國立聯合大學一百年學年度碩士班考試招生

光電工程學系碩士班　入學考試試題

科　目：電磁學　　第 1 頁共 2 頁

** $\mathbf{a}_x$, $\mathbf{a}_y$ are the unit vector in x and y direction respectively.

1. Please describe the definition of plane wave polarization. What are the conditions for linear, elliptical and circular polarizations? What is the handedness for polarization? (10%)

2. A propagating electric field is given by

$$\boldsymbol{E}(z,t)=100e^{-0.01z}\cos(\pi\times10^{7}t+\pi z-\frac{\pi}{4})\text{V/m}$$

(a) Determine the attenuation constant, the wave frequency, the wavelength, the propagation velocity, and the phase shift.

(b) How far must the wave travel before its amplitude is reduced to 1.0 V/m? (10%)

3. A 10.0-MHz magnetic field travels in a fluid for which the propagation velocity is 1.0×10^{8} m/s. Initially, we have $\mathbf{H}(0,0) = 2.0\ \mathbf{a}_x$ A/m. The amplitude drops to 1.0 A/m after the wave travels 5.0 m in the y direction. Find the general expression for this wave. (10%)

4. Given $\mathbf{E}(y, t) = 10.0\cos(\omega t-\beta z)\mathbf{a}_x - 20.0\cos(\omega t-\beta z-45°)\mathbf{a}_y$ V/m.

Find the polarization and handedness. (10%)

5. Suppose, in a nonmagnetic medium of relative permittivity 3, that

$\mathbf{E}(y, t) = 4.0\sin(\pi\times10^{7}t-\beta y)\mathbf{a}_x + 9.0\cos(\pi\times10^{7}t-\beta y)\mathbf{a}_z$ V/m

Determine β and $\mathbf{H}(y, t)$. (10%)

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6. Figure 1, a cylindrical capacitor consists of an inner conductor of radius ***a*** and an outer conductor whose inner radius is ***b***. The space between the conductors is filled with a dielectric of permittivity ε, and the length of the capacitor is ***L***. Determine the capacitance of this capacitor. (15%)

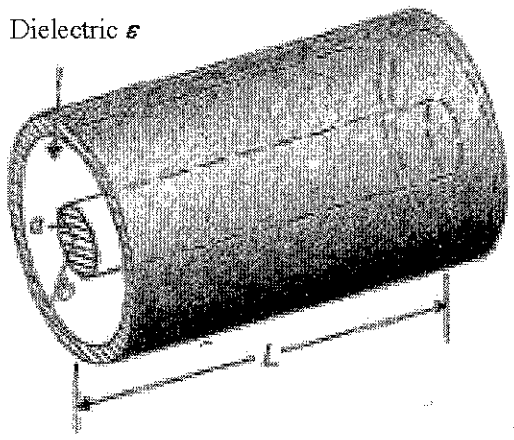

Figure 1

7. Please explain clearly about the Gauss' law. (8%)

8. In figure 2, two particles of charges $q_1$and q_2 are separated by distance d. The net electric field due to the particles is zero at $x = d/4$. With $V = 0$ at infinity, locate (in terms of d) any point on the x axis (other than at infinity) at which the electric potential due to the two particles is zero. (12%)

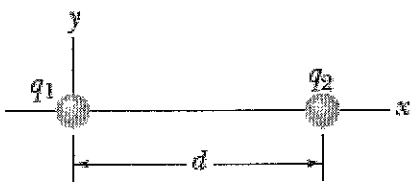

Figure 2

9. In Fig. 3, current i=56.2 mA is set up in a loop having two radial lengths and two semicircles of radii a= 5.72 cm and b = 9.36 cm with a common center P. What are the (a) magnitude and (b) direction (into or out of the page) of the magnetic field at P and the (c) magnitude and (d) direction of the loop's magnetic dipole moment? (15%)

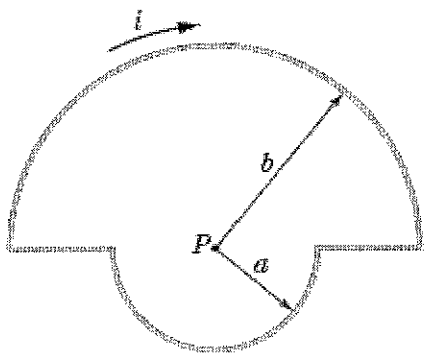

Figure 3