

HW4 due to 11/2 (submit online at NTUCOOL before 9 am)

1.

7.7 The electric field of a plane wave propagating in a lossless, nonmagnetic, dielectric material with $\epsilon_r = 2.56$ is given by

$$\mathbf{E} = \hat{\mathbf{y}} 5 \cos(6\pi \times 10^9 t - kz) \quad (\text{V/m})$$

Determine:

- (a) f , u_p , λ , k , and η .
- (b) The magnetic field \mathbf{H} .

2. (a) An RHC-polarized wave with a modulus of 2 (V/m) is traveling in free space in the negative z direction. Write the expression for the wave's electric field vector, given that the wavelength is 3 cm. (b) Based on these parameters, construct an RHC-polarized plane excitation wave in CST. The surrounding box is vacuum and all boundaries are open add space. Plot the cross-section view of the electric field in terms of arrows as shown in class.

3. (a) At 1 kHz, dry soil is characterized by $\epsilon_r = 2.5$, $\mu_r = 1$, and $\sigma = 10^{-4} (\text{S/m})$ and considered as good conductor. Calculate α , β , λ , u_p , η_c , and skin depth based on the Table 7.1 disclosed in class. (b) in CST, plot the electric field vs propagation distance. Find out the skin depth and compare with the theoretical value in (a)