Engineering 6813 Tutorial 6 (Plane Waves I) Fall, 2009

1. The electric field of a 1 MHz plane wave travelling in the ^{+}z direction has only an x-component. The peak value of E is 1.2π mV/m and this occurs at $t = 0$ and $z = 50$ m. Determine the time-varying forms of the electric and magnetic fields.

2. The electric field of a plane wave propagating in a nonmagnetic material is given by

$$\underset{\sim}{\vec{E}} = \left[\hat{y}3\sin(2\pi \times 10^7 t - 0.4\pi x) + \hat{z}4\cos(2\pi \times 10^7 t - 0.4\pi x)\right] \text{ V/m} .$$

Determine the (a) wavelength, (b) relative permittivity and (c) $\underset{\sim}{\vec{H}}$.

3. The electric field from a particular antenna is given as

$$\vec{\underset{\sim}{E}} = \underset{\sim}{E}_x \hat{x} + \underset{\sim}{E}_y \hat{y}$$

where $\underset{\sim}{E}_x = E_{x_0} \cos(\omega t - kz + \phi_a)$ and $\underset{\sim}{E}_y = E_{y_0} \cos(\omega t - kz + \phi_b)$. Show that when $\phi_b = \phi_a$ or $\phi_b = \phi_a + \pi$ then the E-field is *linearly polarized* – i.e. show that the tip of the E-field vector traces out a straight line in time. What angle does this vector make with the x-axis?