HW#1

6-17. A short conducting wire carrying a time-harmonic current is a source of electromagnetic waves. Assuming that a uniform current $i(t) = I_0 \cos\omega t$ flows in a very short wire dl placed along the z-axis,

a) determine the phasor retarded vector potential **A** at a distance R in spherical coordinates, and
b) find the magnetic field intensity **H** from **A**.

6-18. A 60-(MHz) electromagnetic wave exists in an air-dielectric coaxial cable having an inner conductor with radius a and an outer conductor with inner radius b. Assuming perfect conductors, and the phasor form of the electric field intensity to be

$$\mathbf{E} = \boldsymbol{a_r} \frac{\mathrm{E_0}}{r} \mathrm{e}^{-\mathrm{jkz}} \quad (V/m), \qquad a < r < b,$$

a) find k,
b) find **H** from the $\nabla \times \mathbf{E}$ equation, and
c) find the surface current densities on the inner and outer conductors.

6-19. It is known that the electric field intensity of a spherical wave in free space is

$$\mathbf{E}(R,\theta;t) = \boldsymbol{a_\theta} \frac{10^{-3}}{R} \sin\theta \cos(2\pi 10^9 t - kR) \qquad (V/m)$$

Determine the magnetic field intensity $\mathbf{H}(R,\theta;t)$ and the value of k.

6-20. Given that

$$\mathbf{E}(x,z;t) = \boldsymbol{a_y} 0.1 \sin(10\pi x) \cos(6\pi 10^9 t - \beta z) \qquad (V/m)$$

in air, find $\mathbf{H}(x,z;t)$ and β.