編號： 139

國立成功大學 106 學年度碩士班招生考試試題

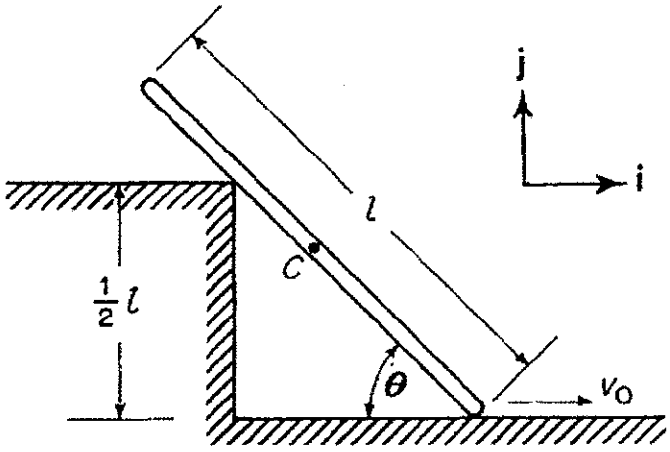
系　　所：航空太空工程學系

考試科目：動力學

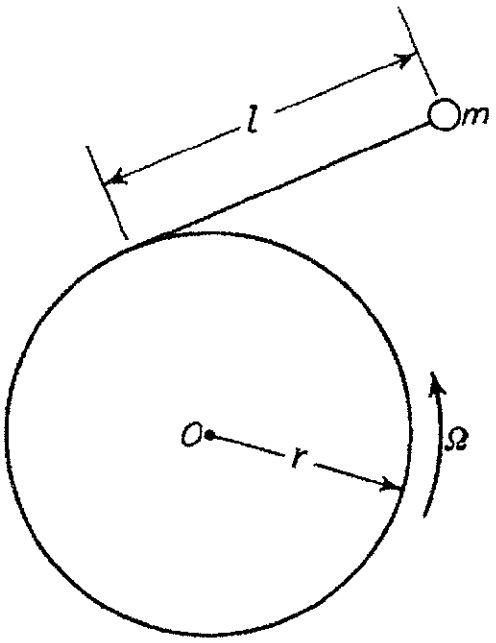
考試日期：0213，節次：2

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. (20%) The lower end of a rigid bar of length l is moved to the right at a constant speed v_0 along a horizontal floor. It slides on the corner of a step of height $l/2$. Assuming planar motion with $30° < \theta < 90°$, find (a) $\dot{\theta}(\theta)$, (b) $\ddot{\theta}(\theta)$, (c) $\mathbf{v}_c(\theta)$ where *C* is at the center of the bar.



2. (30%) A thin flexible rope of negligible mass is wrapped around a cylinder of radius r that is rotating with a constant angular velocity of Ω rad/sec. A particle of mass m is attached to the end of the rope. Assuming that the rope does not slip relative to the cylinder, but can unwind such that a straight portion of length l is produced. (a) Write a differential equation of motion for the particle in terms of the single dependent variable l. (b) If the initial conditions are $l(0) = 0, \dot{l}(0) = r\Omega$, solve for l and the tensile force in the rope as functions of time. There is no gravity.



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3. The square frame constructed by four identical slender bars of mass *m* and length *b* is released from rest at the position shown in as shown in figure 3. Determine:
   a) initial angular acceleration of the frame and acceleration of point A;
   b) the speed of point A after A has dropped b distance. (25%)

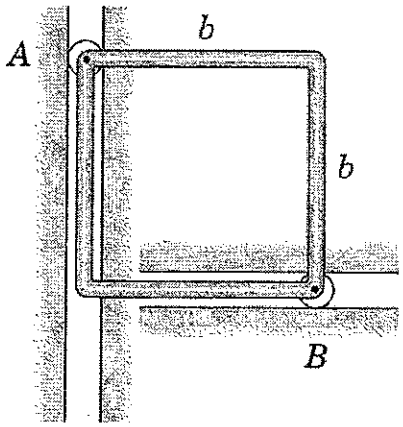

Figure 3

4. The disc of radius *r* rotates about its *z*-axis at constant angular speed p, and arm OCB rotates about the *Y*-axis at constant speed *N* in figure 4. If the disc is rising from point C at constant speed, $\dot{h}$ =v, derive the following in terms of body fixed coordinates (*x, y, z*):
   a. the angular acceleration of the thin disc; (10%)
   b. the acceleration of point D. (15%)

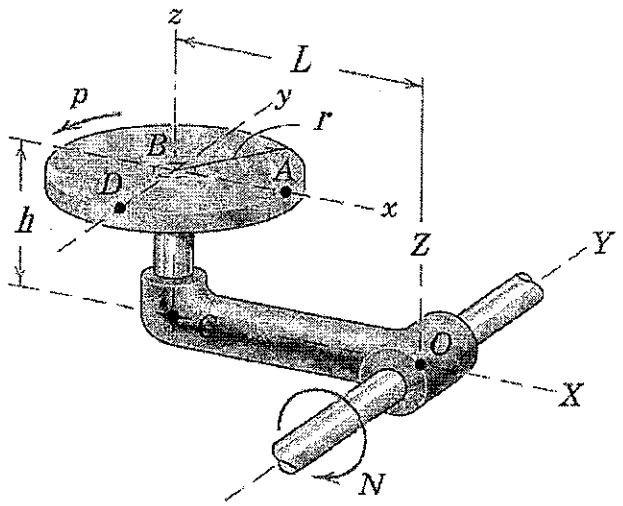

Figure 4