

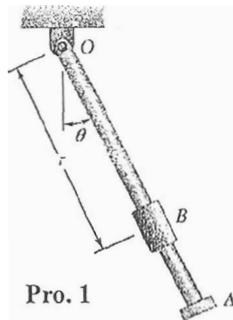
國立台灣科技大學九十九學年度碩士班招生試題

系所組別： 自動化及控制研究所碩士班甲組

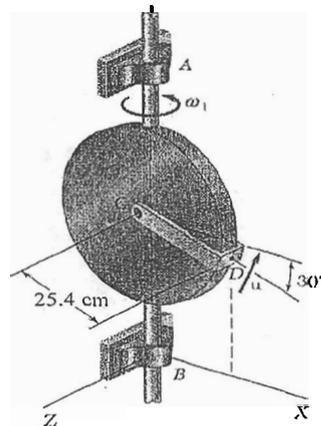
科 目： 動力學

(總分為100分)

1. The oscillation of rod OA about O is defined by the relation $\theta = \frac{4}{\pi} \sin \pi t$, where θ and t are expressed in radians and seconds, respectively. Collar B slides along the rod so that its distance from O is $r = \frac{10}{t+6}$, where r and t are expressed in mm and seconds, respectively. When $t = 1$ s, determine
- The velocity of the collar. (5%)
 - The acceleration of the collar. (5%)
 - The acceleration of the collar relative to the rod. (5%)



2. The circular plate shown rotates about its vertical diameter at the constant rate $\omega_1 = 10$ rad/s. Knowing that in the position shown the disk lies in the XY plane and point D of strap CD moves upward at a constant relative speed $u = 1.37$ m/s, determine
- The velocity of D . (8%)
 - The acceleration of D . (7%)



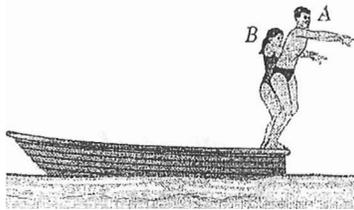
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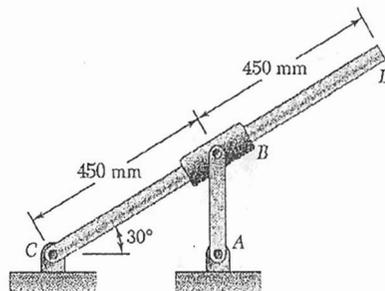
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3. Two swimmers A and B , of mass 75 kg and 50 kg, respectively, dive off the end of a 200-kg boat. Each swimmer has a relative horizontal velocity of 3 m/s when leaving the boat. If the boat is initially at rest, determine its final velocity, assuming that
- The two swimmers dive simultaneously. (6%)
 - The swimmer A dives first and then B . (7%)
 - The swimmer B dives first and then A . (7%)



Pro. 3

4. The collar B of negligible mass can slide freely on the 4-kg uniform rod CD . Knowing that in the position shown crank AB rotates with an angular velocity of 5 rad/s and an angular acceleration of 60 rad/s².
- If both angular velocity and angular acceleration is clockwise, determine the force exerted on rod CD by collar B . (7%)
 - If both angular velocity and angular acceleration is counterclockwise, determine the force exerted on rod CD by collar B . (8%)



Pro. 4



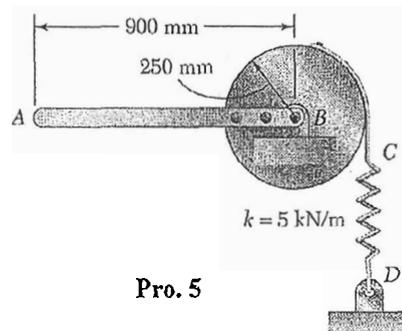
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5. A 7.5-kg slender rod AB is riveted to a 6-kg uniform disk as shown. A belt is attached to the rim of the disk and to a spring which holds the rod at rest in the position. If end A of the rod is moved 20 mm down and released, determine
- (a) The period of vibration. (8%)
- (b) The maximum velocity of end A . (7%)



6. The 18-kg rigid body BD consists of two identical 6-cm-radius spheres and the rod which connects them and has a centroidal radius of gyration of 25.4 cm. The body is at rest on a horizontal frictionless surface when it is struck by the 6-kg sphere A which has a radius of 6 cm and is moving as shown with a velocity v_1 of magnitude 3.7 m/s. Assuming a perfectly plastic impact, determine immediately after the impact,

- (a) The angular velocity of body BD . (10%)
- (b) The velocity of point G . (10%)

