科目：電磁學 系所：應用物理學系
考試時間：100 分鐘 本科原始成績：100 分 是否使用計算機：是

1. Give the physical descriptions to the following terms: (a) Brewster's angle, (b) skin depth, and (c) TEM waves. (15%)

2. Write down and explain the physical meaning of the Poynting's theorem.(10%)

3. A cubic box (sides of length a) consists of five metal plates, which are welded together and grounded. The top is made of a separate sheet of metal, insulated from the others, and held at a constant potential V_0. Find the potential inside the box. (20%)
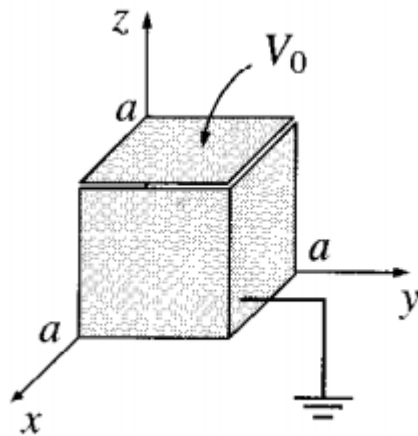
4. A metal sphere of radius a carries a charge Q. It is surrounded, out to radius b, by a linear dielectric material of permittivity ε. Find (a) the potential at the center (relative to infinity), (b) surface bound charge at every surface (or interface), (c) volume bound charge in the dielectric, and (d) the energy of this configuration. (20%)
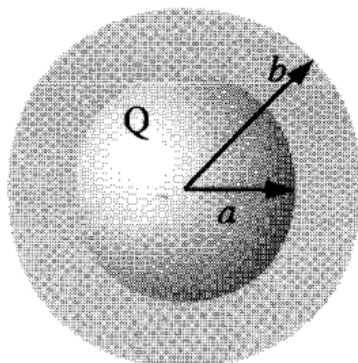

5. A square loop of wire (side a) lies on a table, a distance s from a very long straight wire, which carries a current I. (a) Find the flux of magnetic field through the loop. (b) If the loop is pulled directly away from the wire, at speed v, what electromotive force is generated? In what direction

does the current flow? (c) What if the loop is pulled to the right at speed v, instead of away? (15%)
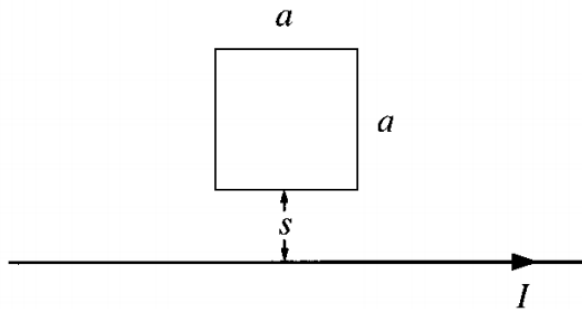
6. In a rectangular waveguide, the TE waves obey the following equation:

$$[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + (\omega/c)^2 - k^2]B_z = 0$$

where ω, c, and k are angular frequency, speed of light, and wave number, respectively.

(a) Derive the B field by using the boundary condition, $B^\perp = 0$, and the technique of separation of variables.

(b) Derive the general formula of the cutoff frequency. (20%)