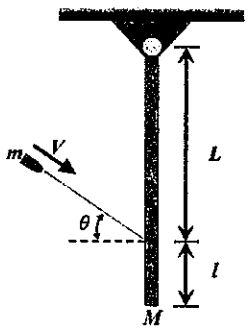
題號： 188　　國立臺灣大學 114 學年度碩士班招生考試試題

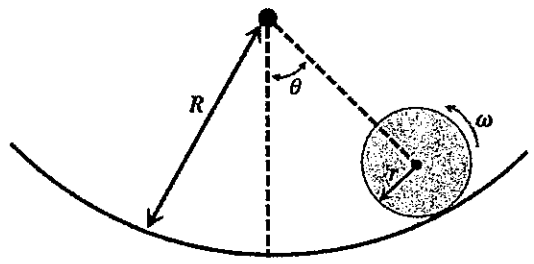
科目： 動力學

節次： 7

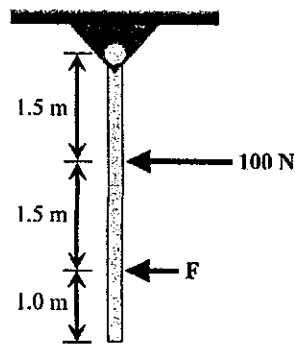
1. The slender rod of mass M shown in the right figure is pinned at O and is at rest. If a bullet of mass m is fired into the rod with a velocity of v, please determine the angular velocity of the rod immediately after the bullet becomes embedded in it. (15%)



2. The disk of mass m and radius r rolls without slipping on the circular path as displayed in the right figure.
(i) Determine the angular acceleration of the disk at the instant when it has an angular velocity of ω. (10%)
(ii) At the moment, determine the normal force that the path exerts on the disk. (10%)



3. At the instant shown, two forces act on the 15-kg slender rod which is pinned at O. Determine the magnitude of force **F** and the initial angular acceleration of the rod so that the horizontal reaction which the pin exerts on the rod is 25 N directed to the right. (15%)



4. A strong baseball player whose weight is 90-kg hits a curveball with a mass of 143 g at a height of 0.75 m above the home plate. The ball leaves the player's bat at an elevation angle of 45^0 and travels toward a fence 3 m high and 100 m away in center field. Please calculate the minimum initial speed of the baseball to clear the center field fence. (Please ignore air resistance) (20%)

5. A system consists of two particles. One is with mass m and the other is 3m. The forces on the particles are $\mathbf{F}_1 = 0$ and $\mathbf{F}_2 = \boldsymbol{F_0}$i. If the particles are initially at rest at the origin, what is the position, velocity, and acceleration of the center of mass after a period of time t? (10%)

6. The earth has mass of $m_e = 5.97\times10^{24}$ kg and mean radius $R_e = 6.38\times10^6$ m moves in a nearly circular orbit of radius $r_{se} = 1.50\times10^{11}$ m around the sun with a period $T_{orbit} = 365.25$ days, and spins about its axis in a period T_{spin} = 23 h 56 min, the axis inclined to the normal to the plane of its orbit around the sun by 23.5°. If we consider the earth as a uniform sphere, please calculate the orbital angular velocity and the orbital angular momentum. (20%)

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