

## 國立台灣科技大學九十九學年度碩士班招生試題

系所組別：光電工程研究所碩士班

科目：電磁學

(總分為100分)

1. A charge  $Q$  (coulombs) is uniformly distributed on a circular loop having a radius  $R$  (meter) as shown in Fig. 1. (a) Please derive the electric potential at the center (point  $A$ ) of the circular loop. (10 %) (b) Please derive the electric field at the center (point  $A$ ) of the circular loop. (10 %)

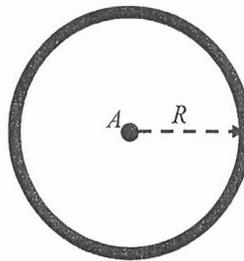


Fig. 1

2. A parallel-plate capacitor of width  $w$ , length  $L$ , and separation  $d$  is partially filled with a dielectric medium of dielectric constant  $\epsilon_r$ , as shown in Fig. 2. A battery of  $V_0$  volts is connected between the two plates. (a) Please find  $\mathbf{D}$ ,  $\mathbf{E}$ , and  $\rho_s$  in each region. (10 %) (b) Please find the capacitance between the two plates. (10 %)

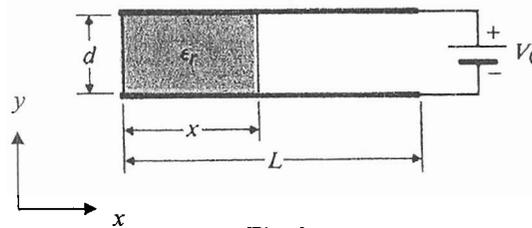


Fig. 2

3. A circular loop, which has a radius  $b$  and carries a direct current  $I$ , is shown in Fig. 3. Please find the magnetic flux density at the center (point  $O$ ) of the circular loop. (10 %)

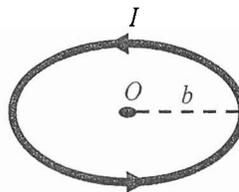


Fig. 3



## 國立台灣科技大學九十九學年度碩士班招生試題

系所組別：光電工程研究所碩士班

科 目：電磁學

(總分為100分)

4. An electric field intensity of an electromagnetic wave propagating in the +y direction in a nonmagnetic, lossless dielectric medium is written as
- $$\vec{E} = \vec{a}_x 3 \cos(10^6 \pi t - ky) - \vec{a}_z 4 \sin\left(10^6 \pi t - ky + \frac{\pi}{3}\right) \text{ (V/m).}$$
- Light velocity inside this medium is  $1.5 \times 10^8$  (m/s).
- What is the polarization of the wave? (5%)
  - Find the wavenumber, frequency, and phasor of the electric field. (5%)
  - Find the instantaneous expression for the corresponding magnetic field intensity. (5%)
  - Find the instantaneous and time-average expressions of the power densities of the wave. (5%)
5. For transmission lines,
- what are three most common types? and draw basically how TEM waves propagate in these three most common transmission lines. (5%)
  - there is a close analog between the characteristics of the electric and magnetic fields for the plane wave propagation and those of the phasors voltage and current for the transmission line, please list two basic governing second order differential equations for plane wave propagation and the corresponding two differential equations for transmission lines. (5%)
  - what does "matched transmission line" mean? (2%)
  - what are the input impedances of open-circuit and short-circuit lossless transmission line if the length of line is half wavelength? (3%)
6. For antenna,
- What is Hertzian dipole? (3%)
  - Please draw the radiation patterns of a Hertzian dipole. (3%)
  - What are the common used parameters to measure the overall ability of an antenna? (3%)
  - What are the disadvantages of a Hertzian dipole? (3%)
  - Draw the radiation pattern of the two-element dipole array. (3%)

