國立中央大學99學年度碩士班考試入學試題卷

所別：機械工程學系碩士班 甲組(固力與設計)(一般生)　科目：動力學　共 1 頁 第 1 頁

機械工程學系碩士班 丁組(系統)(一般生)

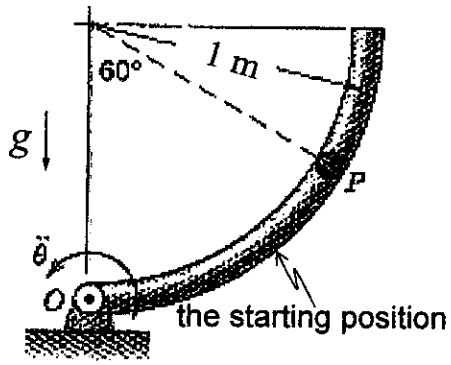
光機電工程研究所碩士班 甲組(機電系統控制)(一般生)

光機電工程研究所碩士班 乙組(光機)(一般生)

＊請在試卷答案卷（卡）內作答

＊本科考試可使用計算器，廠牌、功能不拘

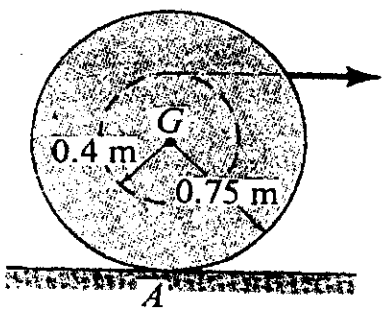
1. (25%) The quarter-circular hollow tube of circular cross section rotates in a horizontal plane with a constant angular acceleration $\ddot{\theta} = 1\ \text{rad/s}^2$. It starts from rest at time $t = 0$ from the position $\theta = 0$. At what time t will the 1-kg particle P slips relative to the tube? The coefficient of static friction between particle P and the tube is $\mu_s = 0.8$ and that of kinetic friction is $\mu_k = 0.6$. (Points will be given only if free body diagram is used.)



2. (25%) The 100-kg spool shown has a radius of gyration k_G = 0.35 m. A cable is wrapped around the central hub of the spool and a variable horizontal force having a magnitude of $P = (t+10)$ N is applied, where t is measured in seconds. Assume that the spool rolls without slipping at A.

(a) (10%) Draw the free-body diagram and the kinetic diagram, respectively. (Kinetic Diagram: a diagram to illustrate all resulting motion on a free body.)

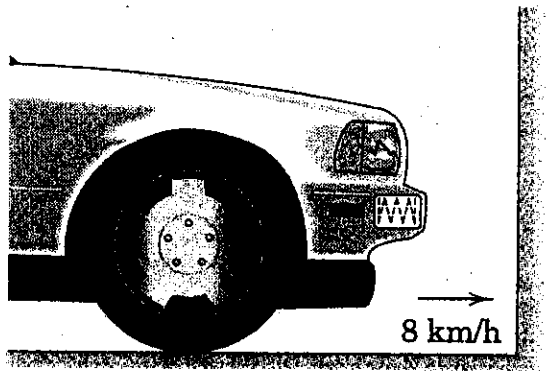
(b) (15%) If the spool is initially at rest, determine its angular velocity in 5 s.



$P = (t+10)$ N

參考用

3. (25%) An energy-absorbing bumper has an equivalent spring constant 525 kN/m at its undeformed state. If the 1200-kg car approaches a rigid wall with a speed of 8 km/h, please determine (a) the velocity v of the car as a function of time during contact with the wall, where $t = 0$ is the beginning of the impact, and (b) the maximum deflection x_{max} of the bumper. (Points will be given only if free body diagram is used.)



4. (25%) The stream of water shown flows at the rate of 0.9 m^3/min and moves with a velocity of magnitude 30 m/s at both A and B. The vane is supported by a pin connection at C and by a load cell at D which can exert only a horizontal force. Neglecting the weight of the vane, determine the reactions at C and D.