國立成功大學

111學年度碩士班招生考試試題

編　號：125

系　所：系統及船舶機電工程學系

科　目：動力學

日　期：0219

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。

Gravitational acceleration g = 9.81 m/s² pointing downward for all questions.

1. As shown in Fig. 1, the 0.2-kg ball is blown through the smooth vertical curved tube whose shape is defined by $r = (0.3 \sin 2\theta)$ 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. When $t = 0.4$ s, determine the angle between F and radial direction r [5%], the radial and angular acceleration: a_r [5%] and a_θ [5%] of the ball, and the magnitude of F [5%].
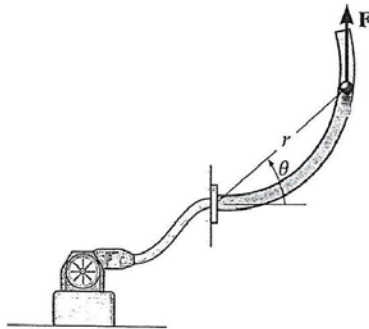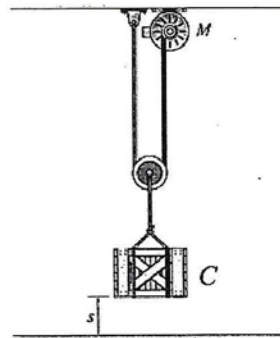

Fig. 1　　　　　　　　　　Fig. 2

2. As shown in Fig. 2, the crate C, having a weight of 20 kg, is hoisted by the pulley system and motor M. If the crate starts from rest and, by constant acceleration, attains a speed of 3 m/s after rising 3m. The motor has an efficiency $\varepsilon = 0.65$. Determine the power P that must be supplied to the motor at the instant $s = 3$ m [15%].

3. At the instant shown in Fig. 3, wheel A rotates with an angular velocity of $\omega = 4$ rad/s and an angular acceleration of $\alpha = 3$ rad/s². Determine link BC's angular velocity ω_{BC} [5%], pin B's acceleration $\mathbf{a_B}$ [5%], link BC's angular acceleration α_{BC} [5%], and piston C's acceleration a_C [5%].
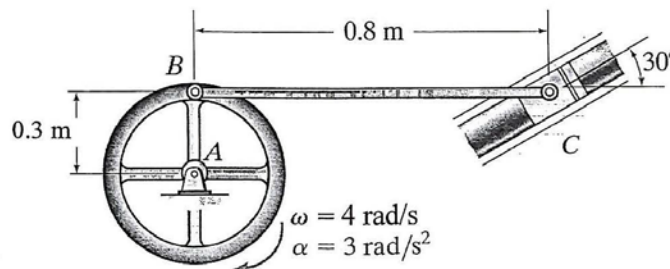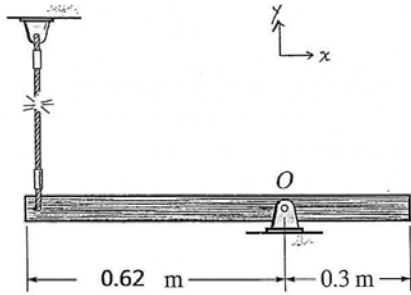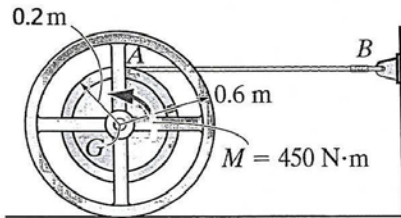

Fig. 3

Fig. 4

Fig. 5

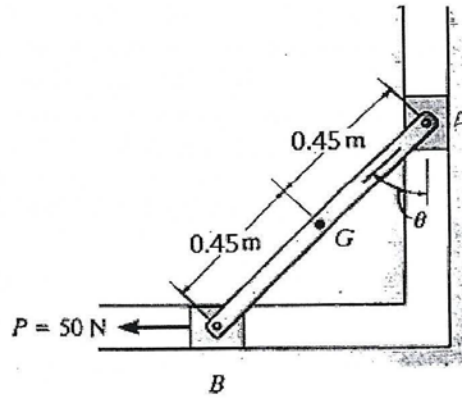Fig. 6

4. As shown Fig. 4, the uniform slender rod has a mass of 15 kg. Determine the horizontal and vertical components of reaction: O_X [5%] and O_Y [5%] at the pin O, and the angular acceleration α [5%] of the rod just after the cord is cut.

5. As shown in Fig. 5, the 100-kg spool has a radius of gyration about its mass center of $k_G = 350$ mm. If the couple moment is applied to the spool and the coefficient of kinetic friction between the spool and the ground is $\mu_k = 0.25$, determine the angular acceleration α of the spool [5%], the acceleration a_G of G [5%] and the tension T in the cable [5%].

6. The 15-kg rod shown in Fig. 6 is constrained so that its ends move along the grooved slots. The rod is initially at rest when $\theta = 0°$. If the slider block at B is acted upon by a horizontal force $P = 50$ N, determine the angular velocity of the rod at the instant $\theta = 45°$. Neglect friction and the mass of blocks A and B. [15%]