4C-999: Electromagnetism for Sci/Eng NAME: _____

Week 13

Group: _____

1. (4 points) Without looking anything up, determine what a light year is in meters.

2. (6 points) Unpolarized light travelling in the z-direction is incident upon three polaroid filters with pass directions given by $+35°$, $-40°$, and $+25°$ counter-clockwise from $+x$. Determine the fraction of the original light which passes through the three filters.

3. (10 points) An electromagnetic wave has an electric field amplitude with a magnitude of $E_m = 12\,\mathrm{V/m}$.

a. (1 point) Calculate the magnetic field amplitude.

b. (3 points) Calculate the (time averaged) energy density, intensity, momentum density (magnitude), and momentum current density of this wave.

c. (3 points) If this light is normally incident upon a $1.0\,\mathrm{m}^2$ surface, determine the rate of energy absorption and force acting on this surface. Answer this question for both a perfectly reflecting surface and a perfectly absorbing surface.

d. (3 points) Assume that this electromagnetic wave is located at the point $(1000\,\mathrm{m}, 0, 0)$ and is generated by a dipole antenna located at $(0, 0, 0)$ and oriented along the z-axis. If the oscillation frequency is $10^6\,\mathrm{Hz}$, determine the electric dipole amplitude (qz_m) of this antenna.