國立暨南國際大學九十六學年度碩士班研究生入學考試試題 **第 2 節**

科目：電磁學 適用：電機所系統組

編號：443

考生注意：
1.依次序作答，只要標明題號，不必抄題。
2.答案必須寫在答案卷上，否則不予計分。
3.限用藍、黑色筆作答；試題須隨卷繳回。

本試題 共 / 頁 第 / 頁

1. A long dielectric cylinder of radius b and dielectric constant ε_r is placed along the z-axis in a uniform electric field $\mathbf{E}_0=\mathbf{a}_x E_0$. Determine the potential distribution $V(r, \varphi)$ and electric field intensity $\mathbf{E}(r, \varphi)$ both inside and outside the cylinder. (20%)
2. A ferromagnetic sphere of radius b is magnetized uniformly with a magnetization $\mathbf{M}=\mathbf{a}_z M_0$. (a) Determine the equivalent magnetization current density J_m and surface current density J_{ms}. (10%) (b) Determine the magnetic flux density at the center of the sphere. (10%)
3. Derive the general wave equations for **E** and **H** in a non-conducting simple medium where a charge distribution ρ and a current distribution **J** exist. Convert the wave equations to Helmholtz's equations for sinusoidal time dependence. (20%)
4. A perpendicular polarized uniform plane in air of frequency f is incident obliquely at an angle of incidence θ_i on a plane boundary with a dielectric medium characterized by a complex permittivity $\varepsilon_2 = \varepsilon_0 - j\varepsilon_1$. Let the incident electric field be $\mathbf{E}_i(x, z) = \mathbf{a}_y E_{i0} \exp[-jk_0(x\sin\theta_i - z\cos\theta_i)]$. (a) Find the expressions of the transmitted electric and magnetic field intensity phasors in terms of the given parameters. (14%) (b)Show that the angle of refraction is complex and the $\mathbf{H}_t$ is elliptically polarized. (6%)
5. A small filamentary rectangular loop of dimensions L_x and L_y lies in the xy-plane with its center at the origin and sides parallel to the x- and y-axes. The loop carries a current $i(t) = I_0\cos\omega t$. Assuming L_x and L_y to be much less than the wavelength, find the instantaneous expressions for the following quantities at a point in the far zone: (a) vector magnetic potential **A** (10%), (b) electric field intensity **E** (5%), (c)magnetic field intensity **H.** (5%)