系別：物理學系　　　　　　科目：電　磁　學

准帶項目請打「V」
簡單型計算機

● 請詳細列出各步驟及計算過程,否則不予計分.

本試題共　1　頁

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.　(10 %)
   (b) At large distances from the rod (that is, where $d \gg L$), what is the field of the rod? Give some discussion on your results.　(3%)

2. A thin annular disk of inner radius a and outer radius b carries a uniform surface charge density σ, as shown in Fig. 2.
   (a) Find the potential at a distance z above the center of the charge distributions.　(10%)
   (b) Use your result from (a) to calculate the electric field at this point.　(8%)

3. A conducting solid sphere of radius R carries a total charge Q.
   (a) Find the electric field and the electric potential inside and outside the sphere. Set the reference point at infinity.　(16%)
   (b) Plot the electric field and the electric potential as a function of r from the center of the sphere.　(4%)

4. A circular loop of radius R, carries a steady current I.
   (a) Find the magnetic field a distance z above the center of the loop.　(10%)
   (b) Find the magnetic moment of the loop.　(5%)

5. A square loop of wire (side a) lies on a table, a distance s from a very long straight wire, which carries a current I, as shown in Fig. 3.
   (a) Find the flux of the magnetic field $\mathbf{B}$ through the loop.　(10 %)
   (b) If someone now pulls the loop directly away from the current wire, at speed v, what electromotive force (emf) is generated? In what direction does the current flow?　(10 %)
   (c) What if the loop is pulled to the right at speed v, instead of away?　(2 %)

6. A metal strip of length L pivoted at one end is rotating freely with an angular velocity ω in a uniform magnetic field $\mathbf{B} = B \hat{z}$ as shown in Fig. 4. What is the induced emf between the two ends (a and b) of the strip? Which end of the strip is positive with respect to the other end?　(12%)
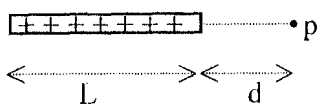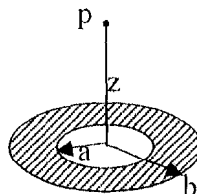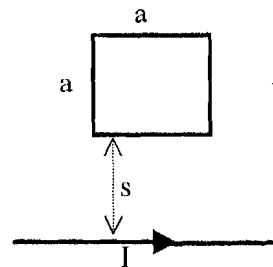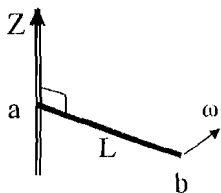

Fig. 1

Fig. 2

Fig. 3

Fig. 4