

# 元智大學 107 學年度 轉學考 招生試題卷

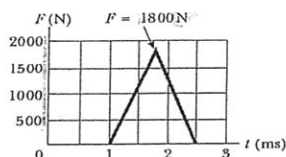
系(所)別：電機工程學系學士班 組別：電機工程學系乙組2年級 科目：普通物理

用紙第1頁共1頁

● 不可使用電子計算機

1. (25%)

An estimated force-time curve for a baseball struck by a bat as shown in the figure.



- (a) (13%) Find the magnitude of the impulse delivered to the ball.  
 (b) (12%) Find the magnitude of the average force exerted on the baseball.

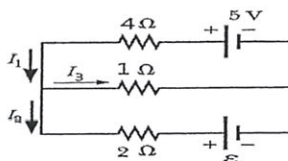
2. (25%)

Consider a conducting sphere of radius  $R$  which has some charges inside the sphere initially, and finally the conducting sphere reaches electrostatic equilibrium.

- (a) (10%) Find the electric field at  $R/2$  in electrostatic equilibrium.  
 [You must explain how you get your answer, otherwise no score will be given!]  
 (b) (5%) Find the direction of the electric field at the surface of the conducting sphere in electrostatic equilibrium.  
 (c) (5%) Explain why the whole surface of the conducting sphere is equal-electric-potential.  
 [You must use  $dV = -\vec{E} \cdot d\vec{S}$  to explain it.]  
 (d) (5%) Assume the electric potential is 5 volt at  $R/2$ , find the electric potential at  $R/4$ .  
 [You must calculate or explain your answer.]

3. (25%)

Given that the direction and magnitude of  $I_3$  are both known, as shown in the figure and  $I_3 = 3A$ . However, the directions of  $I_1$  and  $I_2$  are only assumed.



- (a) (15%) Find the values of  $I_1$ ,  $I_2$ , and  $\epsilon$ .  
 [Hint: The signs of  $I_1$ ,  $I_2$  could be positive or negative.]  
 (b) (10%) Replot the figure with the correction directions of  $I_1$  and  $I_2$  according to their signs.

4. (25%)

Given Maxwell's equations as follow:

$$(1) \oint \vec{B} \cdot d\vec{A} = 0 \quad (2) \oint \vec{B} \cdot d\vec{s} = \mu_0 I + \mu_0 \epsilon_0 \frac{d\Phi_E}{dt} \quad (3) \oint \vec{E} \cdot d\vec{A} = \frac{q}{\epsilon_0} \quad (4) \oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_B}{dt}$$

- (a) (5%) Explain the physical meaning of Equation (1) (i.e., why the right hand side of Equation (1) is zero).  
 (b) (5%) If the conduction current is 2 A in the circuit containing a charging capacitor, find the displacement current.  
 (c) (5%) Continued from (b), find the value of  $\frac{d\Phi_E}{dt}$ .  
 (d) (5%) Based on which equations exactly did Maxwell predict the existence of electromagnetic waves?  
 (e) (5%) In Hertz's experiment, an LC circuit ( $L = 20 H$ ,  $C = 50 \mu F$ ) was used to generate the electromagnetic wave. Find the frequency  $f$  (in Hz) of the electromagnetic wave. [Hint:  $f = \omega / 2\pi$ .]