

Physics 2CL - Physics Laboratory: Electricity and Magnetism, Waves and Optics Summer Session II 2010

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Lectures: Tuesday, Thursday 8:00-9:20 am, York 2722
Topics: Measurements and errors; RLC circuits; propagation of uncertainties; statistical analysis of random errors; normal distribution; least square fitting; probability distributions; χ -squared test for a distribution.
Homework: 2.1, 2.5, 3.7, 3.36, 3.41; 4.2, 4.18; 5.1, 5.20, 5.36; 6.1, 6.4, 7.2; 8.1, 8.6, 8.10

Laboratory: MHA 2544

TAs: TA will be introduced in lab sections.

Section #	meeting times
694438 A50	TuTh 9:30am – 12:20pm
694442 A51	TuTh 2:00pm – 4:50pm
694443 A52	TuTh 5:00pm – 7:50pm
697664 A53	WF 9:30am – 12:20pm

Text (required): John R. Taylor An Introduction to Error Analysis, 2nd Ed., 1997

Manual: <http://physics.ucsd.edu/students/courses/summer2010/session2> and click on Phys2CL link

Notebooks (lab): TWO 7-7/8 x 10 1/8 quadrille ruled notebooks. Label them 1 and 2 (with your name). You will work with one notebook while the other one is being graded.

Calculator: A scientific calculator with a simple statistical analysis package (mean, standard deviation, and linear regression) is required.

Grading Policy:

Lab Work	55 pts
Quizzes	20 pts
Formal Report	25 pts

LAB WORK:

Each student will do experiments 0-6 (in order) starting at lab meeting 2. You should prepare for the experiment in advance by reviewing the relevant material in Wolfson & Pasachoff or some other equivalent textbook, and by reading the written description in the lab manual. Each experiment is performed by two students together (as lab partners).

For each lab, you will take data, make plots, analyze it for its accuracy, and draw conclusions from your work. Prior to leaving the lab, your TA will sign it if you have

completed all necessary work. In most cases, this should include computer printouts of plots of your data and curves that you have fit to it.

The lab report is due at your lab the next section after doing the experiment.

All labs except the last are to be reported in a "brief format" which includes only a description of your analysis of the data and a statement of your conclusions about the results. These brief reports must be written in the lab book. Do not exceed two handwritten pages of text after the signature of the TA. Word-processing is not desired here. Consult the handout "How to ACE your 2CL lab reports".

A "formal report" is required only for the **last** experiment of the final three. It's best to review all of the experiments before choosing and plan to perform the experiment for the formal report during the sixth or seventh lab. More information regarding the report will be given later.

Consult the section "How to ACE the Formal Report."

LAB NOTEBOOK:

1. All data and notes should be entered into the lab notebook. Any additions should be permanently attached to the pages of the notebook (stable or tape). It is OK to copy a data set and attach it to your notebook after lab.
2. Data which is tabulated should include units and uncertainties. It is much easier to grade your notebook if you also present an analysis table. For example:
Suppose you measured a voltage V (with error) and a distance r (with error) and tabulated them in your data table. Next, you decide to plot V^2 versus $1/r^2$. You should extend the table to show V^2 and $1/r^2$ (with the propagated uncertainties) before plotting. Also, a sample calculation is requested to demonstrate how you obtained the table entries (one is sufficient).
In most cases, graphs and preliminary analysis can be completed while "in the lab" using the computers and software (Origin) that are available at lab stations. You may also find it convenient to make graphs by hand, directly on the lab notebook grid.
3. If you are making a least-squares fit, you should start by writing the predicted functional relation and identifying the various coefficients which are to be determined by your "fit". The output of a least-squares analysis should contain both coefficients and their uncertainties. Finally, show the "fit" on the graph with your data for comparison.
4. All results should be compared with the accepted (or theoretical) values (if possible), and any discrepancies should be noted and discussed in your concluding remarks.

ACADEMIC DISHONESTY:

Please read "UCSD Policy on Integrity of Scholarship" in the UCSD General Catalog. These rules will be rigorously enforced. In other words, 'No cheating!' For the purposes of this class, cheating includes submitting another's work as your own, copying from another's homework or lab notebook or 'faking' data. Cheating also includes attempts to manipulate grades unfairly.

COURSE OUTLINE

Section Experiment Theme of Scientific Inquiry Reading (Taylor)

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| 1: Aug 3,4 : | No lab; Ch. 1 & 2 Taylor book |
| 2: Aug 5,6: | Exp. #0: Exploring the Instruments and ORIGIN; Ch. 3 Taylor |
| 3: Aug 10,11: | Exp. #1: RC Circuits; Ch. 4 Taylor |
| 4: Aug 12,13: | Exp. #1: RC Circuits; Ch. 4 Taylor |
| 5: Aug 17,18: | Exp. #2: Oscillation and Damping in the LRC Circuit; Ch. 5 Taylor |
| 6: Aug 19,20: | Exp. #3: Resonance in LRC Circuits; Ch. 6 Taylor |

- 7:** Aug 24,25: Exp. #4: Refraction and Interference with Microwaves; Ch. 7 Taylor
9: Aug 26,27: Exp. #5: Diffraction and Interference with Coherent Light; Ch. 8 Taylor
9: Aug 31, Sept. 1: Exp. #6: Lenses and the Human Eye; Ch. 12 Taylor