**Engineering 7811 Tutorial 1 Winter 2010**

1. The electric field of a particular e-m wave given by $\underset{\sim}{\vec{E}} = \hat{x}E_0 \cos\left[10^8\pi\left(t - \frac{z}{c}\right) + \theta\right]$ is the sum of $\underset{\sim}{\vec{E}}_1 = \hat{x}0.03\sin\left[10^8\pi\left(t - \frac{z}{c}\right)\right]$ and $\underset{\sim}{\vec{E}}_2 = \hat{x}0.04\cos\left[10^8\pi\left(t - \frac{z}{c}\right) - \frac{\pi}{3}\right]$ where $c$ is the velocity of light. Find $E_0$ and $\theta$.

2. Given that the $E$-field of a particular spherical wave in free space is

$$\underset{\sim}{\vec{E}} = \hat{\theta}\left(\frac{E_0}{r}\right)\sin\theta\cos(\omega t - kr)\ ,$$

determine the $\underset{\sim}{\vec{H}}$ field.

3. The time average Poynting vector (average power density) for the radiation from a particular antenna is given by

$$\vec{\mathcal{P}}_a = A_0 \frac{\sin\theta}{r^2}\hat{r} \quad \mathrm{W/m^2}$$

where $A_0$ is the peak value of the power density, $\theta$ is the usual spherical coordinate, and $\hat{r}$ is the radial unit vector. Determine the total radiated power.