編號： 125　　國立成功大學 108 學年度碩士班招生考試試題

系　　所：系統及船舶機電工程學系

考試科目：動力學　　考試日期：0223，節次：2

※ 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. As shown in Fig. 1a, the 0.2-kg ball is blown through the smooth vertical circular tube whose shape is defined by $r = (0.6 \sin\theta)$ m, where θ is in radians. If $\theta = (\pi t^2)$ rad, where t is in seconds. **F** is the force exerted by the blower on the ball. (1) Derive the formula of the angle ψ between the direction of the force **F** and radial direction r at any given time t, as shown in Fig. 1b [5%]; (2) determine the magnitude of force **F** exerted by the blower on the ball when $t = 0.55$ s. [15%]

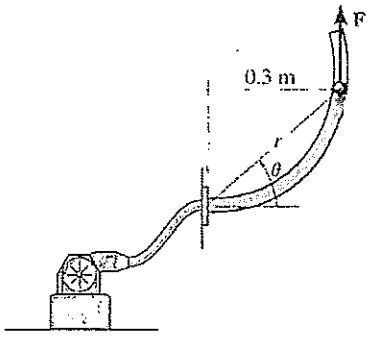

Fig. 1a

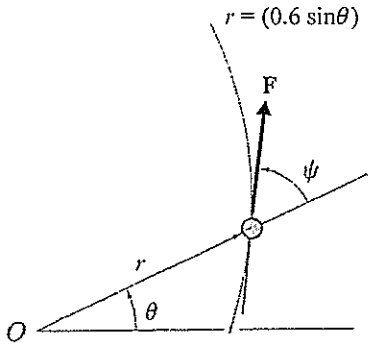

Fig. 1b

2. As shown in Fig. 2, the block has a weight of 80 kg and rests on floor for which the coefficient of kinetic friction is $\mu_k = 0.4$. If the motor draws in the cable at constant rate of 6 m/s, (1) determine the acceleration of the block [10%]. (2) Determine the output (W) of the motor at the instant $\theta = 60°$ by (method 2a) using the velocity of the block and total force on it [5%]; by (method 2b) using the cable tension and velocity (6 m/s) drawn by the motor [5%]. Neglect the mass of the cable and pulleys.

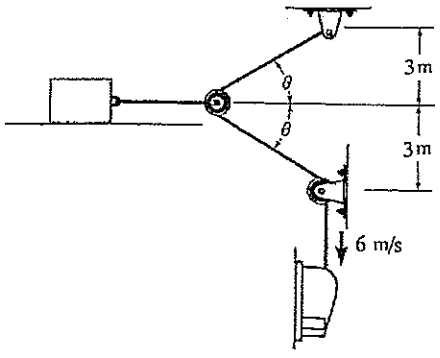

Fig. 2

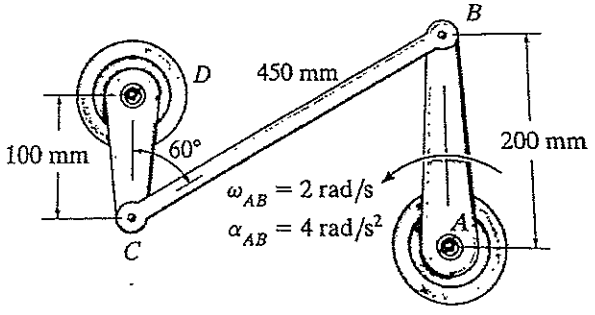

Fig. 3

3. Member AB has the angular motions as shown in Fig 3. Determine (1) the angular velocity of members CB [5%] and DC [5%] and (2) the angular acceleration of members CB [5%] and DC [5%].

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4. As shown in Fig. 4a and Fig. 4b, the solid cylinder and hollow (thin) cylinder roll down the inclined plane without slipping. The inclined angle is θ. The coefficient of static friction on the plane surface is μ_s. Each cylinder has the radius R, length L, mass M and moment of inertia I_G about the rotating axis passing through their mass centers G. The gravitational acceleration is g. (1) Determine the acceleration a_G of the mass center for a cylinder with a certain I_G [10%]. Hint: a_G is the function of θ, R, M, g and I_G. (2) Show that $I_G = 0.5MR^2$ for the solid cylinder [5%] and $I_G = MR^2$ for the hollow cylinder [5%]; (3) prove that a_G of the solid and hollow cylinder does not depend on the R, L and M; also a_G of the hollow cylinder is smaller than the a_G of the solid cylinder regardless of R, L and M [5%].

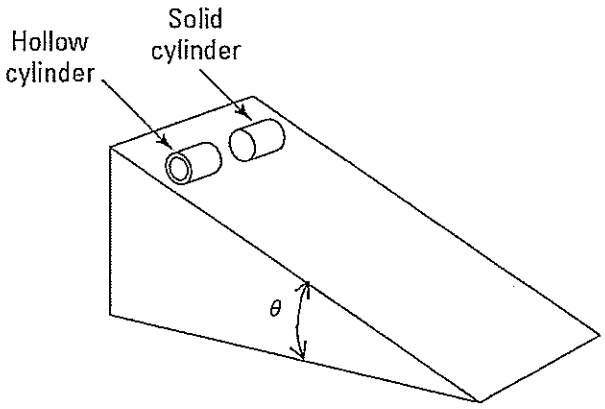

Fig. 4a

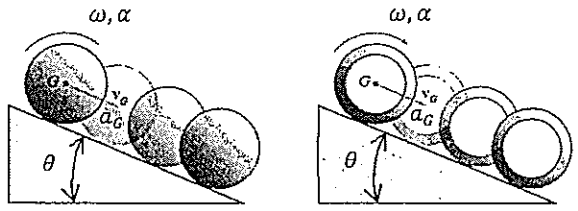

Fig. 4b

※ ω: angular velocity of the cylinder
※ α: angular acceleration of the cylinder
※ v_G: velocity of the mass center of the cylinder
※ a_G: acceleration of the mass center of the cylinder

5. Two disks A and B each have a mass of 1 kg and the initial velocities shown in Fig. 5 just before they collide. If the coefficient of restitution is $e = 0.6$, determine the speed of disk A and disk B just after impact [15%].

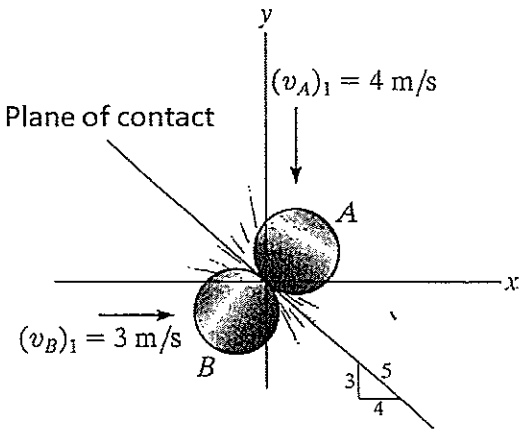

Fig. 5