EEL 3473 – FALL 2009
HOMEWORK # 2
DUE WEDNESDAY, SEPTEMBER 16, 2009

1. Derive a wave equation for $\vec{H}$ in free space in the time domain. Start by taking the curl of the Maxwell equation $[\nabla x\vec{H} = \frac{\delta\vec{D}}{\delta t}]$. Recall that $\vec{J} = \rho = o$ is assumed and $\vec{D} = \varepsilon_o\vec{E}$, $\vec{B} = \mu_o\vec{H}$.

2. Solve the wave equation in Problem 1 for the behavior of the wave ($\vec{E}$ and $\vec{H}$, direction and magnitude of propagation velocity v), if it is assumed that $\vec{H} = H_x(z,t)\ \hat{x} = f(t + \frac{z}{v})\hat{x}$ as a starting point. You will also need to use one of the "curl" equations. Work in analogy to the way we derived and solved the wave equation for $\vec{E}$ in class, and then found $\vec{H}$. You can check if your derived fields are in the correct direction by recalling that the direction of propagation is in the direction of $\vec{E}x\vec{H}$.

3. Derive a wave equation for $\vec{E}$ in free space in the time domain for the case where $\rho = o$ but $\vec{J}(\vec{r},t)$ is finite and equal to $\sigma\vec{E}(\vec{r},t)$.