PHYS 3110 JUNIOR LAB 1
FALL 2009

12024 LSC 005B, LSC 110, LSC 174
http://faculty.uca.edu/saustin/3110/3110_f09.html

Instructor

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Office hours: M W F 9am-9:50pm, MWF 11am-12pm

Course Description

Part of the physics major core. A laboratory course that includes, but is not confined to, experiments related to upper-division physics courses such as Mechanics, Electromagnetism, and Optics. Selection of experiments is adapted to the needs and program of the individual student. Involves student presentations. Requires attendance at department seminar. Prerequisite: PHYS 2443 or 2430. Fall.

Goals

- Instrumentation, data acquisition, and analysis methods that are used in physical science research.
- Practice in the presentation of scientific results in written and oral forms.

Note that this lab course is fundamentally different in difficulty and philosophy from the physics labs you have done within your other physics courses. This is a problem-solving laboratory experience, and not a series of cook-book labs. You will be responsible for learning how the equipment works and then using it properly. Your data may often be low signal-to-noise, which will require you to use statistical techniques to extract results from your data. Your success with the experiments will reflect the amount of dedication and initiative you use when dealing the problems and puzzles that will arise. Your success will also reflect the amount of care and detail you take while doing and writing up the laboratories.

Requirements

Projects

You will choose projects that sum to a total weight of 4 during the semester. Some projects must be done by ones self (solo), other projects can be done by a group of two (pairs). See attached list for more details including the maximum amount of time you can use the equipment.
When you begin an experiment you will meet with the instructor. We will discuss your knowledge and background concerning the experiment.

Laboratory Note Books

You must purchase a laboratory note book and must be a bound notebook with graph paper (Do not use loose sheets of paper).
Always use ink, do not erase or tear out pages. If something is wrong, cross it out or make a note in the margin why it is wrong.
Write everything down, diagrams, settings, date and time, data, calculations, notes,mistakes, etc...

You will meet with the instructor once a week to discuss your work. Your notebook will be a record of this work.

Detailed laboratory notebooks or log books are an essential part of doing experiment physics (and lab work in general whether it is in a lab course or an industrial research lab).

Written Lab Reports

Reports will be written as a scientific paper in the style used for American Institute of Physics (AIP) publications. Your reports will consist of the six major sections (sub-sections within these can also be used) and a listing of references:

- Abstract. Description of the experiment and the central results using a few sentences.
- Introduction. Summary of the background and physics involved in the experiment. Include mathematical details relevant to later discussion in the report.
- Experimental Procedures. Describe the experimental method and discuss the systematic and statistical errors. Include diagrams of apparatus. This should describe the procedure, but should not be a step-by-step lab manual.
- Results. Present raw data and the analysis methods used to transform that data into meaningful results. Use table and figures (graphs) to present results. All tables must have titles and all figures must have captions. Both tables and figures must be referred to in the text of this section of the report. Experimental error must be reported for all data and results.
- Discussion. Discuss the results and the physics involved.
- Conclusions. This section should sum up, state the conclusions, state recommendations, and terminate gracefully.

References. Cite all textbooks, manuals, reference books, scientific papers, and etc. that you used that were essential to performing the experiment and writing up the report. Citations to these references must appear in the text of the report.

Two hardcopies and one electronic copy of the manuscript must be submitted for review. Manuscripts that are reviewed as acceptable will receive A, B, or C grades. Manuscripts that are rejected will receive a D or F grade, but can be re-submitted for a maximum possible grade of C.

Oral Lab Exams

One-on-one oral exams based on the projects will be given during the weekly meetings with the instructor.

End of Semester Oral Presentations

A presentation of your last experiment will be presented in a seminar setting. The presentations should be aimed at others in PHYS 3110 who may have not done the particular experiment. The presentations must be about 15-minutes. The presentations must include: the physics principles, description of the equipment, results, personal insights into the methods and results. “PowerPoint” type presentations are preferred, but keep it simple, content is more important than glitz.

Grading and Grades

Note Books (5%)

Lab Reports (75%)

Oral Exams (10%)

Oral Presentation (10%)

Starting Grade Scale
90%≤A≤100%
80%≤B<90%
70%≤C<80%
60%≤D<70%
0%≤F<60%

Keys, Key Codes, and Passwords

You will be given access to LSC 110 to run certain experiments. This will be done by assigning you a key to that room. You are responsible for returning that key at the end of the semester. You grade for the course will be withheld if you do not return the key by 2009 December 8.

You will be assigned a key code for LSC 005B. Access to the computational lab LSC 174 will also be given through your id cards, and usernames and passwords will be assigned.

Safety

Some of the equipment used in the experiments can be dangerous if used improperly. Become familiar with the equipment before using. If you are unsure about something seek help from the instructor.

If you observe something that you consider dangerous in the lab, report it to the instructor.

Professional Conduct

Observe all safety procedures. Be courteous and conscientious toward other lab students. Equipment must not be abused. There are lab apparatus which are very delicate and very expensive (thousands of dollars). Anyone acting in an unprofessional manner that puts other students and equipment in jeopardy will be dropped from the course.

Academic Misconduct

Academic misconduct include cheating, falsification, multiple submission, plagiarism, abuse of academic materials, and complicity or misconduct in research; the definition of academic misconduct is stated in the Student Handbook. Any student guilty of an act of academic misconduct will be subjected to one or more of the following penalties as outlined in the Student Handbook: 1. The students' grade in the course or on the examination or assignment affected by the misconduct may be reduced to an extent, including reduction to failure. 2. The student may be placed on probation or suspended from the university for a specific period of time. 3. The student may be expelled from the university. Expect to receive the maximum penalty for any academic misconduct.

Misc Policies

All other policies not explicitly covered in the syllabus can be found in the Student Handbook. For example, academic policies in general can be found beginning on page 26 and the sexual harassment policy can be found on page 93.

Projects

Kater Physical Pendulum (weight =0.5, solo, 1 week)
Determining the Acceleration of Gravity to High Precision.

h (weight = 1.0, solo, 2 weeks)
Photoelectric Effect and the Determination of Planck's Constant.
Demonstrates the photoelectric effect and the photon nature of light, as well as, a measurement of the fundamental constant h.

Nuclear Decay (weight = 1.0, solo, 2 weeks)
Determining the decay rates of samples with multiple radioactive isotopes.

e/m (weight = 1.0, solo, 2 weeks)
Determination of the Charge to Mass Ratio of an Electron.
A beam of electrons moving in the presence of a magnetic field enables the determination of e/m.

Franck-Hertz (weight = 1.0, solo, 2 weeks)
Quantization of the first electronic excitation of Mercury atoms.
A fundamental demonstration of quantization by the interaction of an electron beam and mercury atoms.

e (weight = 1.5, pair or solo, 3 weeks)
Determination of the Charge of an Electron Using the Millikan Oil Drop Method.
Charged oil droplets moving under the influence of gravity, an electric field, and air resistance are used to determine e.

c (weight = 1.5, pair or solo, 3 weeks)
Determination of the Speed of Light Using the Foucault Method.
A laser beam is split and the distance traveled while a mirror rotates at a given rate provides the necessary parameters to accurately determine the speed of light.

G (weight = 2.0, pair or solo, 4 weeks)
Determination of the Universal Gravitational Constant Using a Cavendish balance.
Uses the physics of a torsional balance and gravitational attraction to measure the fundamental constant G.

Photon Duality (weight = 2.0, pair or solo, 4 weeks)
Wave-particle duality of individual photons with single and double slits and a photoelectric photometer.

Apparatus Sign-up

Must do a combination of labs that sum to a weight of four.

	week	Pendu-lum (solo) 1 week	h (solo) 2 weeks	Nuclear Decay (solo) 2 weeks	e/m (solo) 2 weeks	Franck-Hertz (solo) 2 weeks	e (pair) 3 weeks	c (pair) 3 weeks	G (pair) 4 weeks	Photon Duality (pair) 4 weeks
weight		0.5	1	1	1	1	1.5	1.5	2	2
	Aug 20–26									
	Aug 27–Sep 2									
	Sep 3–9									
	Sep 10–16									
	Sep 17–23									
	Sep 24–30									
	Oct 1–7									
	Oct 8–14									
	Oct 19–25									
	Oct 26–Nov 1									
	Nov 2–8									
	Nov 9–15									
	Nov 16–22									

Weekly Meeting Sign-Up

Sign up for one half-hour block of time per week.

	M	T	W	Th	F
8:00 AM	X		X	X	X
8:30 AM	X		X	X	X
9:00 AM				X	
9:30 AM				X	
10:00 AM	X		X	X	X
10:30 AM	X		X	X	X
11:00 AM				X	
11:30 AM				X	
12:00 PM				X	X
12:30 PM				X	X
1:00 PM				X	X
1:30 AM				X	X