6. Find the torque between two circular loops of wire, carrying the same current I, and of the same radius R, when they are located at a distance L apart, with L>>R, and with their axes parallel and the currents in the same direction. Express the torque in terms of the angle θ between their axes and their line of centers. (12%)

（θ角，請看圖）
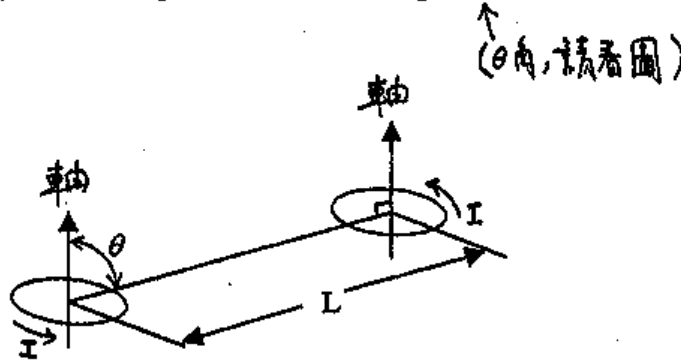
7. Start from Maxwell's equations. Try to obtain an expression describing the propagation of a plane wave (let it propagate in the x-direction) of angular frequency ω. The parameters for the medium under consideration are: conductivity σ, magnetic permeability μ, and dielectric constant ε. (15%)

8. A plane electromagnetic wave is incident normally on the interface between two dielectric media. Derive the Fresnel's equations and find the condition on the indices of refraction that yield equal transmitted and reflected intensities. (12%)


plane wave

Dielectric 1
$n_1 , \varepsilon_1 , \mu_1$

Dielectric 2
$n_2 , \varepsilon_2 , \mu_2$
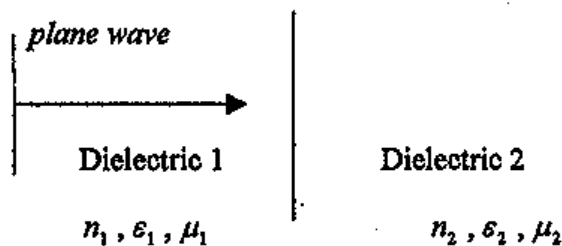
** 請盡量按試題順序作答,若有需要用到的變數或參數,請自行定義.

1. Referring to the figure below, assume that the potential V in this problem is a function only of ϕ in cylindrical coordinates. The equipotential surfaces are given by ϕ =constant. The boundary conditions are $V = 0$ at $\phi = 0$ and $V = V_0$ at $\phi = \alpha$. Find the electric field intensity between these two planes. (10%)
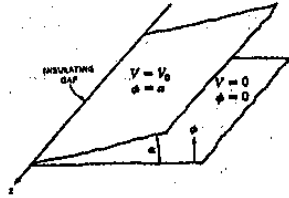
2. A large, charged, flat metal plate with a hemispherical protrusion, and an equally and oppositely charged plane conductor are shown in the figure below where $b \gg a$. Find the distribution of charge on the plates and the hemispherical protrusion. [You may start from constructing a satisfactory potential function for this problem.] (15%)
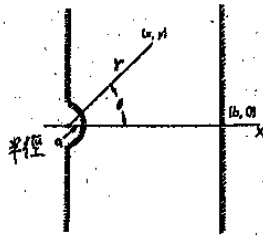
3. A filamentary conductor is formed into an equilateral triangle with sides of length L carrying current I. Find the magnetic induction at the center of the triangle, as shown in the figure below. (12%)
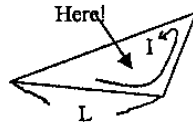
4. A long straight wire carrying current I is placed a distance R above a semi-infinite magnetic medium of permeability μ. Calculate the force per unit length acting on the wire; be sure to specify the direction of the force. (12%)

5. A grounded, infinite, circular, cylindrical conductor (radius R) is introduced into an uniform electric field with its axis perpendicular to $\vec{E}_0$. Assume that the axis of the cylindrical conductor is on the x-axis and the electric field is in the z-direction. Find the electric potential everywhere outside the conductor. (12%)

注意:背面有試題