淡江大學 100 學年度轉學生招生考試試題

34

系別：物理學系三年級　　科目：電　磁　學

考試日期： 7 月 19 日(星期二) 第 3 節　　本試題共 4 大題， 1/1 頁

※ 請詳細列出各步驟及計算過程,否則不予計分.
※ 每題 25 分.

1. A thin insulating rod of length L lies along x-axis and carries a uniformly distributed charge +Q.
   (a) Find the electric field at a point P along its axis at a distance d from one end as shown in **Fig. 1.**
   (b) At large distances from the rod (that is, where $d >> L$), what is the field of the rod? Give some discussion on your results.
   (c) Find the potential at a point P.

2. A point charge q is held a distance d above an infinite grounded conducting plane, (x-y plane at z = 0) as shown in **Fig. 2.**
   (a) What are the boundary conditions for the potential V in the region above the plane ($z \geq 0$)?
   (b) Find the potential V(x,y,z) in the region above the plane, $z \geq 0$, and prove that it satisfy the boundary conditions.

3. A straight segment of wire carries a steady current I, as shown in **Fig. 3.**
   (a) Find the magnetic field at a point P generated by the segment of wire.
   (b) What is the field at P for the straight-line extended to infinite ?
   (c) Find the force per unit length between two long, parallel wires a distance d apart, carrying currents I_1 and I_2.

4. A square loop of wire, of side a, lies midway of a very long rectangular loop of short side $3a$. (Actually, the short ends are so far away that they can be neglected.) A counterclockwise current I in the square loop is gradually increasing $dI/dt = k$ (a constant), as shown in **Fig. 4.**
   (a) What is the flux through the long rectangular loop?
   (b) Find the mutual inductances.
   (c) Find the emf induced in the large loop. Which way will the induced current flow?

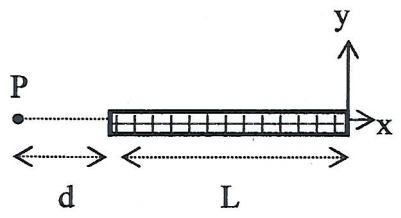

Fig. 1

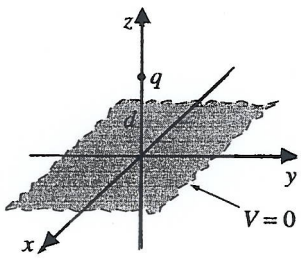

Fig 2

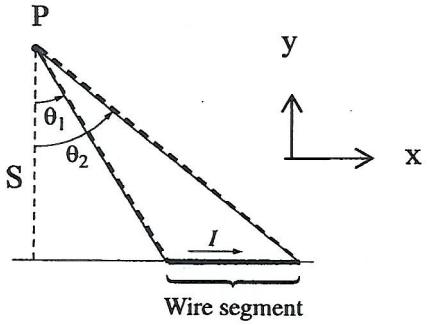

Fig. 3

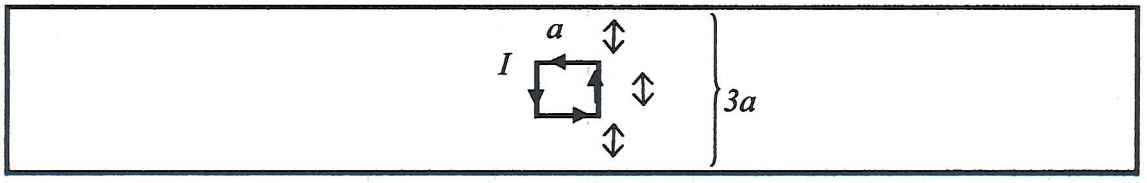

Fig. 4