Physics 218—Oscillatory and Wave Phenomena
Lab: Tuesday 2:45–4:00 p.m.
Lab Description, Spring 2018

Instructor:	Andrew Dougherty
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Lab:	HSC 025 610-330-5212
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Web Page:	`http://workbench.lafayette.edu/~doughera/`

Office Hours: Please feel free to e-mail, call or stop by at any time and ask a question or set up an appointment. I will be available during my office hours and on most other days during the free times indicated on my schedule.

Classes on Snow Days and Other Emergencies: If I am unable to make it to class, I will leave a message on my voice mail (610-330-5212).

Description: The lab is intended to complement the Phys 218 lecture class, and provide a significant emphasis on experimental and computational approaches to the study of oscillatory and wave phenomena.

Student Learning Outcomes: After completing the lab portion of this course, you should be able to

- Apply models of oscillations and waves to appropriate physical systems,
- Apply the basic principles and practices of error analysis in experimental physics.
- Numerically simulate the motion of oscillators and waves.

Texts: *Waves and Oscillations*, by Walter Fox Smith (Oxford University Press), and *An Introduction to Error Analysis*, by John R. Taylor. Additional material will be drawn from your introductory physics text.

Attendance: Regular attendance is expected. It is **your** responsibility to keep up. If you know in advance that you will be absent, please let me know.

Labs: The experimental study of nature is an important part of this course as well. A significant portion of the course will be devoted to laboratory experiments. In addition to performing experiments on specific topics, you will also gain experience in computer acquisition and analysis of data, error analysis, and modern instrumentation techniques.

Numerical Simulations: We will also explore numerical simulations of oscillatory and wave phenomena. Such explorations can provide a different, but important, perspective on natural phenomena. They allow you to change parameters more quickly and conveniently than is usually possible in real experiments. You will also be able to visualize and study phenomena that are difficult to observe directly in the laboratory.

We will use *Mathematica* in this lab. I will post various "Getting Started" links on the course web page. If you would like a good, relevant introductory book, I recommend *Getting Started with Mathematica*, by C-K. Cheung, Gerard E. Keough, Robert H. Gross, and Charles Landraitis.

We will also use `python` for numerical simulations. I will post additional links on the course web page.

Lab Notebook and Reports: You are required to keep an accurate and complete log of your lab work in this course in a laboratory notebook. This notebook will not be graded, but it must contain all the information needed to analyze the experiment, as was the case in your introductory physics course.

For some experiments, you will work with one or two other students as a team. You must each still submit an individual lab report, though you may certainly work together on the analysis.

For each experiment, you must submit a *brief* report by the due date indicated on the schedule below. This report should not duplicate material in the original hand-out or in your text, but it should include the following:

1. Introduction. Give a *brief* introduction both to the theory and experiment. Specific references to a text or the lab handout should be used instead of laborious copying. Be sure, however, to clearly state the main idea of the experiment and the basic technique to be used.

2. Procedure. It is not necessary to discuss the procedure unless you make any modifications to the experiment. Sometimes, this section can be skipped.

3. Data. Give a clear presentation of your data.

4. Results and Discussion. This is the heart of the report. You need not reproduce algebra steps, but be sure that enough information is given that another student in a course similar to Phys 218 could understand what you have done. All graphs should be clearly labeled. All quantities should have appropriate units and uncertainties, where applicable. There is no fixed format for this section, but it is important that it be clear, accurate, and complete.

   NOTE: It is often convenient to combine the data and results sections. If you find yourself duplicating information, go back and think about reorganizing your report.

Lab reports will be graded on a scale of 0-100. The key points you will be graded on are:

1. Evidence that you have identified and understood the key physical concepts involved in the experiment.

2. Quality of data taken—within the limits of the apparatus, this reflects the care with which you performed the experiment.

3. Analysis and interpretation of data.

4. Clarity and organization of your presentation.

Numerical Simulation Reports: For numerical simulations, the precise items you need to submit will be given in the individual handouts. The general criteria for lab reports will also apply to the simulation reports.

In addition, you will be required to e-mail me a copy of your working program. I will attempt to run your program, so it must be submitted in a format that will work. For assignments that require you to make a number of changes to your program, you normally only need submit the working version that you used for the last part of the assignment.

Late Penalties for Reports: For each weekday that a report is late, I will normally deduct 5 points from the maximum possible grade of 100%. I will, of course, allow for extenuating circumstances such as illness.

Academic Honesty: You are encouraged to work together on lab reports, but collaborations should not be one-way only. You are also encouraged to consult other texts and resources. You must fully understand whatever work you turn in, and it must be your own work. Consult the separate handout for the department's Academic Honesty policy. Please ask if you have any questions.

Andrew Dougherty Spring 2018
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Time	Mon.	Tues.	Wed.	Thurs.	Fri.
8:00					
8:30					
9:00					
9:30					
10:00	*prep*		*prep*		*prep*
10:30					
11:00	**Phys 112**	*prep*	**Phys 112**	*prep*	**Phys 112**
11:30	HSC 100		HSC 100		HSC 100
12:00					*Physics Club*
12:30					
1:00	(out)	**Phys 338**		**Phys 338**	
1:30		HSC 017		HSC 017	
2:00	(out)		**Phys 218**		
2:30		**Phys 218**	**Lab**	*Office*	
3:00	*Office*	**Lab**	*Office*	*Hours*	
3:30	*Hours*	HSC 042	*Hours*		
4:00	Department	Committee	*Physics Club*	Committee	
4:30	Meeting	Meeting		Meeting	

ACADEMIC HONESTY GUIDELINES
Department of Physics

It is expected that each student taking courses in the Department of Physics is familiar with the statement "Principles of Intellectual Honesty" appearing in the Lafayette College Student Handbook. The following guidelines are intended to indicate how that statement pertains to your work in physics. Your instructor may have further guidelines for your specific course. We assume that students are honest; if you are not certain as to what is expected of you, consult your instructor before proceeding.

I. EXAMINATIONS:

1. Bring only those materials specifically authorized by your instructor. Frequently in the elementary courses, you will be permitted to bring in a formula sheet or you will be provided with one.
2. If you find that the seating arrangement is such that you can see someone else's paper, don't look! Better yet, ask if you can sit in another seat.
3. If you use a calculator, clear the answer before setting the calculator aside.
4. If you fail to hand in your paper at the end of the period you will be awarded a grade of zero for that test.

II. TAKE-HOME EXAMINATIONS: Take-home examinations are often assigned in some courses. Specific rules governing such tests will be announced by your instructor. The overriding principle, however, is that any work submitted be your own or be specifically credited to its source. There should be no discussion of the test questions with *anyone* other than the instructor.

III. HOMEWORK: You must acknowledge *all* collaborators. You are encouraged to learn from one another. You should first try to do homework problems on your own; after all you will have to do similar problems on your own in tests. However, discussion of difficult problems with others can help you to develop your own analytical skills and is encouraged, provided that, *after discussion* you write up solutions *on your own.* Do *not* borrow or lend homework papers. There is an important difference between discussing a problem with someone and copying his or her work. There have been students who have loaned papers to friends for a few minutes to "check answers", and been horrified to find themselves charged with academic dishonesty because their "friends" copied their solutions.

Please Note: The same ethical standards of academic integrity and honesty apply to the on-line homework as to the written homework, except that there is no place for you to specifically acknowledge collaboration. However, the same general rules apply.

IV. LABORATORY: Usually two or more students will work together in performing experiments and will submit reports of their work. In some courses, a single joint report may be submitted. Specific instructions will be announced by your instructor. If the words used to describe some part of the experiment are taken from some other source (such as the lab manual), then the source should be cited. (Reference to the lab manual can usually substitute for laborious copying.) If you consult with *anyone* about the experiment (e.g. students in your lab class other than your lab partner), that consultation should be acknowledged in your report. Do *not* borrow or lend a completed lab book or any portion of one.

V. PAPERS: Refer to the statement "Principles of Intellectual Honesty" in the Student Handbook.

Physics 218 Lab Schedule, Spring 2018				
Date		**Title**	**Due**	
Jan.	23	Introduction		
	30	Numerical Simulations in *Mathematica*	**Feb.**	13
Feb.	6	The Pendulum		20
	13	The Torsional Oscillator: Part 1		27
	20	The Torsional Oscillator: Part 2	**Mar.**	6
	27	Introduction to Numerical Simulations in Python		20
Mar.	6	Simulating a Damped, Driven Oscillator		27
	13	*Spring Break*		
	20	Simulations *continued*		
	27	Resonance in AC Circuits	**Apr.**	3
Apr.	3	Coupled Oscillators		
	10	Coupled Oscillators *continued*		17
	17	A.C. Circuits and Filters		24
	24	A.C. Circuits & Fourier Analysis		
May	1	Fourier Analysis *continued*	**May**	8

Revised: April 12, 2018