

國立臺灣科技大學
八十七學年度碩士班招生考試試題

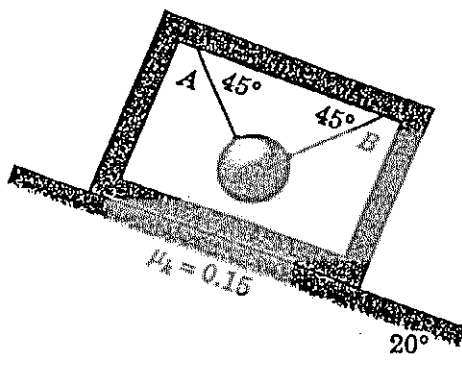
所 別： 機械工程技術研究所
學程別：

組別：固力與設計組、控制組

科目：動力學

共四題，每題 25 分，可不依序作答，但題號請務必標示清楚。解題時請註明所依據之定律或原理；自由體圖需簡明繪於答案卷上。若需自行定義代號或向量，亦請於圖上標示清楚。重力加速度 g 之值請以 9.81 m/s^2 計算。

1. The 10-kg steel sphere is suspended from the 20-kg frame which slides down the 20° incline. If the coefficient of kinetic friction between the frame and the incline is 0.15, compute the tension in each of the supporting wires A and B.



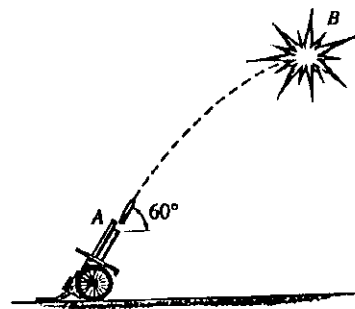
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2. The 50-N projectile is fired from the ground level with an initial velocity of $v_A = 24\text{m/s}$ in the direction shown. When it reaches its highest point B it explodes into two 25-N fragments. If one fragment travels vertically upward at 3.6 m/s, determine the distance between the fragments after they strike the ground. Neglect the size of the gun.



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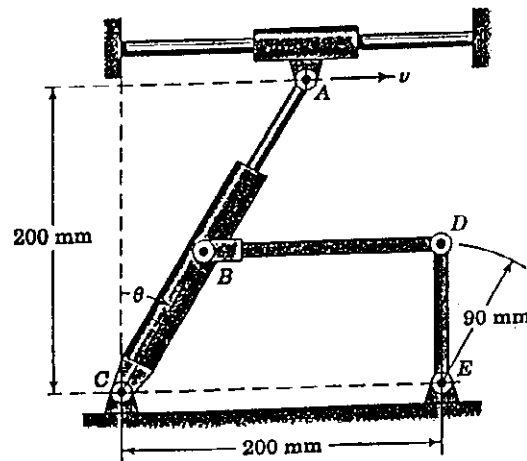
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3. For the position shown where $\theta = 30^\circ$, point A on the sliding collar has a constant velocity $v = 0.3\text{m/s}$ with corresponding lengthening of the hydraulic cylinder AC. For this same position BD is horizontal and DE is vertical.

Determine

- (i) the angular velocity $\dot{\theta}$ of link CB;
- (ii) the angular acceleration $\ddot{\theta}$ of link CB;
- (iii) the angular velocity ω_{ED} of link ED;
- (iv) the angular acceleration α_{ED} of link ED

at this instant.



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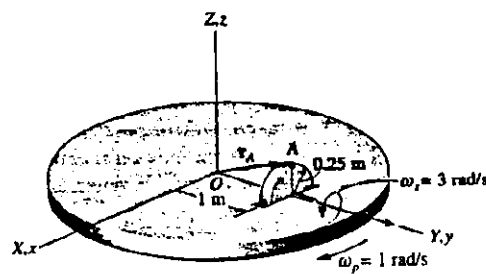
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4. The 10-kg disk shown in the figure is spinning about its horizontal axis with a constant angular velocity $\omega_s = 3 \text{ rad/s}$, while the horizontal platform on which the disk is mounted is rotating (in clockwise direction) about the vertical axis at a constant rate $\omega_p = 1 \text{ rad/s}$. Determine

- (i) the angular velocity and angular acceleration of the disk;
- (ii) the velocity and acceleration of point A on the disk;
- (iii) the angular momentum (with respect to coordinate frame X-Y-Z) and kinetic energy of the disk

when it is in the position shown.



(*)
Fig. 20-7