

Phys 375 HW 1
Fall 2010
Problems Due 13 September, 2010

- 0. Summarize the results of your lab-0 experiment** and data collection. Briefly describe the procedure, make a diagram of the experimental layout, and show an example data plot. Include all .m MatLab files used, data files obtained, and a plot of the beam intensity as a function of time. Submit your electronic lab report to your TA, Nightvid Cole, ncole1@umd.edu. The report is due before the beginning of class on Monday/Wednesday.

To do the next two problems, consult the summary of experimental error analysis and propagation on the class web site under “Notes on Error Analysis” (http://www.physics.umd.edu/courses/Phys375/Anlage_Fall2010/erroranalysis.pdf).

- 1. Error analysis.** For the following list of data, calculate (“by hand” – i.e. use a calculator and show your work) the mean, mode, median, standard deviation, variance, and standard deviation of the mean. Please do the analysis “by hand” – just this once. You can check your results with MatLab.
{7.127, 7.125, 7.041, 6.963, 7.125, 6.820, 7.027, 6.843, 7.067, 7.084}
- 2. Error propagation.** You are trying to determine the acceleration due to gravity g by measuring the period of a pendulum, T , of length L using the relation $T = 2\pi\sqrt{\frac{L}{g}}$.
The summary of measured data is $T = 3.818 \pm 0.009 \text{ sec}$, and $L = 361.58 \pm 0.40 \text{ cm}$. By propagating errors, determine the best value and uncertainty in g . If you could go back and revise the experiment, which quantity would you want to measure more precisely?
- 3. Pedrotti³, 3rd edition, problem 1-3.**
- 4. Pedrotti³, 3rd edition, problem 1-15.**
- 5.** An electromagnetic wave is specified (in SI units) by the following function:
$$\vec{E} = (-6\hat{i} + 3\sqrt{5}\hat{j})(10^4 \text{ V/m}) \exp\left[i\left\{\frac{1}{3}(\sqrt{5}x + 2y)\pi \times 10^7 - 9.42 \times 10^{15} t\right\}\right]$$
Find:
(a) the direction along which the electric field oscillates,
(b) the scalar value of amplitude of electric field,
(c) the direction of propagation of the wave,
(d) the propagation number and wavelength,
(e) the frequency and angular frequency, and
(f) the speed.
- 6.** An underwater swimmer shines a beam of light up toward the surface. It strikes the air-water interface at 35° . At what angle will it emerge into the air?