本科考試可使用計算器，廠牌、功能不拘　　　計算題需計算過程，無計算過程者不予計分

(1) (Please see Fig. 1) A ball with 1 kg mass is tied by two ropes which are fixedly attached at points A and B in another ends. The ball performs a circular motion with a constant tangential velocity v = 2.5 m/s and a radius r = 0.5 m in the horizontal plane. Please calculate: (a) the tensile forces of two ropes (15%), and (b) the range of tangential velocity that two ropes produce the tensile forces at the same time (10%)

(2) (Please see Fig. 2) A uniform slender rod of length L and mass m is released from rest in the vertical position shown in Fig. 2. Assume both the friction at point B and the mass of the roller are negligible. Derive the initial acceleration of point B in terms of m, L, θ and g (g: gravitational acceleration). (25%)

(3) (Please see Fig. 3) Ball B, of mass 5 kg, is suspended from a cord, of length 0.5 m, attached to cart A, of mass 10 kg, which can roll freely on a frictionless horizontal track. While the cart is at rest, the ball is given an initial horizontal velocity Vo= 2.4 m/s. Determine (a) the velocity of B as it reaches its maximum elevation (15%), and (b) the maximum vertical distance h through which B will rise (10%).

(4) (Please see Fig. 4) (a) Assume $y(t)$ is the known displacement of the ground. Derive the equation of motion of the seismometer (地震儀) for unknown displacement $x(t)$ by using Newton's second law (7%).

(b) What is the natural frequency? (5%) (c) For $y(t) = \delta(t)$, the unit impulse function, find the time response $x(t)$ if the system is originally at rest at $t = 0$　(13%).
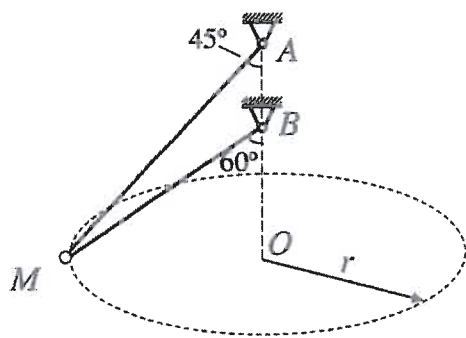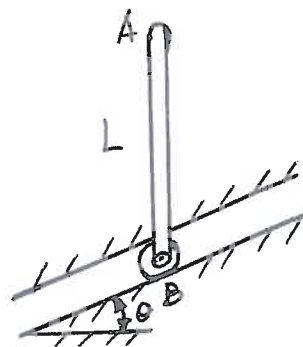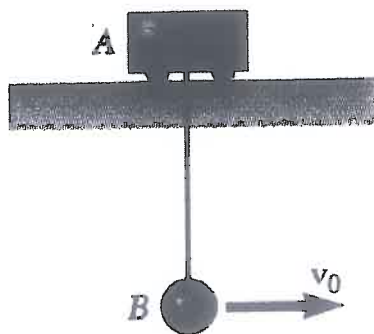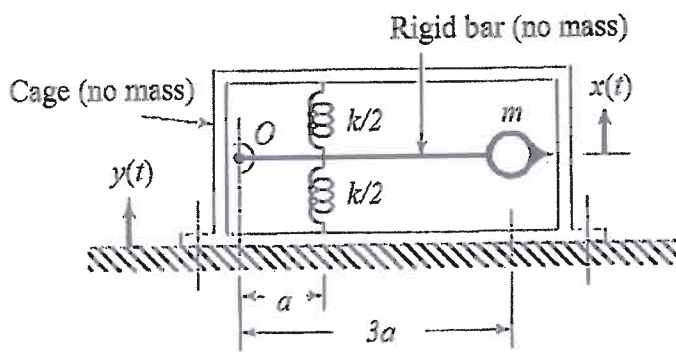

Fig. 1

Fig. 2

Fig. 3

Fig. 4