E E / Mteor / Agron 518
Spring 2008
Problem Set 1
Due Tuesday, January 22, 2008

Assigned January 15, 2008, updated January 17, 2008.

1. Review "Style Conventions" and Tables 1 through 4 in "Guide for Metric Practice." Write out the unit mK in full (i.e. how it would be written without using abbreviations). Write two correct forms of the abbreviation for the units "watts per steradian."

2. (1.3 in Ulaby's "Fundamentals of Applied Electromagnetics," 1997 version). The height of an ocean wave is described by the function

$$y(x,t) = 1.5 \sin(0.5t - 0.6x)\,\text{m}. \tag{1}$$

   Determine the phase velocity (u_p) and the wavelength (λ), and then sketch (or graph with MATLAB) $y(x,t)$ at $t = 2$ s over the range from $x = 0$ to $x = 2\lambda$.

3. (1.4 in Ulaby). Use the trigonometric identity $2 \sin x \sin y = \cos(x-y) - \cos(x+y)$. Note that the function $\sin(x)$ is maximum at $\frac{\pi}{2} \pm 2\pi n$ and minimum at $\frac{3\pi}{2} \pm 2\pi n$.

4. (1.8 in Ulaby). Don't forget to include the units of α.

5. (1.9 in Ulaby). Complex number: $z = x + jy$, where $j = \sqrt{-1}$. Equation (1.41) is $|z| = \sqrt[+]{x^2 + y^2}$ and Equation (1.43) is $|z| = \sqrt[+]{zz^*}$ where * denotes complex conjugate.

6. (3.2 in Ulaby).

7. (3.3 in Ulaby).

8. Use "Electric Hockey" on the PHET website (`http://www.colorado.edu/physics/phet/web-pages/index.html`) to recall the effect of electric fields. Play and experiment. Then make the puck positive. Place a positive charge to the left of the puck, and another positive charge behind the goal. Experiment so that you can position the charges to make a goal, and to not make a goal, by only sliding the charge to the left of the puck left or right. Does changing the mass of the puck make a difference? Explain why or why not.

9. A short tutorial for MATLAB written by one of my former professors is available on the course webpage in either PDF or HTML. Read and do the examples in MATLAB. Please read up to (and including) Section 3.2, Scripts and Functions. Then read Section 5, Advanced Graphics. Finally read Section 7, Efficiency in MATLAB. Recreate Figures 1 through 5 and 7 and either insert or paste these into a word processor and print them out.