

國立嘉義大學九十七學年度
光電暨固態電子研究所碩士班（乙組）招生考試試題

科目：電磁學

1. (a) What is linearly polarized light? (10%)
 (b) What is circularly polarized light? Represent them by mathematical formula and explain them. (10%)
2. Write down the (real) electric and magnetic fields for a monochromatic plane wave of amplitude E_0 , frequency ω , and phase angle zero that is
 - (a) traveling in the negative x direction and polarized in the z direction; (10%)
 - (b) traveling in the direction from the origin to the point $(1, 1, 1)$, with polarization parallel to the xz plane.
 In each case give the explicit Cartesian components of propagation constant k and polarization. (10%)

3. A metal sphere of radius a carries a charge Q (as shown in Fig. 3). It is surrounded, out to radius b , by linear dielectric material of permittivity ϵ .

- (a) Find the potential at the center (relative to infinity) V_c . (5%)
- (b) Find the polarization P . (5%)
- (c) Find the bounded volume charge density ρ_b . (5%)
- (d) Find the bounded surface charge density σ_b . (5%)

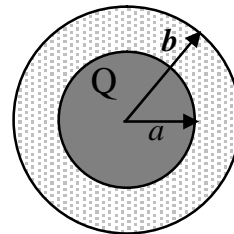


Figure 3

4. Find the magnetic field at point P on the axis of a tightly wound solenoid consisting of n turns per unit length wrapped around a cylindrical tube of radius a and carrying current I as shown in the figure 4. Express your answer in terms of θ_1 and θ_2 . It is known that the magnetic field a distance z above the center of a circular loop of radius R , which carries a steady current I , is

$$\frac{\mu_0 I}{2} \frac{R^2}{(R^2 + z^2)^{3/2}} \quad (20\%)$$

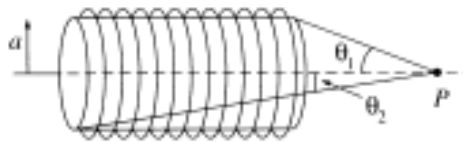


Figure 4

5. A particle of charge q enters a region of uniform magnetic field \mathbf{B} (pointing into the page). The field deflects the particle a distance d above the original line of flight, as shown in Fig. 5. Is the charge positive or negative? In terms of a , d , B and q , find the momentum of the particle. (20%)

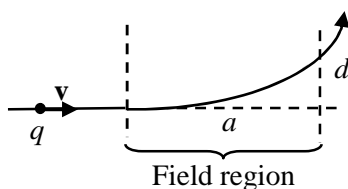


Figure 5