

## Homework Assignment #10 – not graded; no due date

*Ungraded Problems:*

1. A TEM wave described by the expression given below is traveling through air and is normally incident on the interface between the air and a dielectric with  $\epsilon_r = 3.0$  and  $\mu_r = 1.0$ . Show that power is conserved. That is, show that the power in the incident wave is divided between the reflected and transmitted waves. The interface lies along the  $xy$ -plane, which is located at  $z = 0$ . The frequency of operation is 400 MHz.

$$\tilde{\mathbf{E}} = \hat{\mathbf{x}} 0.80 e^{-j8.38z} \text{ V/m}$$

2. [adapted from Prob. 8.4 in the textbook (Ulaby & Ravaioli, 8<sup>th</sup> ed.)] A RHCP plane wave with an electric field modulus (magnitude) of 1.13 V/m is propagating through air but then encounters a dielectric medium with  $\epsilon_r = 4.2$  at normal incidence. The dielectric occupies the region defined by  $z > 0$ . The frequency of operation is 400 MHz.
  - a. Find a mathematical expression for the E-field phasor of the incident wave, given that the field points in the  $+x$ -direction at  $z = 0$  at  $t = 0$ .
  - b. Calculate the reflection and transmission coefficients applicable at the boundary between air and the dielectric medium.
  - c. Find mathematical expressions for the E-field phasors of the reflected wave and the transmitted wave.
  - d. Determine the percentages of the incident average power reflected by the boundary and transmitted into the dielectric.
  - e. Determine the polarizations of the reflected and transmitted waves.