淡江大學九十三學年度碩士班招生考試試題

系別：物理學系　　科目：電　磁　學

准帶項目請打「○」否則打「×」
×簡單型計算機

本試題共 1 頁

共五大題，每題各佔20%. 務必詳細作答.

1. Find the magnitude and direction of the electric field at point P due to the electric dipole in Fig. 1. P is located at a distance $r \gg d$ along the perpendicular bisector of the line joining the charges. Express your answer in terms of the magnitude and direction of the electric dipole moment $\vec{p}$.

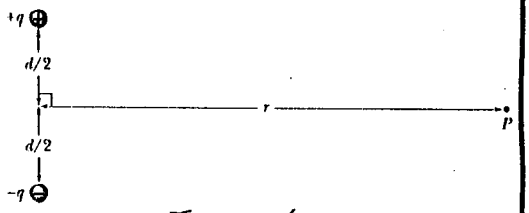

Fig. 1.

2. A metal sphere of radius R, carrying charge q, is surrounded by a thick concentric metal shell (inner radius a, outer radius b, as in Fig. 2.). The shell carries no net charge.
(a) Find the surface charge density σ at R, at a, and at b.
(b) Find the potential at the center, using infinity as reference.
(c) Now the outer surface is touched to a grounding wire, which lowers its potential to zero (same as at infinity). How do your answers to (a) and (b) change?

3. A length of wire is formed into a closed circuit with radii a and b, as shown in Fig. 3 , and carries a current i. (a) What are the magnitude and direction of $\vec{B}$ at point P? (b) Find the magnetic dipole moment of the circuit.

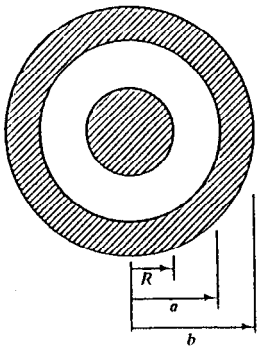

Figure 2.

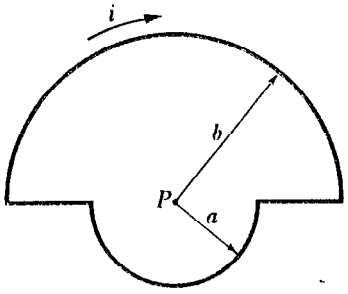

Fig. 3.

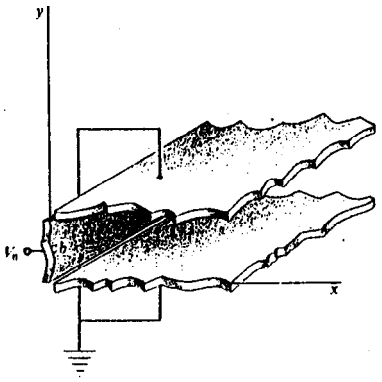

Fig. 4.

4. Figure 4 shows two grounded, semi-infinite, parallel electrodes separated by a distance b. At $x = 0$ an electrode is maintained at a potential V_0. The problem is to find the potential V at any point between the plates.

5. A long circular cylinder of radius R carries a magnetization $\mathbf{M} = kr^2\hat{\phi}$, where k is a constant, r is the distance from the axis, and $\hat{\phi}$ is the "circumferential" unit vector (Fig. 5). Find the magnetic field due to $\mathbf{M}$, for points inside and outside the cylinder.

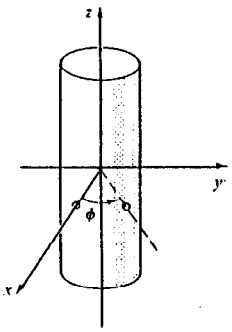

Fig 5