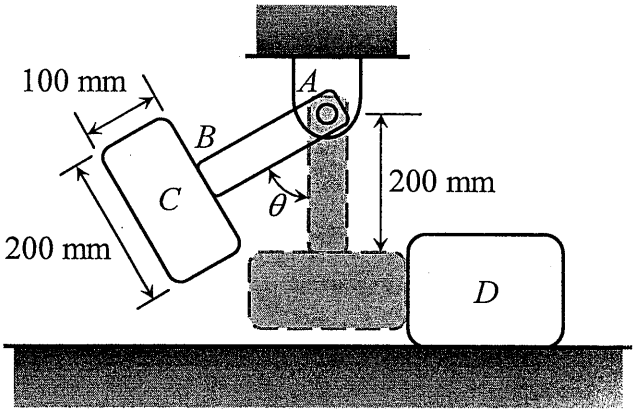

Fig. 4

5. (20%) Two uniform slender 15-kg bars OA and AB are pinned at A, as shown in Fig. 5. The torsional spring at A has a stiffness k_t = 80 N-m/rad and is undeformed when $\theta = 0^\circ$. If the system is released from rest when $\theta = 60^\circ$ and $\phi = 45^\circ$, determine the angular velocity of wheel B when $\theta = 90^\circ$. The 10-kg wheel at B has a centroidal radius of gyration of 75 mm and is observed to roll without slipping on the horizontal surface.

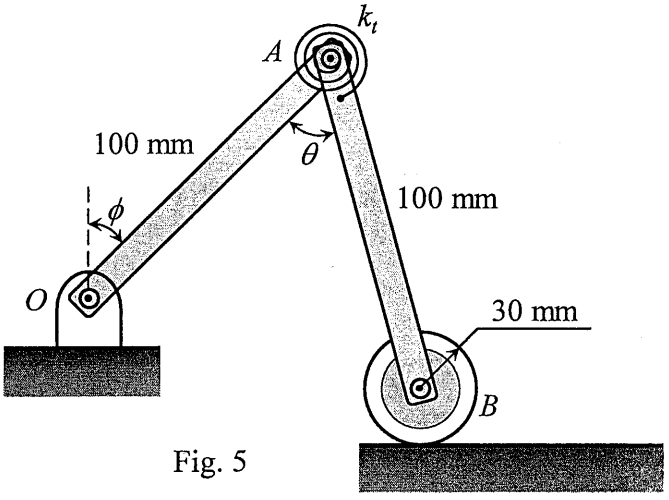

Fig. 5