國立成功大學 106 學年度碩士班招生考試試題

系　　所：生物醫學工程學系

考試科目：工程力學

考試日期：0213，節次：1

※ 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. Explain the following terms: (20%)
   (a) Beating phenomenon. (4%)
   (b) Conservative force. (4%)
   (c) Principle of linear impulse and momentum. (4%)
   (d) Principle of virtual work. (4%)
   (e) Coulomb's friction. (4%)

2. A 10-kg block is suspended from a spring of constant k = 4.0 kN/m, as shown in Figure 1. At time t = 0, it has a downward velocity of 1 m/s as it passes through the position of static equilibrium. Assume the gravity g = 10 m/s^2. Determine the followings: (30%)
   (a) The static spring deflection δ_s. (5%)
   (b) The natural frequency of the system in both rad/sec (ω_n) and cycles/sec (f_n). (5%)
   (c) The system period τ. (5%)
   (d) The displacement of x as a function of time, x = x(t), where x is measured from the position of static equilibrium. (5%)
   (e) The maximum velocity attained by the mass. (5%)
   (f) The maximum acceleration attained by the mass. (5%)

Figure 1

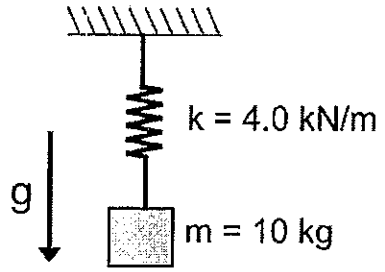
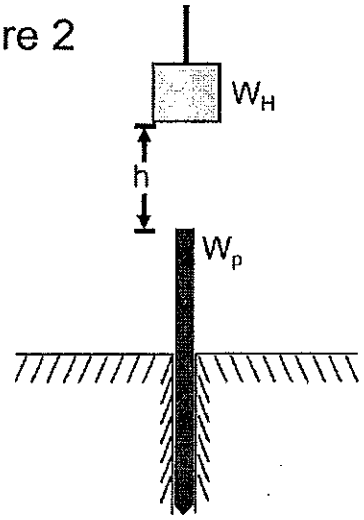


Figure 2



3. It is desired to drive a pile of weight W_p = 1800 kg into the ground by dropping a hammer of weight W_H = 200 kg at a distance of h = 5 m onto the pile, as shown in Figure 2. Determine the distance that the pile is driven into the ground by a single blow of the hammer, if it is assumed that the ground provides a constant resisting force of 3000 kg. Assume the impact to be perfectly plastic and the gravity g = 10 m/s^2. (20%)

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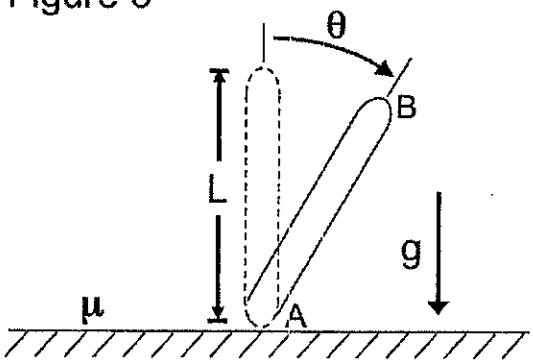
4. A slender bar shown in Figure 3 has a uniform cross section and mass **m**. The bar is released at rest when vertical ($\theta = 0$) and rotate in a vertical plane under the action of gravity. The coefficient of static friction between the bar's endpoint A and the horizontal surface is μ. Determine the followings: (15%)
   (a) The static friction exerted on the bar's endpoint A. (5%)
   (b) The normal force exerted on the bar's endpoint A. (5%)
   (c) The coefficient of static friction μ when the bar begins to slip. (5%)

Figure 3



5. The hoop shown in Figure 4 is cast on the rough surface such that it has and angular velocity $\omega = 10$ rad/s and an angular deceleration $\alpha = 5$ rad/s^2. Also, its center has a velocity of $V_O = 20$ m/s, and a deceleration $a_O = 10$ m/s^2. Determine the acceleration of point A at this instant. (15%)

Figure 4