

國立成功大學
110學年度碩士班招生考試試題

編 號：153

系 所：生物醫學工程學系

科 目：工程力學

日 期：0202

節 次：第 2 節

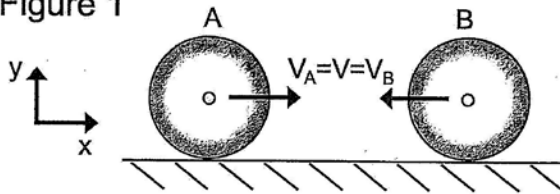
備 註：可使用計算機

※ 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. Explain the followings: (20%)
 - (a) The difference between kinetics and kinematics. (5%)
 - (b) Conservative force. (5%)
 - (c) Principle of linear impulse and momentum. (5%)
 - (d) Principle of virtual work. (5%)

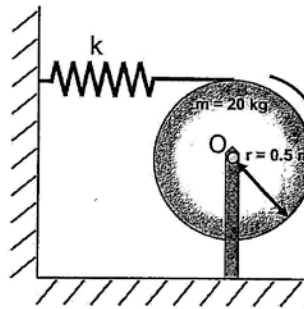
2. In Figure 1, two spheres (same mass) slide towards each other with the velocity $V_A=V_B=V$, and eventually make a collision that results in 0 velocity. (i) Please derive this process from both the aspects of conservation of energy and conservation of momentum. (ii) Explain the outcome of the derivation. (20%)

Figure 1



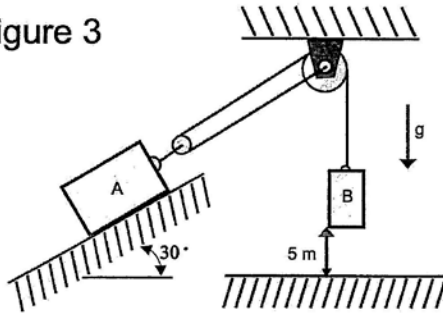
3. A flywheel, with mass (m) of 20 kg and radius (r) of 0.5 m, is made for energy storage, as shown in Figure 2. A radius of gyration for this flywheel passing through its center of mass is 0.3 m. A flexible rope is used to connect the flywheel with a spring, with spring constant $k = 200$ N/m. Consider the moment that the flywheel is spinning at $\omega = 3$ rad/s, where the spring has extended by 0.5 m. Please determine the followings: (15%)
 - (a) The maximum extension of the spring δ_{max} . (5%)
 - (b) ω_{max} when the moment the spring reaches δ_{max} and the spring suddenly turns to slack (no tension). (10%)

Figure 2



4. In Figure 3, a 500 kg sliding block A has a coefficient of dynamic friction $\mu_k = 0.2$ with an inclined plane, which is connected to a 200 kg block B through a string and the pulleys. The block B sits away from the ground at 5 m and now is released at rest. Determine the velocity of the block A when the block B is about to reach the ground. (20%)

Figure 3



5. An ice skater rotates along its central axis, as shown in Figure 4. The skater ($m = 70$ kg) can be represented by a sphere as the head (5 kg) and five cylinders as the body (25 kg), the arms (10 kg each) and the legs (10 kg each). At the beginning, the skater is rotating at 1 rad/s around the central axis. (25%) Please (1) prove the mass moments of inertia I_{zz} of the body is equal to $0.5mR^2$; (10%) (2) determine the speed of the skater when the positions of the arms changed from stretching to holding the chest. (15%)

Figure 4

