PH-214 Homework 5

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Problem 1

Part 1

$$0.8 * 10^{-6} = 1.8 * 10^{-6} \cos(\phi)$$

$$\phi = \boxed{63.61^\circ}$$

Part 2

$$E = 3 * 10^8 * 1.8 * 10^{-6} = \boxed{540 \text{ V/m}} \qquad \omega = \boxed{8 * 10^7 \text{ rad/s}} \qquad \lambda = \frac{1}{k} = \boxed{0.25 \text{ m}}$$

Part 3

$$v = \frac{\omega}{k} = 2 * 10^7$$

$$\mu_r \epsilon_r = \frac{1}{v^2} \qquad \mu_r = \frac{1}{v^2 * \epsilon_r} = \boxed{3.125 * 10^{-17}}$$

$$Z = \sqrt{\frac{\mu}{\epsilon}} = \boxed{6.25 * 10^{-10}}$$

Problem 2

$$\theta_i = \arctan\left(\frac{n_2}{n_1}\right)$$

$$\frac{E_{0r}}{E_0 i} = \frac{\left(\frac{n_2}{n_1}\right)^2 \cos(\theta_1) - \sqrt{\left(\frac{n_2}{n_1}\right)^2 - \sin^2(\theta_1)}}{\left(\frac{n_2}{n_1}\right)^2 \cos(\theta_1) + \sqrt{\left(\frac{n_2}{n_1}\right)^2 - \sin^2(\theta_1)}}$$

$$\tan(\theta_i) = \frac{n_2}{n_1}$$

$$\frac{E_{0r}}{E_0 i} = \frac{(\tan(\theta_i))^2 \cos(\theta_i) - \sqrt{(\tan(\theta_i))^2 - (\sin(\theta_i))^2}}{(\tan(\theta_i))^2 \cos(\theta_i) + \sqrt{(\tan(\theta_i))^2 - (\sin(\theta_i))^2}}$$

Problem 3

Part 1

$$E = E_0 \hat{y} \cos(kx - \omega t)$$

$$\overrightarrow{H} = -\hat{z}$$

$$\overrightarrow{H_0} = \overrightarrow{H_0}^{||} = \overrightarrow{H_i}^{||}$$

$$\frac{B_0}{\mu_0} = \frac{B_1}{\mu_1}$$