

國立臺北科技大學 102 學年度碩士班招生考試

系所組別：2401、2402、2403、2404 光電工程系碩士班

第二節 電磁學 試題

第一頁，共一頁

**注意事項：**

1. 本試題共 7 題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Evaluate  $\oint_S (\hat{a}_r 3 \sin \theta) \cdot d\vec{s}$  over the surface of a sphere of radius 5 centered at the origin. 10%
2. A spherical distribution of charge  $\rho = \rho_0 [1 - (\frac{R^2}{b^2})]$  exists in the region  $0 \leq R \leq b$ . This charge distribution is concentrically surrounded by a conducting shell with inner radius  $R_1 (> b)$  and outer radius  $R_0$ . Determine  $\vec{E}$  everywhere. 20%
3. The polarization in a dielectric cube of side L centered at the origin is given by  $\vec{P} = P_0 (\hat{a}_x x + \hat{a}_y y + \hat{a}_z z)$ . Determine the surface and volume bound-charge densities. 10%
4. Find the resistance between two concentric spherical surfaces of radii  $R_1$  and  $R_2 (R_1 < R_2)$  if the space between the surfaces is filled with a homogeneous and isotropic material having a conductivity  $\sigma$ . 20%
5. Consider a plane boundary ( $y = 0$ ) between air (region 1,  $\mu_{r1} = 1$ ) and iron (region 2,  $\mu_{r2} = 5000$ ). Assuming  $\vec{B}_1 = 0.5\hat{a}_x - 10\hat{a}_y$  (mT), find  $\vec{B}_2$ . 15%

6. The electric field of an electromagnetic wave

$$\vec{E} = \hat{a}_x E_0 \cos[10^8 \pi (t - \frac{z}{c}) + \theta]$$

is the sum of

$$\vec{E}_1 = \hat{a}_x 0.03 \sin[10^8 \pi (t - \frac{z}{c})]$$

And

$$\vec{E}_2 = \hat{a}_x 0.04 \cos[10^8 \pi (t - \frac{z}{c}) - \frac{\pi}{3}]$$

Find  $E_0$  and  $\theta$ . 15%

7. A right-hand circularly polarized plane wave represented by the phasor

$$\vec{E}(z) = E_0 (\hat{a}_x - j\hat{a}_y) e^{-jkz}$$

impinges normally on a perfectly conducting wall at  $z = 0$ . Determine the polarization of the reflected wave. 10%