國立嘉義大學九十三學年度
光電暨固態電子研究所碩士班招生考試試題

科目：電磁學

一、Two infinite insulated conducting planes maintained at potentials 0 and V_o form a wedge-shaped configuration, as shown in Fig. 1. Determine the potential distributions for the regions:

（a）$0 < \phi < \alpha$. (10%)

（b）$\alpha < \phi < 2\pi$. (10%)

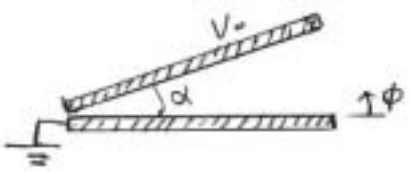

Fig. 1

二、A capacitor consists of two concentric spherical shells of radii R_i and R_o. The space between them is filled with a dielectric of relative permittivity ε_r from R_i to b（$R_i < b < R_o$）and another dielectric of relative permittivity $3\varepsilon_r$ from b to R_o. Determine：

（a）$\vec{E}$ and $\vec{D}$ everywhere ($R < R_i$, $R_i < R < b$, $b < R < R_o$, $R > R_o$) in terms of an applied voltage V. (15%)

（b）the capacitance. (5%)

三、A current *I* flows down a long straight wire of radius *a*. If the wire is made of linear material (copper, say, or aluminum) with susceptibility x_m, and the current is distributed uniformly,

（a）What is the magnetic field at a distance *s* from the axis? (6%)

（b）Find all the bound currents. (8%)

（c）What is the net bound current flowing down the wire? (6%)

四、An alternating current $I = I_o cos(wt)$ flows down a long straight wire, and returns along a coaxial conducting tube of radius *a*.

（a）In what direction does the induced electric field point (radial, circumferential, or longitudinal) ? (4%)

（b）Assuming that the field goes to zero as $s \to \infty$, find $\boldsymbol{E}$(s, t). (6%)

（c）Integrate the displacement current density $\boldsymbol{J}_d$ to get the total displacement current $\boldsymbol{I}_d$. (10%)

五、From the point of view of electromagnetics, the power transmitted by a lossless coaxial cable can be considered in terms of the Poynting vector inside the dielectric medium between the inner conductor and the outer sheath. Assuming that a d-c voltage V_o applied between the inner conductor (of radius *a*) and the outer sheath (of inner radius *b*) causes a current *I* to flow to a load resistance, verify that the integration of the Poynting vector over the cross-sectional area of the dielectric medium equals the power V_oI that is transmitted to the load. (20%)