國立彰化師範大學 99 學年度碩士班招生考試試題

系所：光電科技研究所　　科目：電磁學

☆☆請在答案紙上作答☆☆　　共 1 頁，第 1 頁

1. An inverted hemispherical bowl of radius R carries a uniform surface charge density σ. Find the electric potential at the "north pole", using infinity as the reference point. (15%)
2. A point charge q is situated a distance a from the center of a *neutral* conducting sphere of radius R ($R < a$). (a) Find the force on the point charge q. (b) Find the electric potential on the conducting sphere. (15 %)
3. A parallel-plate capacitor, consisting of two metal plates of area A held a distance d apart, is *half*-filled with a linear dielectric material of dielectric constant ε_r (Fig. 1). (a) Find the capacitance of this system. (b) For a given potential difference V between the plates, find the electric field, the electric displacement, and the polarization in both the air and the dielectric regions. (c) Find the bound surface charge density on the top surface of the dielectric. (d) Find the free surface charge density on the top plate. (20 %)
4. A current I flows down a long straight wire of radius a. If the wire is made of linear material with susceptibility (χ_m), and the current is distributed uniformly, (a) What is the magnetic field a distance s from axis? (b)Find all the bound currents (include direction). (c)What is the net bound current flowing down the wire? (15 %)
5. A long solenoid with radius a and n turns per unit length carries a time-dependent current $I(t) = I_0 \cos(\omega t)$ in φ direction. Find the electric field (magnitude and direction) at a distance s from axis (both inside and outside the solenoid). (15 %)
6. A plane linear-polarized electromagnetic wave is incident obliquely on a plane interface from the air to the medium with the refractive index n. The incident angle is θ_i. The electric field is parallel to the plane of incidence. (a) Derive the Snell's law. (b) Explain the Brewster's angle. (c) Write the boundary condition of electric field and magnetic field of incident, reflected and transmitted wave. Determine the coefficient of reflection. (20%)

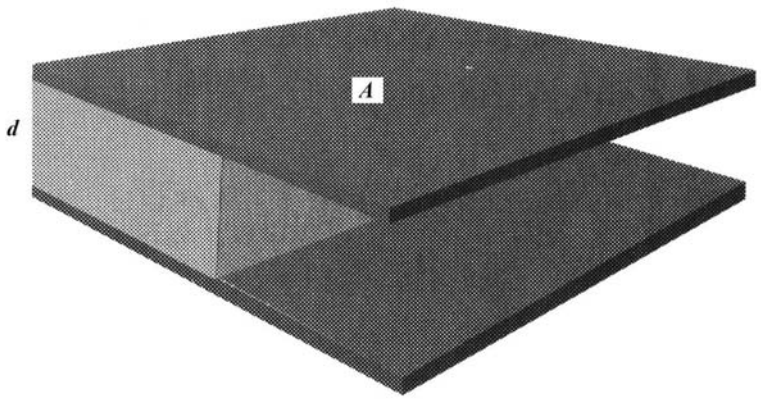

Fig. 1