國立成功大學 106 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：0213，節次：2

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

1. The small bodies A with mass m_A and B with mass m_B ($m_B = 2m_A$) are connected and supported by the pivoted links OA and AB of negligible mass. If A is released from rest in the position shown in Fig. 1, calculate its velocity v_A as it crosses the vertical centerline. Neglect any friction. **(10%)**

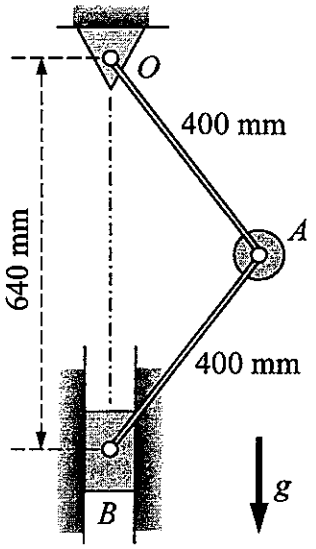

Fig. 1

2. Crank OA rotates with a clockwise angular velocity 12 rad/s. For the position illustrated in Fig. 2, **(25%)**
   (a) determine the angular velocity ω of link AB and the velocity of piston B;
   (b) find the velocity of the center G of homogeneous link AB;
   (c) determine the angular acceleration α_{AB} of link AB and the acceleration a_B of point B.

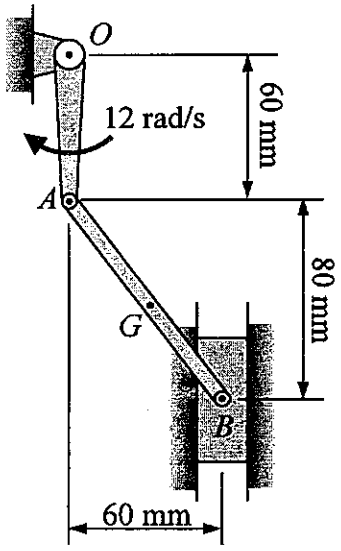

Fig. 2

3. The homogeneous slender rod of mass 1 kg and length 3 m has a particle A (negligible radius, mass 1 kg) attached to its end. If the initial angular velocity is 10 rad/s clockwise at the position shown in Fig. 3, determine the angular velocity as it passes the vertical position. **(5%)**

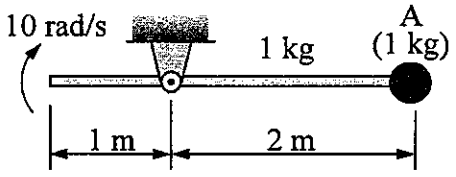

Fig. 3

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4. Consider a mass M connected by a spring k_s, damper c and a flexible beam of length L, bending rigidity EI and negligible mass, as shown in Fig. 4. Note that the beam deflection at its end is $PL^3/(3EI)$ when a load P is applied at that location. The system is mounted on a base vibrating with a sinusoidal displacement of amplitude u_0 and frequency ω. **(30%)**
   (a) Draw the free body diagram of the mass M and derive its equation of motion;
   (b) Determine the natural frequency of the system. Discuss how the length and the stiffness of the beam affect the natural frequency.
   (c) Discuss how the magnitude of the damping coefficient c and the input frequency ω affect the response $x(t)$.

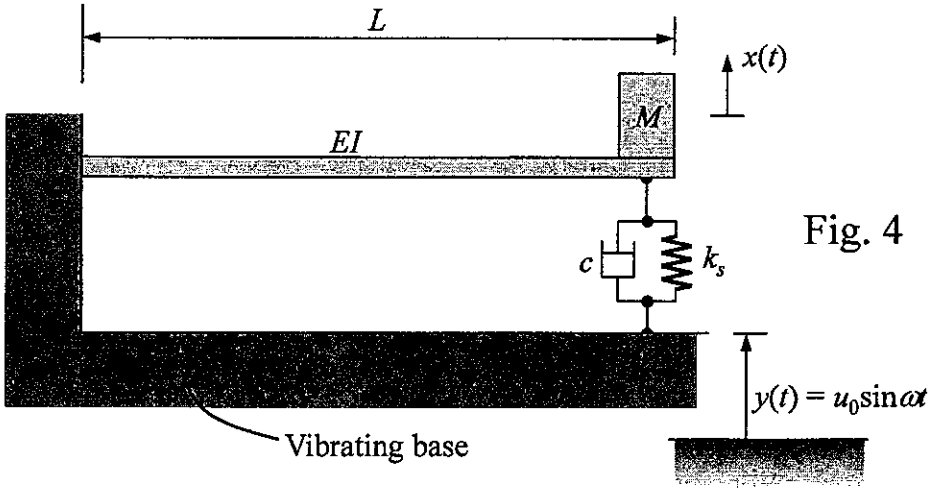

Fig. 4

5. A small sphere A of mass m_A and a small sphere B of mass m_B ($m_B = 2m_A$) are placed on an incline and on a horizontal plane, respectively. If the sphere A is released from rest shown in Fig. 5, it rolls downward and then hit sphere B. The coefficient of kinetic friction between the planes and the spheres is μ =0.096 and the coefficient of restitution is e = 0.8. **(30%)**

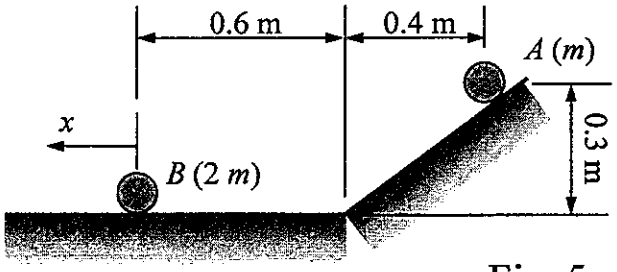

Fig. 5

   (a) Determine the velocity of sphere A at the instance just before collision;
   (b) Determine the velocities of the two spheres just after collision;
   (c) Determine the displacement of sphere B from the initial position to its final position when it stops.