Electromagnetics II 1st exam. (Prof. Seong-cheol, Kim)

6th Oct 2007, AM 10:00 ~ 12:00

1. From the time harmonic wave equation for scalar potential V and the retarded scalar potential solution, write down the phasor solution of the wave equation. With the phasor solution, discuss about the quasi-static conditions, as much as you can.

2. For electromagnetic fields to exist in a linear, homogeneous, isotropic, source-free conductive region, show that the $\vec{E}$ field must satisfy the following equation:

$$\nabla^2\vec{E} + (\omega^2\mu\varepsilon - j\omega\mu\sigma)\vec{E} = 0$$

3. Show that a linearly polarized plane wave $E_0\cos(\omega t - \beta z)\hat{x} + E_0\cos(\omega t - \beta z)\hat{y}$ can be expressed as a sum of left- and right-handed circularly polarized waves of equal amplitude.

4. Given that the skin depth for graphite at 100(MHz) is 0.16 (mm), determine (a) the conductivity of graphite, and (b) the distance that a 1 (GHz) wave travels in graphite such that its field intensity is reduced by 30 (dB).

5. A right-handed circularly polarized plane wave is incident on the plane conducting boundary.

$$\vec{E} = \hat{x}E_{10}e^{-j\beta z} - \hat{y}jE_{10}e^{-j\beta z}$$

Derive the instantaneous expression for the reflected plane wave and discuss about the polarization of the reflected wave.