

Syllabus for Physics 0212

Introduction to Laboratory Physics

Fall 2009

Course and Instructor Information

CRN 10926
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Office hours Monday: 8:00am-10:00am
 Tuesday: 2:00pm-4:00pm
 Wednesday: 9:00am-11:00am
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 Other times by appointment.

Course Description and Objectives

All sciences are a combination of theory (the hypothesis) and measurement (the experiment). A theory has no value unless it can be verified, or tested, by experiment. Once a theory passes this test, it may be expanded and tested further, which is the way that Physics and other sciences progress. So understanding experimental work is vital to understanding the process of science. A typical introductory physics course sequence, such as Physics 0110 and 0111, teaches the student the basic principles of Physics that were learned through the interplay of theory and experiment over several hundred years. Such courses focus on the theory side of Physics. In this course, you will learn how the experimental process works by learning how to obtain, analyze and present experimental results. You will also see the basic principles you have learned in action, to see the physical reality behind the equations. Along the way you will learn to use the basic tools of experimental physics, from simple measuring devices such as a ruler, to sophisticated digital data acquisition systems. You will learn how physical theories are tested within the bounds of experimental uncertainties. By the end of the course you will have performed experiments and tested theories on the topics of mechanics, waves, energy conservation, fluid mechanics, electricity and magnetism, optics, spectroscopy and radiation.

The course is structured in two parts, a recitation and a lab with attendance required for both. The 50-minute recitation lecture will introduce the physical principles that are to be demonstrated by the experiments in the lab sessions. The lab sessions will include instruction on how to use the equipment and how to perform the experiment. The remainder of the lab will be used to collect and analyze the data.

Required Materials

The following materials are required for the course and may be purchased at the University Book Center.

- 1) A lab manual titled, *Introduction to Laboratory Physics* by Russell J. Clark.
- 2) The *Student Lab Notebook with Spiral Binding* (50 Carbonless Duplicate Sets) by Hayden McNeil.
- 3) A scientific calculator that has trigonometric, logarithmic and exponential functions. Statistical functions are also useful.

General Information for the Labs

- 1) **Eating and drinking are not permitted in the labs.** This is both for your safety and to prevent damage to the laboratory equipment.
- 2) **Students are responsible for reading and understanding the section in the manual on the scheduled experiment before coming to the lab class.** Make sure you understand the physical principles to be demonstrated and the general procedure for the experiment. The more prepared you are, the faster and easier the lab will go. If you have any questions about the experiment, feel free to ask them at any time in lecture or in the lab. A schedule of the experiments is listed below.
- 3) All labs except the first will start with a quiz of 5 questions.
- 4) After the quiz, the lab teaching assistant (TA) will give instruction on the experiment and the procedure. **Listen to this presentation very carefully** as the TA will explain exactly how to use the equipment and perform the experiment. Failure to follow the instructions could result in wasted time and damaged equipment. It could also pose a threat to your safety and the safety of those around you.
- 5) Before starting the experiment, make sure you understand the function and purpose of the equipment. The lab manual should provide sufficient documentation for using the equipment, but if there is anything you do not understand, ask the TA.
- 6) Students will work in groups of two with the following exceptions. If a class has an odd number of students, one group will have three people. If a lab session has more than 16 students, there will be one or more groups of three. If a piece of equipment fails and cannot be replaced, the members of that group will split up and join other groups. **Under no circumstances should a group have more than three students.**
- 7) Once the data is collected, you should analyze it before you leave the lab so that if you have any questions about the analysis you can ask your TA for help. Also, if you find some of your data is flawed or inconsistent you will have the opportunity to fix the problem and collect a new set of data.

Lab Notebooks

Each student will keep a lab notebook, which is a vital practice for any scientist. The purpose of the notebook is to record all aspects of the experiment and to write down any information that may be of importance. If you are unsure if something is important, write it down anyway. Be neat, concise, clear and legible when writing in your notebook. Here are some guidelines for what to include:

- 1) Write down notes about the experimental procedure, possible sources of error, safety considerations, equipment status and any general observations you care to make. Include the title of the experiment, the date and the names of your TA and lab partners.
- 2) Record the conditions under which you performed the experiment. Some experiments require that you change the parameters each time you collect data. Make sure you record those parameters before you start. For instance, in the lab on Oscillatory Motion you will record the period of a simple pendulum for five different lengths. You should record each length in your notebook before you begin taking the data.
- 3) Record your data. In some experiments you will record the data by hand just by writing down your measurements. Be neat and tabulate the data so it is easy to read. Label the data and include physical units. Having a table of numbers is no good if you do not know what those numbers mean. In other cases a computer will collect and store large data sets. In actual research you would then record the file name and location of the file but here you only need to record the results of the analysis such as the slope and intercept from a linear fit to the data.
- 4) Record your mistakes. Even scientists are human, so you will sometimes make a mistake in the procedure or in setting up the experiment and you will record flawed data. Do not erase the data or delete it. Just make a note of the mistake, fix the problem and record a new set of data. You should not include the

flawed data in your analysis but you should still keep a record of it because you can often learn a lot from your mistakes.

- 5) Do not use the lab handouts as a replacement for the lab notebook. You will be provided with handouts to fill out for the informal lab reports. You should record your data in your lab notebook and later copy it to the handout. **You will turn in the carbon copies of your lab notes at the end of the lab session.** These notes will be graded based on organization, clarity and completeness. **The lab note grade will also include points for participation.**

Lab Schedule

	Week	Lab	Room	Quiz	Report	Due the Week of	HW Due
1	08-31 to 09-03	Ballistic Motion	402		Informal	09-07 to 09-10	09-11
2	09-07 to 09-10	One Dimensional Motion	408	✓	Informal	09-14 to 09-17	09-18
3	09-14 to 09-17	Oscillatory Motion	402	✓	Formal	See Schedule	09-25
4	09-21 to 09-24	Fluid Mechanics	408	✓	Informal	09-28 to 10-01	10-02
5	09-28 to 10-01	Sound and Human Hearing	402	✓	Informal	10-05 to 10-08	10-09
6	10-05 to 10-08	DC Circuits 1	408	✓	Informal	10-12 to 10-15	10-16
7	10-12 to 10-15	Fall Break – no lecture or lab					
8	10-19 to 10-22	DC Circuits 2	408	✓	Informal	10-26 to 10-29	10-30
9	10-26 to 10-29	e/m Ratio of the Electron	402	✓	Formal	See Schedule	11-06
10	11-02 to 11-05	Optics 1	408	✓	Informal	11-09 to 11-12	11-13
11	11-09 to 11-12	Optics 2	402	✓	Informal	11-16 to 11-19	11-20
12	11-16 to 11-19	Optical Spectroscopy	408	✓	Informal	11-30 to 12-03	12-04
13	11-23 to 11-26	Thanksgiving Break – no lecture or lab					
14	11-30 to 12-03	Radiation and Radioactivity	402	✓	Informal	12-07 to 12-10	12-11
15	12-07 to 12-10	Make-up Labs– no lecture or lab					

Informal Lab Reports

There are two types of reports in this course, formal and informal. Two of the experiments will require formal reports (see the schedule above) and the rest will be informal. You will be provided with a handout for each of the informal labs and in general you should be able to finish the handout before the end of the lab session. Your informal lab report will include the handout and duplicate pages from your lab notebook for that experiment (graded for neatness and accuracy). The handouts are available on Courseweb. Informal lab reports are due in the following lab session. **The grade on an informal report will be reduced by 10% for each day that it is late.**

Formal Lab Reports

Scientists generally communicate the results of their experiments by submitting articles to peer reviewed journals. The journal editors send each article off to a group of peers (experts in the field) who review it and determine if it is worth publishing. Generally the peers will return the article with comments and suggestions the author (or authors) must address before it can be published. This iterative peer review system is what assures the integrity and quality of scientific papers.

In this class you will write two formal lab reports each of which will be structured like a journal article. Instructions on how to write the formal lab report will be given in the lecture and sample reports are available online through Courseweb.

For each formal lab report you will submit a first and second draft, each of which will be submitted to www.turnitin.com and also graded by your TA. Through www.turnitin.com your report will be reviewed anonymously by several of your peers (other students in this course). In turn, you will anonymously review several reports of your peers and provide feedback on this whole process through a series of online surveys.

Formal Lab Report Schedule

The due dates are strict and late reports, reviews or surveys will not be accepted.

Lab Title	Background Survey	First Draft	Writing Survey	First Draft Reviews	Review Survey	Second Draft	Writing Survey
Oscillatory Motion	09-25	10-02	10-05	10-09	10-13	10-16	10-19
The Charge to mass (e/m) Ratio of the Electron	--	11-13	11-16	11-20	11-23	12-04	12-07

Homework (LON-CAPA)

This semester we will be using an online homework system called LON-CAPA which may be accessed at the following address (there is also a link in Courseweb):

<http://nplq1.phyast.pitt.edu/>

Your username for this system is the same as your Pitt email username and your initial password will be your PeopleSoft ID number (available through my.pitt.edu). Instructions on how to use this system to complete your homework assignments will be provided by the instructor.

You must complete each assignment by the due date (same as the lab report) or you will not receive credit for that assignment. The lowest homework grade will be dropped.

Lecture Questions

The recitation lecture will utilize the Student Interactive Response System (SRS) to take attendance. This system consists of hand-held infrared transmitters, called pads, assigned to individual students. The pads will be stored in bins on a cart at the front of the room so that you may pick up your pad before lecture and then place it back there at the end of lecture. **Do not take the pads out of the classroom!** Many other classes use the same system and pads. Remember, if a pad is missing the SRS system makes it easy to identify the student who used it last. Recitation attendance and your lab notes are each worth 5% of your total grade.

Please observe the following rules for the SRS:

1. Memorize your pad number and the bin where it is located.
2. Pick up your pad as you enter the classroom.

3. If your pad is missing, check nearby bins as it may have been misplaced. If you still cannot find it then ask the instructor which pad you may use as an alternate.
4. **Do not pick up a pad that is not assigned to you or use more than one pad (such as when a friend is absent).**
5. There are multiple receivers in the hall, aim your pad at the one with the clearest line of sight. A red light will flash on the receiver when it receives your answer and your pad number will change color on the computer screen, valid answers are blue and invalid answers are red. You may push any key (A to E) to be counted when the instructor takes attendance. The F, G and H keys are not used.
6. **Place the pad back in the proper bin at the end of lecture.**

Grades

The lowest informal report, quiz and homework grades will be dropped. **Makeup labs, quizzes and exams will be given at the discretion of the lecture instructor.** The grades are weighted according to the table below.

Recitation Attendance	4%
Quiz	12%
Homework	10%
Formal Lab Report 1 st Draft	10%
Formal Lab Report 2 nd Draft	16%
Formal Lab Peer Reviews and Surveys	6%
Informal Lab Report	32%
Final Exam	10%

Grade Change Policy

Grade cutoffs are chosen to be as fair as possible but ultimately the line has to be drawn somewhere and it has to be drawn straight. Extra credit opportunities may be offered to the class as a whole but not to individual students. Once your final grade for the semester has been submitted to the Registrar it will not be changed unless there is a verifiable error in the grade book, such as a missing grade or a grade that was entered incorrectly. You can check all of your course grades at any time on Courseweb (<http://Courseweb.pitt.edu/>).

Note that individual TAs will grade assignments differently. Therefore, the lab section grades (such as informal and formal lab reports) will be compared at the end of the semester and, if needed, adjusted to compensate for the variations in the TA grading styles.

Courseweb

The University of Pittsburgh provides an online portal for participating classes called Courseweb and a site has been created for this course. Here you will find relevant course material such as a copy of the syllabus, sample exams, etc. You may also view your grades online through this site. To access the site go to

<http://courseweb.pitt.edu>

and login using the username and password for your Pitt email account. If you need to setup your email account or have forgotten your username and password then call the computer center help desk (4-HELP or 412-624-4357). Once you are logged in, you will see a list of your courses that participate in Courseweb.

Clicking on the title of this course will take you to the associated web site. Feel free to contact the instructor or use the online help if you have questions about how to access the material.

Students with Disabilities

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services, 216 William Pitt Union, (412) 648-7890/(412) 383-7355 (TTY), as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course. A comprehensive description of the services of that office can be obtained at:

<http://www.drs.pitt.edu>