

淡江大學 105 學年度日間部寒假轉學生招生考試試題

11-1

系別：物理學系三年級

科目：電磁學

考試日期：12月3日(星期六) 第1節

本試題共 5 大題， 1 頁

※ 請詳細列出各步驟及計算過程，否則不予計分。

※ 每題 20 分。

1. A point charge $+q$ sits at origin.

- Find the electric field a distance r from the origin.
- Find the charge density ρ .
- What is the flux of \mathbf{E} through the shaded area (one side of a cube) shown in Fig. 1? (Answer the question by computation or explanation.)

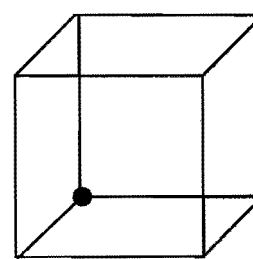


Fig. 1

2. (a) Are they possible electrostatic field? Why?

$$\mathbf{E}_a = c[(z^2) \mathbf{i} + (xy^2) \mathbf{j} + (2zx) \mathbf{k}]$$

$$\mathbf{E}_b = c[(x^2 + y^2) \mathbf{i} + (2xy + 2yz^2) \mathbf{j} + (2y^2z) \mathbf{k}]$$

Here c is a constant with the appropriate units.

- For the possible one, find charge density $\rho(x,y,z)$.

3. A center hollow disk (inner radius a , outer radius b , as shown in

Fig. 2) with uniform surface charge density σ .

- Find the potential at a distance z above the center of the charge distributions first.
- Use the result from (a) to find the electric field at p .

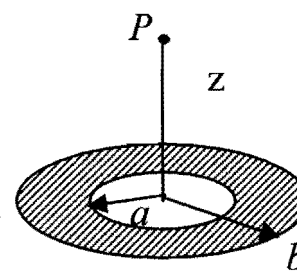


Fig. 2

4. A **toroidal coil** with rectangular cross section (inner radius a , outer radius b , height h), consists of N closely wound turns and carries a steady current I , as shown in Fig. 3.

- Find the magnetic field $\vec{B}(\mathbf{r})$, both inside and outside the coil.
- Find the flux through a single turn and the self-inductance of the coil.
- Find the energy stored in the coil.

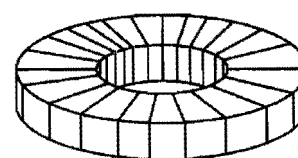


Fig. 3

5. 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

- traveling in the negative x direction and polarization in the z direction;
- traveling in the direction from the origin to the point $(1, 1, 1)$, with polarization parallel to the xz plane.