

國立成功大學

112學年度碩士班招生考試試題

編 號： 126

系 所： 系統及船舶機電工程學系

科 目： 動力學

日 期： 0206

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。請注意，所有問題請以數字作答。重力加速度 $g = 9.81 \text{ m/s}^2$ ，圓周率 $\pi = 3.14 \text{ rad}$ 。

(1) At the instant shown in Fig. 1, cars A and B are traveling at the speeds shown. If B is accelerating at 1600 km/h^2 while A maintains a constant speed, determine the velocity $v_{A/B}$ [5%] and acceleration $a_{A/B}$ [5%] of A with respect to B . Both $v_{A/B}$ and $a_{A/B}$ are the magnitude of the resultant.

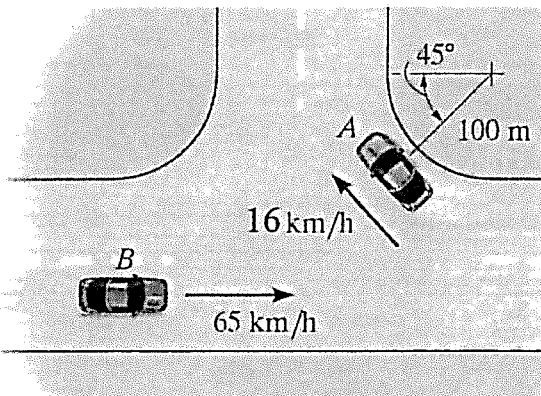


Fig. 1

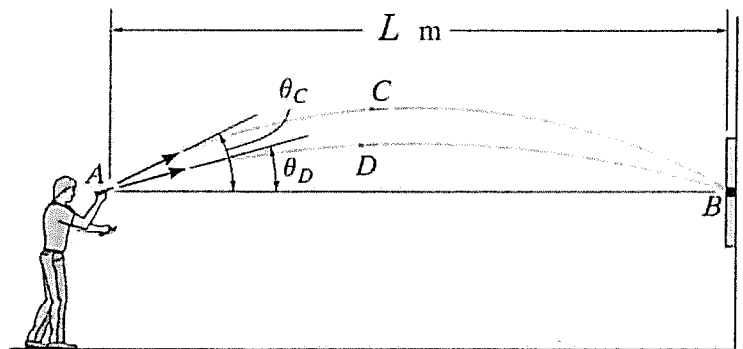


Fig. 2

(2) See Fig. 2, the man at A wishes to throw two darts at the target at B so that they arrive at the same time. If each dart is thrown with a speed of 10 m/s , determine the angles θ_C [5%] and θ_D [5%] at which they should be thrown and the time Δt [5%] between each throw. Note that the first dart must be thrown at $\theta_C (>\theta_D)$ then the second dart is thrown at θ_D . The distance between A and B is $L = 4.35$.

(3) At the instant shown in Fig. 3, the wheel rotates with an angular velocity of $\omega = 14.5 \text{ rad/s}$ and an angular acceleration of $\alpha = 7.5 \text{ rad/s}^2$. Determine the magnitudes of the resultants as follows: the velocity v_B of pin B [5%], angular velocity ω_{BC} of rod BC [5%], acceleration a_B of pin B [5%], acceleration a_C of pin C [5%], and angular acceleration α_{BC} of link BC [5%].

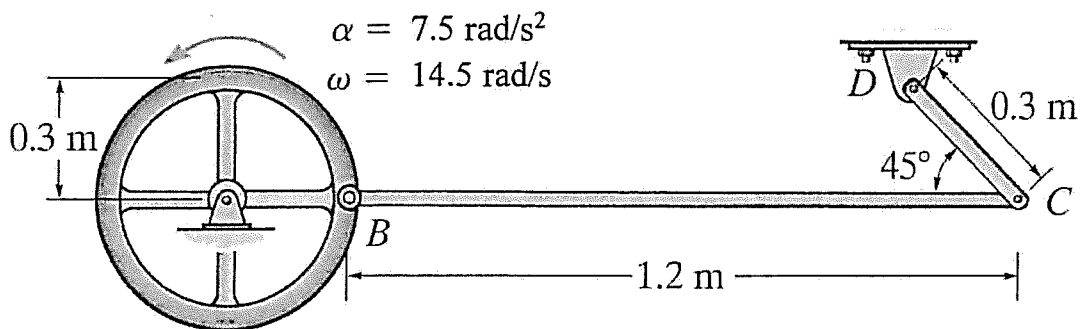


Fig. 3

(4) As shown in Fig. 4, the 2-Mg car is traveling along the curved road described by $r = (52.5e^{2\theta})$ m, where θ is in radians. If a camera is located at A and it rotates with an angular velocity of $\dot{\theta} = 0.05$ rad/s and an angular acceleration of $\ddot{\theta} = 0.01$ rad/s² at the instant $\theta = \pi/6$ rad, determine the acceleration in r - θ coordinate: a_r [5%] and a_θ [5%], and the resultant friction force F [10%] developed between the tires and the road at this instant. Note: $Mg = 1000$ kg.

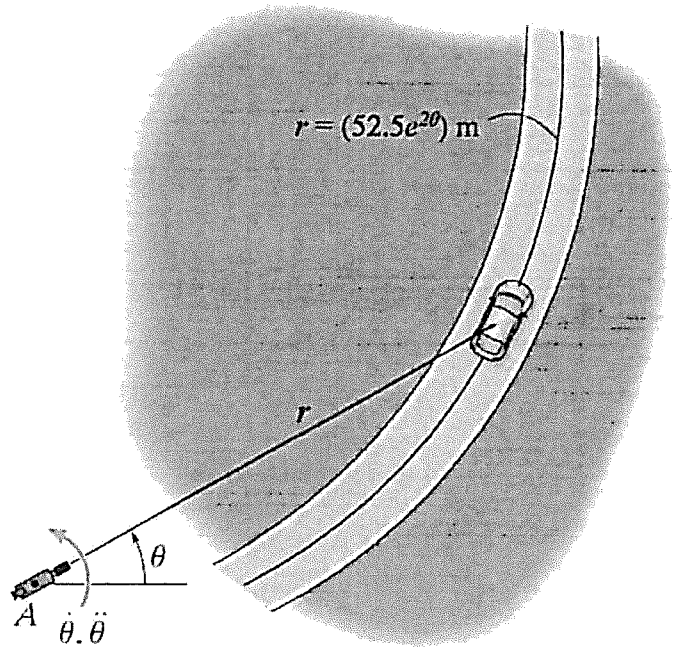


Fig. 4

(5) The motor exerts a force of $F = (23 t^2)$ N on the cable (see Fig. 5), where t is in seconds. Determine the speed v [15%] of the 23-kg crate A when $t = 4$ s. The coefficients of static and kinetic friction between the crate and the plane are $\mu_s = 0.3$ and $\mu_k = 0.25$, respectively.

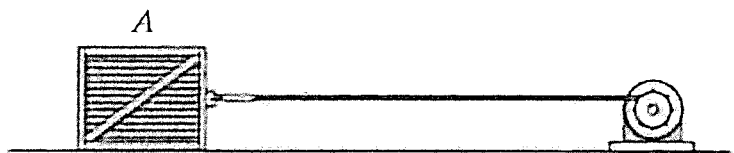


Fig. 5

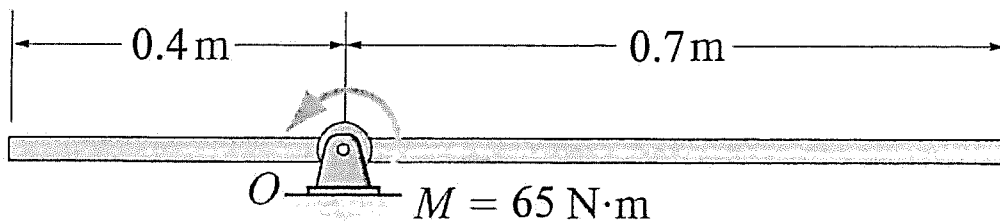


Fig. 6

(6) At the instant shown in Fig. 6, the uniform 35 kg slender rod has a counterclockwise angular velocity of $\omega = 7$ rad/s. Determine the tangential component O_t [5%] and normal component O_n [5%] of reaction of pin O on the rod and the angular acceleration α [5%] of the rod at this instant.