國立臺北科技大學九十五學年度碩士班招生考試

系所組別：1730 電腦與通訊研究所丙組

第二節 電磁學 試題

填 准 考 證 號 碼

注意事項：

1. 本試題共 5 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. A spherical shell in free space is configured with outer radius b and inner radius a. If the shell contains a charge density given by

$$\rho_v = -\frac{\rho_o}{R^2}, \qquad a \le R \le b$$

where ρ_o is a positive constant. Determine electric flux density in

(a) $R \le a$, (5%)

(b) $a \le R \le b$, (10%)

(c) $R \ge b$. (5%)

2. A direct current I flows in a straight wire of length 2L. Find the magnetic flux density **B** at a point located at a distance r from the wire in the bisecting plane: (a) by determining the vector magnetic potential **A** first, (10%) and (b) by applying Biot-Savart law. (10%)

3. In free space, the magnetic field in cylindrical coordinate (r, ϕ, z) is given by

$$H = \hat{a}_\phi \frac{100}{r} \cos(9 \times 10^9 t - kz) \qquad (mA/\text{m})$$

where $\hat{a}_\phi$ is the unit vector in ϕ direction.

(a) Determine the wave number k. (5%)

(b) Determine electric field E. (10%)

(c) Determine the displacement current density J_d. (10%)

4. A 50Ω lossless transmission line is terminated with a standard open load. Find the input impedance and return loss for (a) 72.125 wavelength (10%), (b) 316.25 wavelength (10%), long away from the terminator.

5. Determine the wave impedance of TE mode and guide wavelength of TM mode at a frequency equal to twice the cutoff frequency in a waveguide. (15%)