LE 333 Assignment #0

1. Derive a vector wave equation from Maxwell's equations.

2. Show that a uniform plane wave given by

$\mathbf{E} = \mathbf{E}_0 e^{-j\mathbf{k}\cdot\mathbf{r}}$,

where $\mathbf{E}_0$ is a *constant* vector, **k** denotes the wavenumber vector, and **r** denotes the position vector, is a solution to the wave equation in problem 1.

3. Show that if **E** is given by a uniform plane wave, then $\mathbf{E} \perp \hat{\mathbf{k}}$, $\mathbf{H} \perp \hat{\mathbf{k}}$, and $\mathbf{E} \perp \mathbf{H}$,

i.e., **E, H** form a TEM wave.

(HINT: Use Maxwell's equations)

4. Derive the generalized boundary conditions for electromagnetic fields (**E**, **D**, **H**, **B**) across the interface between two media with (ε_1, μ_1) and (ε_2, μ_2) when there exist both surface electric and magnetic currents, (denoted by **Js** and **Ms**, respectively) on the interface.

5. Repeat problem 4 for the case where one medium is a perfect electric conductor.