

EE 3109 Applied Electromagnetics
2022/23 Semester B
Week 4: Tutorial Questions

(There are fewer tutorial questions this week. Please study prev. questions and work on your assignment!)

1. 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.
2. For a wave characterized by the electric field $\mathbf{E}(z, t) = \hat{\mathbf{x}} a_x \cos(\omega t - kz) + \hat{\mathbf{y}} a_y \cos(\omega t - kz + \delta)$, identify the polarization state, determine the polarization angles $(\psi, \chi)^*$, and sketch the locus of $\mathbf{E}(0, t)$ for each of the following cases:
 - (a) $a_x = 3$ V/m, $a_y = 4$ V/m, and $\delta = 0^\circ$
 - (b) $a_x = 3$ V/m, $a_y = 4$ V/m, and $\delta = 180^\circ$
 - (c) $a_x = 3$ V/m, $a_y = 3$ V/m, and $\delta = 45^\circ$
 - (d) $a_x = 3$ V/m, $a_y = 4$ V/m, and $\delta = -135^\circ$

*(While the polarization angles (ψ, χ) existed in the original question, we will ignore this part since we did not cover them in this course.)

3. A linearly polarized plane wave of the form $\mathbf{E} = a_x e^{-jkz} \hat{\mathbf{x}}$ can be expressed as the sum of an RHC polarized wave with magnitude a_R , and an LHC polarized wave with magnitude a_L . Prove this statement by finding expressions for a_R and a_L in terms of a_x .

Sources: Ulaby Ch7 Q9, 10, 15.