Phys 331

Advanced Laboratory I

Basic Information

Class hours and location:	Lecture	Monday	15:10 - 16:00	Physics Room 123
	Lab Sec. 1	Wednesday	13:10 - 16:00	Physics Room 227
	Lab Sec. 2	Thursday	13:10 - 16:00	Physics Room 227

Instructor Contact: Lucas Illing
Physics P230/ LAB P236
Phone: 517-7336
Email: illing@reed.edu

Office hours: Tue 10:30-12:00 & Thu 4:00-5:30 (+ by appointment)

Textbook	R. E. Simpson	*Introductory Electronics for Scientists and Engineers*
	J. Essick	Copy of new edition of *Hands-on Introduction to LabVIEW for Scientists and Engineers*

Evaluation:	Lab Performance	10%
	Lab Ticket	15%
	Lab Reports/Assignments	75%

Webpage: http://academic.reed.edu/physics/courses/Physics331/index.html

Details

Course Description

The goal of this course is for you to develop a working knowledge of basic electronics and computer assisted data acquisition and analysis. You should become familiar with the fundamental building blocks used in analog and digital electronic devices, such as filters, transistors, operational amplifiers, and logic circuits, learn how they work, when to use them, and how to integrate them together. You will also learn how to interface electronics with computers, in particular, we will use LabVIEW to acquire and analyze data. After taking this course, you should feel competent to build simple electronic circuits of the sort typical in research and have sufficient background to use computers to interface with and partially automate experiments.

Course Texts

Robert E. Simpson	*Introductory Electronics for Scientists and Engineers*
John Essick	*Hands-on Introduction to LabVIEW for Scientists and Engineers*

We will be using only selected portions of Simpson's book (see schedule). We will be following many of the LabVIEW labs that are described in John Essick's book.

For many topics it is useful to have a second perspective and I encourage you to consult other books on electronics. In particular, I put the book *The Art of Electronics* by Paul Horowitz and Winfried Hill on reserve because it is considered by many to be the classic electronics text, and is used widely by graduate students, postdocs and researchers.

Attendance Policy

You must be present for every scheduled laboratory period and arrive on time. You will have 3 hours to complete the lab. I will relax this rule when we come to the LabVIEW experiments, which will be essentially self-guided.

Lab Tickets

During the first quarter lab tickets are due at the beginning of each lab period.

Lab Reports

Laboratory reports and LabVIEW write-ups are *due at 11:00 on the day of your lab-section*. You may leave your labs in the box outside my door or hand them to me in person. I will not accept late lab reports. The reports will be returned the following week.

Lab reports for the Fall semester will be similar to those for Physics 200.

The reports will be graded on a 1-12 grading scale: 12 = excellent and 1=poor.

The lab reports have to contain what every scientific paper or report has to contain:

Title and Author Names	-	include the name of your lab partner.
Introduction	-	describe the theme of the lab and explain why the topic is important.
Details	-	the meat of the lab (see below).
Discussion / Conclusion	-	Describe the key things that you discovered, learned, or measured in this laboratory.

Details

The structure of the sections containing the detailed information may vary depending on the experiments. You should structure this part in a way that is logical and that makes the report readable.

Procedures - For these labs, you typically don't need to write a separate procedure section. Instead, incorporate a brief description of what you did in the Results and Analysis section. This could be as simple as "We built this circuit: <<schematic drawing of circuit>>. We set Vin = 5 Volts P-P and measured Vout on the 'scope."

Results and Analysis - The data you took and the analysis of those data. For multi-part labs, it's best to divide this section into Part A, Part B, etc.

As a reminder, resources for writing reports: http://library.reed.edu/instruction/physics/physics200.html
Linda Maddux is our fabulous science librarian.

Laboratory Notebook

I require you to keep a "lab notebook" for the electronics experiments, i.e. for the first part of the course until fall break. The *notebook pages* pertaining to each report have to be *attached to the end of the report* when you hand it in.

These pages will *not be graded* as such but I will look at them if some points in the report are unclear to me. There is an exception: if the quality of the experimental record that you keep on the notebook pages is unacceptable or if you don't have a lab notebook, then I will deduct points because sufficient record keeping is a necessary part of your lab performance.

In your lab notebook you should record science. It is a document that contains what happened in lab rather than what you think should have happened. For example, do not "correct" what you later think was a mistake ("Oh, this measurement should have had an DC-offset of 1 Volt"). If necessary, add dated comments to that effect, such as "I think I left the oscilloscope in the AC-coupled mode and therefore did not measure the DC-offset voltage of approximately $1V$."

Although in general a notebook is an actual notebook, for the purpose of this course, I accept notes kept on any type of letter paper.

For each experiment record on the first page the date, your and your lab parter's name, and the experiment name. Your notebook must have consecutively numbered pages.

I will want to see and sign off the lab notebooks at the end of each lab period, after you have cleaned up the lab station.

To avoid unnecessary writing, you and your lab partner can decide to either have one joined notebook or, alternatively, you may keep separate notebooks. In the former case hand in a copy. In the latter case, one of you should keep a detailed record and the other may copy over just the "relevant" data to his/her notebook and include a reference. For example, you may say: "We observed RESULTS, for details of the setup see NAME's notebook, pg. ## ." In either case, who does the experimentation and who the record keeping should switch weekly and this should be recorded in the lab notebook.

You may share the raw data (as it appears in the notebook) in either paper or electronic form with your lab partner (but only your lab partner) after you have left the lab. You may absolutely not share data that has been processed, graphed, etc.

Spring - Experiments in contemporary physics

Guided and independent projects. Possible topics:

Optical Bandgap of Semiconductor
Doppler-Free Saturated Absorption Spectroscopy
Temperature Dependence of Diode's Saturation Current
Isotope Shift of Balmer Series In Hydrogen
Mass of Cosmic Ray Muon
Fabrication of Fullerenes
Rubidium Optical Properties
Quantum Dots
Sonoluminescence
Radio Telescope
Chaotic Electric Circuit
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