編號： 40 國立成功大學 102 學年度碩士班招生考試試題

系所組別：物理學系

考試科目：電磁學 考試日期：0224，節次：2

※ 考生請注意：本試題不可使用計算機

1. Illustrate the physical meaning: (5 points each)

   1). Linear polarization E&M wave; 2). Circular polarization E&M wave; 3). Maxwell displacement current; 4). Faraday's induction law; 5). Phase velocity and group velocity of E&M wave

2. Calculate and answer the following questions according to classical Newton's law (non-relativity): an electron moves circularly around a proton in a plane with a constant speed, the radius is $5\times10^{-11}m$.

   1). the speed of electron? 2). the revolution frequency? 3). the electric potential at the position of proton? 4). the magnetic induction field B at the position of proton? 5). the magnetic moment? (4 points each)

3. As figure 1 shown, an electric dipole $\vec{P}=e\vec{d}$ in vacuum. Find

   1). the electric potential at point O'

   2). the electric field at point O'

   3). the total electric flux across a closed surface covering this dipole

   4). the torque of this dipole oriented at an angle 45° to a uniform electric field $\vec{E}$

   5). the potential energy of this dipole oriented at an angle 45° to a uniform electric field $\vec{E}$. (4 points each)

4. A capacitor as show in figure 2, half sphere with dielectric ε_1, half sphere with dielectric ε_2. (5 points each)

   1). Find the capacitance C. Sphere with radius R_0 is a metal ball

   2). If total charge Q placed on metal ball, find the electric field at point p(1)

   3). If total charge Q placed on metal ball, find the energy density at point p(2)

5. (5 points each)

   1). Find impedance Z of an AC current in a series RLC circuit

   2). Find the resonance driven frequency for an AC current in a series RLC circuit

   3). Find the energy stored in a capacitor (capacitance C and charge Q)

   4). Find the energy stored in an inductor (inductance L and current I)

Useful data: $m_e = 9\times10^{-31}kg$; $e = 1.6\times10^{-19}C$; $\varepsilon_0 = 8.85\times10^{-12}F/m$

$\mu_0 = 1.26\times10^{-6}H/m$; $\vec{p} = (\varepsilon_r - 1)\vec{E}$; $\vec{D} = \varepsilon_0\vec{E} + \vec{p}$

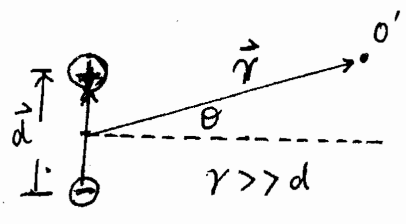

Figure 1

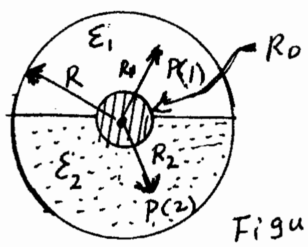

Figure 2