國立臺灣大學 102 學年度碩士班招生考試試題

1. (20%)

A 50-kg block shown in Fig. 1 rests on a horizontal plane. The coefficient of kinetic friction is μ_k=0.3. If the block is subject to a 400-N towing force as shown, determine the velocity of the block in 3 sec. starting from rest.

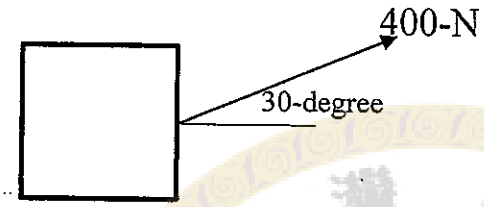

Fig. 1

2. (20%)

The ram *R* shown in Fig. 2 has a mass of 100-kg and is released from rest 0.75 m from the top of the spring *A*. The spring has a stiffness k_A=12 kN/m. If a second spring *B* having a stiffness k_B=15 kN/m is 'nested' in *A*, determine the maximum displacement of *A* needed to stop the downward motion of the ram. The un-stretched length of each spring is indicated in the figure. Neglect the mass of the spring.

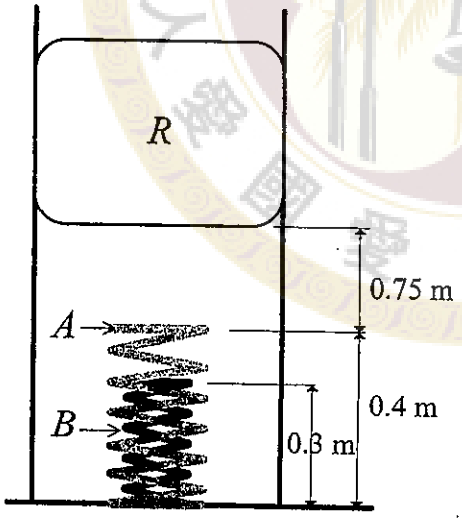

Fig. 2

3. (20%)

Blocks *A* and *B* shown in Fig. 3 have a mass of 3–kg and 5-kg, respectively. If the system is released from rest, determine the velocity of block *B* in 6 sec. Neglect the mass of the pulleys and cord.

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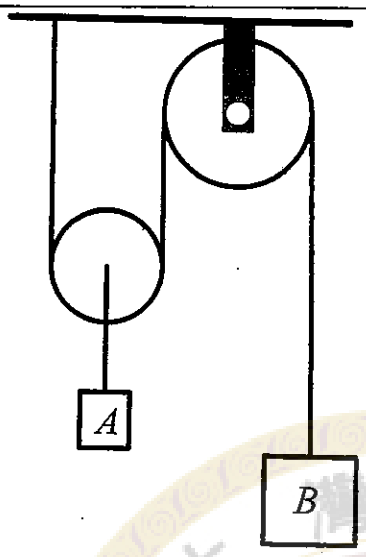

Fig. 3

4. (20%)
The right –angle bar rotates clockwise with an angular velocity which is decreasing at the rate of 4 rad/s^2. Find the velocity and acceleration of point *A* when ω=2 rad/s.

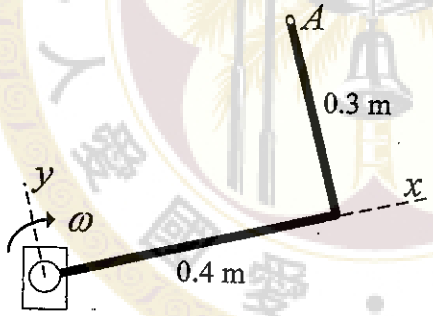

Fig. 4

5. (20%)
The 5-kg slender rod shown in Fig. 5 is pinned at *O* and is initially at rest. If a 4-g bullet *B* is fired into the rod with a velocity of 400 m/s as shown in the figure, determine the angular velocity of the rod just after the bullet becomes embedded in the rod.

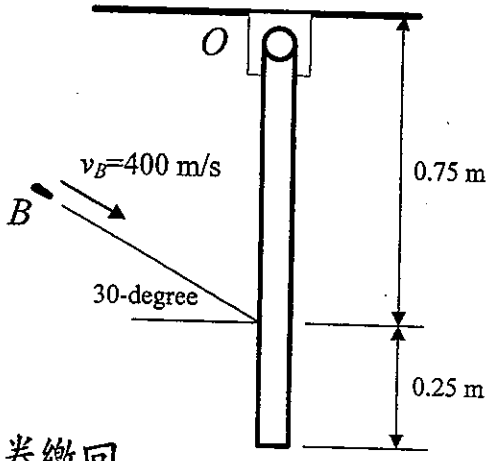

Fig. 5

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