所別：太空科學研究所碩士班　　科目：電磁學

1. The electric field intensity in a dielectic (perfect) medium is given as $\vec{\mathrm{E}} = E\cos(\omega t - kz)\vec{\mathbf{a}}_x$ V/m, where E is its peak value, and k is a constant quantity. Determine
   (a) the magnetic field intensity in the region, (10 points)
   (b) the direction of power flow, and (5 points)
   (c) the average power density. (10 points)
2. A uniform volume charge distribution exists in a spherical volume of radius a. Compute the total energy of the system using
   (a) $W = \frac{1}{2}\int_v \rho_v V dv$, (10 points)
   (b) $W = \frac{1}{2}\int_v \vec{\mathrm{D}} \cdot \vec{\mathrm{E}} dv$, (5 points) and
   (c) $W = \int V dq$. (5 points)
3. A point charge q is located above the surface of a conducting plane of infinite extent and depth.
   (a) Calculate the potential and electric field intensity at any point P. (10 points)
   (b) Show that the total charge induced on the surface of the plane is $-q$. (10 points)
4. A very long, hollow conductor of inner radius a and outer radius b is located along the z axis and carries a current I in the z direction. If the current distribution is uniform, determine the magnetic field intensity at any point in space. (20 points)
5. The charge is uniformly distributed in the shape of a ring of radius a. Determine the electric field intensity at any point on the axis of the ring. (15 points)