國立成功大學 108 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：0223，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. The simple 2-kg pendulum is released from rest in the horizontal position shown in Figure 1. As it reaches the bottom position, the cord wraps around the smooth fixed pin at ***B*** and continues in a smaller arc in the vertical plane. Calculate the magnitude of the force ***R*** supported by the pin at ***B*** when the pendulum passes the position $\theta = 60°$. (25%)

2. The semicircular plate of mass ***m*** and radius ***r*** is at rest on a smooth horizontal surface when the force ***F*** is applied at ***B***. Determine the coordinates, as defined in Figure 2, of the point ***P*** that has zero initial acceleration. (25%)

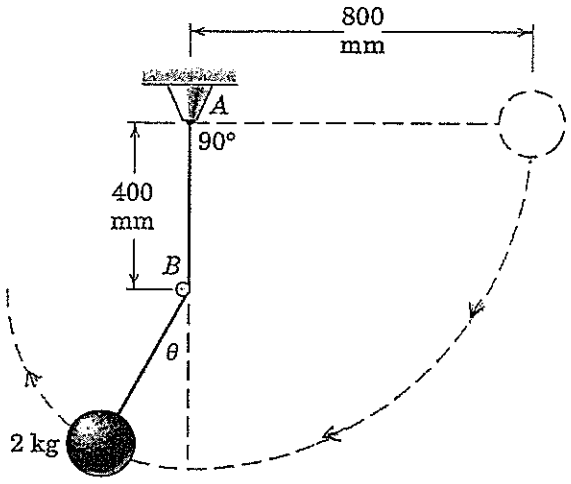

Figure 1

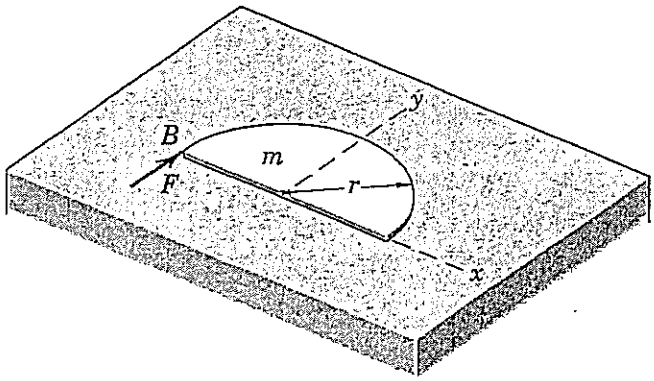

Figure 2

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3. Formosat-5 is an Earth observation satellite operated by the National Space Organization (NSPO) of Taiwan. It has been launched on 24 August 2017 and uses the Sun-synchronous orbit, which is kind of low Earth orbit, with the orbit altitude of z = 725 km (i.e., it is 725 km above the earth's surface). Assume its orbit is circular orbit and treat the Earth as a sphere of radius **R** =6378 km. The value of the Earth's gravitational parameter μ_{earth}=398600 km^3/s^2 and the universal gravitational constant has the value G=6.6742×10^{-11} $m^3/kg \cdot s^2$. The Earth's mass is m_{earth}=5.974×10^{24} kg and the Formosat-5's mass is m_{sat}=475 kg. Derive the equations of its speed, orbit period, and total energy. (30%)

4. An aircraft is in the process of making a steady horizontal turn (level turn) at the rate of ω_z. During this motion, the propeller is spinning at the rate of ω_p. If the propeller has two blades, determine the moments which the propeller shaft exerts on the propeller at the instant the blades are in the vertical position. For simplicity, assume the blades to be a uniform slender bar having a moment of inertia **I** about an axis perpendicular to the blades passing through the center of the bar, and having zero moment of inertia about a longitudinal axis. (20%)