Phys 375 HW 4
Fall 2006
Due 16 / 18 October, 2006

1. Consider the disturbance given by the expression
$\vec{E}(z,t) = \left[\hat{i}\cos(\omega t) + \hat{j}\cos(\omega t - \pi/2)\right]E_0\sin(kz)$, where $\hat{i}$ and $\hat{j}$ are unit vectors in the x- and y-directions. What kind of wave is it? Draw a sketch showing its main features.

2. Substances such as sugar, Karo syrup, and insulin are optically active; they rotate the plane of polarization in proportion to both the path length and the concentration of the solution. A glass vessel is placed between two perfect crossed linear polarizers, and 50% of the natural light incident on the first polarizer is transmitted through the second polarizer. By how much did the sugar solution in the cell rotate the light that passed by the first polarizer?

3. Pedrotti[3], 3rd edition, problem 15-1

4. Pedrotti[3], 3rd edition, problem 15-2

5. An ideal polarizer is rotated at a rate ω between a similar pair of stationary crossed polarizers. Show that the emergent flux density will be modulated at four times the rotational frequency. In other words, show that $I = \dfrac{I_1}{8}(1 - \cos(4\omega t))$, where I_1 is the flux density emerging from the first polarizer and I is the final flux density.

6. Pedrotti[3], 3rd edition, problem 14-2