國立成功大學 105 學年度碩士班招生考試試題

系　　所：工程科學系

考試科目：電磁學

考試日期：0228，節次：2

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Suppose a positive point charge q is placed at the center of a spherical dielectric shell of an inner radius r_i and an outer radius r_o. The dielectric constant of the shell is ε_r. (25%)

(a) Find the electric field intensity as function of the radial distance r. (8%)

(b) Find the electric potential as function of the radial distance r. (7%)

(c) Find the electric flux density as function of the radial distance r. (5%)

(d) Find the polarization vector as function of the radial distance r. (5%)

2. Charges introduced in the interior of a conductor will move to the conductor surface and redistribute themselves in such a way as to make both the volume charge density of free charges and the electric filed intensity vanished under equilibrium conditions. (25%)

(a) Prove this statement. (15%)

(b) Estimate the time it takes to reach equilibrium. (10%)

3. The space between two parallel conducting plates each having an area S is filled with an inhomogeneous ohmic medium whose conductivity varies linearly from σ_a at one plate ($z = 0$) to σ_b at the other plate ($z = d$). A d-c voltage V_0 is applied across the plates. (30%)

(a) Find the total resistance between the plates. (15%)

(b) Find the surface charge densities on the plates. (15%)

4. A parallel-plate capacitor with a capacitance C_1 is connected with an a-c source of amplitude V_0 and angular frequency w, $v = V_0 \sin(wt)$. (20%)

(a) Show that the displacement current in the capacitor is the same as the conduction current in the wires. (10%)

(b) Find the magnetic field intensity at a distance r from the wire. (10%)