國立暨南國際大學九十二學年度碩士班研究生入學考試試題

第 2 節物理 適用：(電機所電子組 424)

(本試題共 一 頁，第 一 頁)

考生注意：1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分，並限以藍黑色筆作答。
3. 試題隨卷繳回。(餘請詳閱試場規則)

1. Two blocks with m=16kg and M=88kg are not attached but are contacted as shown in the Figure 1 The coefficient of static friction between the blocks is μ_S=0.38, but the surface beneath the larger block is frictionless. (a) (5%) What is the minimum magnitude of the horizontal force $\vec{F}$ required to keep the smaller block from slipping down the larger block?
Now we suppose that the larger block is fixed to the surface below it. And we still want to keep the smaller block from slipping down the larger block. (b) (5%) Is the magnitude of the frictional force between the blocks then greater than, less than, or the same as that you obtain in part (a)? Please verify your answer. (c) (5%) Is the required minimum magnitude of the horizontal force $\vec{F}$ then greater than, less than, or the same as that you obtain in part (a)? Please verify your answer.

2. (15%) Two curved plastic rods, one with charge $+q$ and the other with charge $-q$, form a circle of radius R in an x-y plane as shown in Figure 2. The x-axis passes through their connecting points. The charges are distributed uniformly on the rods. What are the magnitude and direction of the electric field $\vec{E}$ produced at point P, the center of the circle?

3. As a parallel-plate capacitor with circular plates 20cm in diameter is being charged, the current density of the displacement current in the region between the plates is uniform and has a magnitude of 20A/m^2. (a) (10%) Calculate the magnitude B of the magnetic field at a distance r=50mm from the axis of symmetry of this region. (b) (10%) Calculate dE/dt in this region.

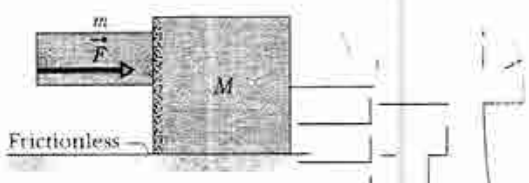

Figure 1

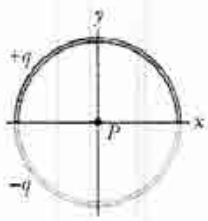

Figure 2

4. (a)(7/%) Your space vehicle is traveling directly away from the earth with a speed c/2, where c = 3 x 10^8 m/s is the velocity of light. A light signal is sent from earth. The speed with which this light passes your vehicle, as measured by the crew, would be? (b)(9%) It is found that light from a distant galaxy is shifted down in frequency (redshifted) by a factor of 3. What is the relative speed with which the galaxy is receding in the direction of the line of sight?

5. How many photons/s are contained in a beam of electromagnetic radiation of total power 150 W if the source is (a)(7%) an AM radio station of 1100kHz, (b) (7%) 8-nm x rays, and (c) (7%) 4-MeV gamma rays?

6. (13%) A wave function $\psi = A(e^{ix} + e^{-ix})$ in the region $-\pi < x < \pi$ and zero elsewhere. Normalize the wave function and find the probability of the particle been found between x = 0 and x = π /8.