

國立臺灣科技大學
九十四學年度碩士班招生考試試題

系所組別：機械工程系碩士班甲組、機械工程系碩士班丁組
科目：動力學

(總分 100 分)

共四題，每題 25 分，可不依序作答，但題號務必標示清楚；所有解答之文字、座標、自由體圖(FBD)、受力圖(KD)等需簡明書寫於答案卷上；解答時，請先註明所依據之定律或原理。

- 1 As Figure 1 shows, the ball of mass m released from position A with a velocity of 3 m/s and swings in a vertical plane. At the bottom position, the cord strikes the fixed bar at B , and the ball continues to swing in the dashed arc. Calculate (i) the velocity v_C as it passes the position C , and (ii) at the instant at C , the total resultant force exerts on bar B .

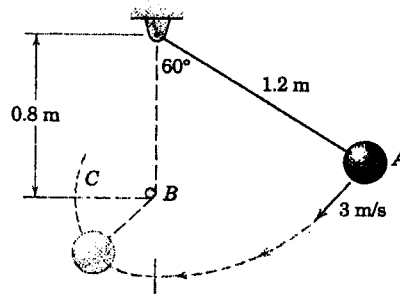


Figure 1

- 2 We all once played bowling. As the ball leaves the hand it has an initial translating velocity v_0 and an initial rotating speed ω_0 as Figure 2 shown. Assuming that the ball is on a vertical plane motion, please use your knowledge and skills in Dynamics, prove that the bowling ball will eventually reach a pure rolling status. Assume necessary variables and draw required KD to help with your proof.

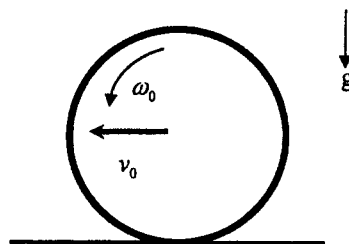


Figure 2

- 3 A bead B slides along a slot in a 500 mm diameter disk, which is rotating about a vertical axis as shown in Figure 3. At the instant shown, $\omega = 3 \text{ rad/s}$, $\dot{\omega} = 8 \text{ rad/s}^2$, $s = 200 \text{ mm}$, $\dot{s} = 250 \text{ mm/s}$, and $\ddot{s} = -50 \text{ mm/s}^2$. Determine the velocity \mathbf{v}_B and acceleration \mathbf{a}_B of the bead at this instant (write your answer in vector form).

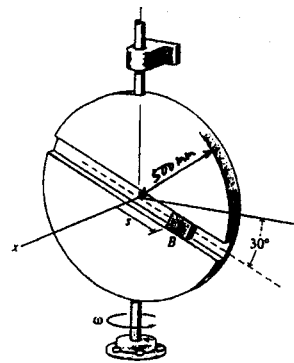


Figure 3

- 4 The slender bar AB shown in Figure 4 rests on a smooth surface at B and is attached to a collar at A that slides freely on the smooth vertical rod. The bar has a uniform cross section and a mass of 20 kg; the collar has negligible mass. The bar is initially at rest with $\theta = 0^\circ$ when it is disturbed and rotates in a vertical plane under the action of gravity. Determine the angular velocity and acceleration of the bar as well as the reactions at A and B when $\theta = 60^\circ$.

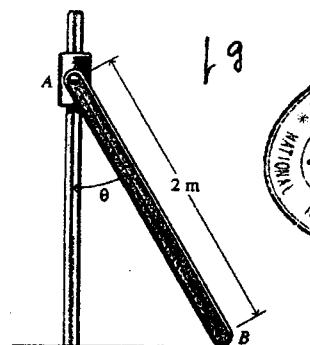


Figure 4

