PHYS 122L Introductory Physics Laboratory Summer, 2015

SYLLABUS

Instructor: **Dr. Laszlo Takacs**
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Teaching Assistant: **Jaron Kropp, kroppj1@umbc.edu**

Place and Time:

Lab	PHYS 110, We and Fr, 9:00 am – 1:00 pm
Lecture	PHYS 107, We and Fr, 2:00 am – 4:15 pm

Office hours: Th 3:30-4:30 pm; or talk to me during lab.

Required Course Materials:

Lab Pack, sold by the bookstore. (If it's not on the shelf, go to the desk and ask for a copy. There is a revised, Summer 2015 version. Make sure to get that, not an earlier one.)

Official two-copy ***Lab Notebook***, also available at the bookstore. (Ask a clerk, if you are not sure what to buy.)

Your ***Introductory Physics textbook*** from PHYS 121/122 (or any similar book) must be at hand for reference.

Course Objectives

This is probably the first serious physics lab you will have ever taken. Therefore, there will be about as much emphasis on how to carry out and report a measurement as on the physics of the lab itself. Nevertheless, keep in mind that clear understanding of the principles involved is essential. Busy work without understanding is worthless, no matter how neatly documented. Here is a formal list of objectives, in order of importance:

- Observe physical phenomena familiar from your lecture courses. Become familiar with the intricacies of working in a lab, such as how to plan a measurement, how to set up and use equipment, and how to take and record data.
- Learn how to analyze your data and compare theory with experiment.
- Learn the proper methods of estimating and reporting errors. Although it is not the main purpose of the lab, no lab report is complete without an estimation of the experimental error for every directly measured and derived quantity. Learn how to use error propagation and fit theoretical curves (straight lines) to measured data.
- Learn to present your results in a complete, concise, and clearly written report. (In the real world your work is usually judged by what you write about it: a report for your manager in industry, a dissertation as a graduate student, a research paper in academia. Badly

written reports are dismissed, regardless of the quality of work itself.)

What do you need for the course?

1. Lab Pack: Contains a summary of the principles of error estimation, detailed description of each measurement, and a sample laboratory report. Become familiar with the relevant material before the lab. There may be a pop-up quiz at the beginning of the lab about the upcoming measurement.
2. A standard notebook that consists of permanently bound pages and duplicate pages that are perforated. At the end of each lab section, you will tear out the duplicate pages and submit them to the TA, while keeping the primary copy for your own records. The TA will staple your duplicate pages to your lab report before returning the graded report to you. Make sure you have turned in your duplicate data pages at the end of each section. Lab reports without these pages will be subject to a 30% grade reduction.
3. Any general physics textbook. Consult it whenever you feel uncertain about the principles. Reports with incorrect physics will be harshly downgraded. You must understand what you are doing in the lab and why. The pop-up quizzes will also test your understanding of the principles.
4. Any notes, corrections, addenda passed out in the lab or posted on BlackBoard.
5. Chemical safety goggles. Use them whenever there is the slightest chance of a mishap. Even if your measurement is not dangerous, the one performed by the other half of the class may be.
6. Access to Microsoft Word and Excel with option to print. These programs are available on practically every computer, most probably including your laptop. The necessary features are available in any version. Make sure that you are familiar with the version available to you. Both Word and Excel have extensive Help systems. If your data evaluation required the use of a spreadsheet, attach a printout to your lab report. Incorporate only the main results and plots in the main text of the report. Make sure to back up your files properly and to have a plan B for printing. ***Difficulties with your computer are not acceptable reasons for a late report.***

Course grade

4 full lab reports, 80 points each	320
5 short lab reports, 70 points each	350
2 homeworks, 80 points each	160
4 pop-up quizzes: 10 points each	40
Final presentation (in pairs)	80

The total is 950. I will add 10 points to the short-report grades to bring the possible maximum to 80, then drop the lowest assignment score, either a homework, a lab report, or the presentation. I do not drop any quiz grade. With that, the achievable total is 920.

Grades will be assigned approximately according to the following scale:

A = 820 or above
B = 720-819
C = 600-719
D = 500-599

"Incomplete" is given only in exceptional cases. In order to be considered for an "I", you must have completed at least 7 of the 11 assignments and have C or better standing at the time of incapacitation.

Course Policies

Summer schedule

This course requires substantial amount of work, thus it requires dedication and clear focus, especially in the compressed summer schedule. The requirements are the same as during the regular semester, except for a shorter lab report required from We to Fri. Do not let up; it is impossible to catch up, if you fall more than one day behind.

Some of you might take this course and PHYS 122 simultaneously. The schedule is designed to allow for that. It is also possible to be successful in both of them. But if you intend to tale both 122 and 122L, make sure to have no other commitment for the time of the session. Take no other course or part time work. There is just that much you can do in six weeks. You will have classes in the morning and in the afternoon every day, the evenings are needed for preparation and homework, the weekend for catching up. Success begins with setting reasonable goals. Do not try to take 122 and 122L plus work 20 hours per week.

Reading assignments

Come well prepared to the lab. Read the relevant chapter from the lab manual and polish up on your basic physics knowledge, if necessary. Summaries of the principles will be given in class and also posted on Blackboard, but it is not enough, unless you do your share of individual study. Have a plan of what you will do in the lab – you can record it in your notebook, if you wish. Good preparation leads to correct and efficient work in the lab.

Homework

Homework assignments for the first two weeks will be posted in Blackboard. For any solution that requires calculation in Excel, you must include a printout of the results, with the main answer circled or highlighted. The correct answer without the work will receive NO credit, but partial credit is given for partially correct attempts. For other questions, homework solutions can be handwritten, but please, try to write clearly and be organized.

Notice that the homework grades account for a substantial portion of your final grade. Accordingly, the assignments are hard and long, comparable to a lab report. Take them very seriously and schedule sufficient time (~6 hours) for completing them.

Full lab reports

To receive full credit for a lab, you must attend the lab, take data, submit the yellow copy of your record, and submit a hard copy of your written report at the beginning of the next lab. Full reports must be prepared of experiments done on Fridays. Do NOT email your report to me or to the TA without prior arrangement; we will delete such emails upon receipt.

Reports must be typed using a word processor and should conform to the format supplied at the beginning of the semester and in the sample report at the end of the Lab Pack. It must be spell-checked and written in clear English. (Publishers return a manuscript without review, if it is full of grammatical errors.) You may talk to your classmates regarding the lab reports, but each of

you ***must submit your own original text, graphs, analysis, and report***.

The measurements rarely require the entire 4 hours scheduled for the lab. If you finish early, you should start working on your lab report, preferably in the lab, so that you can check details you forgot to record. If you prefer, you can work at a place of your choosing. The lecture begins only at 2 pm, you can get a lot done before that. Do not waste the time on your cell phone.

Copying someone else's work is cheating. If your report is too similar to someone else's work – from your class or from a previous semester – you will get zero for the report. Be prepared to provide an electronic copy of your report for electronic comparison using SafeAssign, in case of any suspicion. Of course, it is understood that the raw data of your partner equal yours. But the evaluation, graphs and the text must be clearly different. A rubric for grading the lab reports is posted in BlackBoard to direct your focus.

Short lab reports

Writing a complete laboratory report takes much time that may be hard to find between We and Fr. Thus a shorter report with somewhat reduced expectations (and 10 fewer points) is due on Fr of the measurement done the previous We. The difference compared to a full report is that

- No theoretical introduction and explanation of the experimental work is required. After all, most of that information is in the Lab Pack anyway. But do mention, if you do something differently.
- The requirements concerning the format of graphs and tables are relaxed. The key is to submit a report that contains all the evaluation and interpretation, with giving up on details that contribute little to the essence of the report, but take up a lot of time. For example, figures with hand-written labels are acceptable. The quality of the text will be scrutinized less rigorously.

Of course, the data need to be presented clearly, no shortcut is allowed with error evaluation, and a discussion of the results with meaningful conclusions are still needed, just as in a full report.

Academic Integrity

"By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating could result in disciplinary action that may include, but is not limited to, suspension or dismissal." More on the requirements of academic integrity can be found at http://www.umbc.edu/gradschool/procedures/integrity.html

I am ready to give zero for the assignment in question for the first proven case of misconduct and F in the course for a second offense. It has never happened before, do not be the first example.

Late submission (both homework and lab report) must be given to me, to the TA, or turned in to the physics office, room 220 in the Physics Building, and marked with the date and time by the person receiving it. The score will be reduced according to the formula:

$$\text{Final Score}(t) = \text{Original Score} * 2^{-t/5},$$

rounded up to the nearest integer. Here t equals the number of full or partial work days by which the assignment is late. According to this formula, one day late due to printing problems costs you

about 13% of the grade for that assignment – not the end of the world unless it happens repeatedly. An assignment that is due on Fr but is submitted the following We is 5 days late, thus it receives 50% of the otherwise deserved credit. It is much less than full credit, but still much more than zero! You can hurt your grade the most by not turning in an assignment. Of course, timely work is best and that is what I expect.

Make-up lab policy: Make-ups will be allowed only for a documented medical or legal problem, athletic event, religious observance, or a death in the immediate family. The instructor must be notified as soon as possible, preferably well before the lab is missed. Going out of town on a recreational trip or a family event does not constitute a valid reason for requesting make-up.

Oral presentations: You will give a 20-minute talk based on one of the labs at the end of the semester. You and your partner will propose an addition, correction, or refinement to one of the measurements. You don't have to do the measurement you propose (though it may be beneficial if logistically possible). We'll discuss how to prepare for such presentations during lectures. The goal is to give you experience in presenting scientific results and answering questions in front of your peers. No matter what job you do in the future, you can benefit from learning how to present a topic in a clear and concise form.

BlackBoard

Assignments, lab notes, and announcements will be posted on BlackBoard. Take a look at the course's BlackBoard page a day or two before the next lab, or if you suspect that guidance should be available in a given situation, such as inclement weather. We will also enter your grades into Bb so that you will be aware of your standing in the course at any time.

Disabilities

If you have any condition such as a physical or learning disability, which will make it difficult for you to carry out the work as described or which will require academic accommodations, please notify me ASAP, but definitely during the first weeks of classes.

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Course schedule

Day #	Date	Activity	Assignment
1	July 8	Experimental error, error propagation, normal distribution; Excel and its use for error analysis	**Hw#1**
2	July 10	Maximum likelihood, least squares; straight line fitting in Excel; preparation for next week's measurements	**Hw#2**
3	July 15	Group A: Atwood's machine Group B: The Ballistic Pendulum	**Short LR#1**
4	July 17	Group A: The Ballistic Pendulum Group B: Atwood's machine	**Full LR#2**
5	July 22	Group A: Simple Harmonic Motion Group B: Angular Momentum	**Short LR#3**
6	July 24	Group A: Angular Momentum Group B: Simple Harmonic Motion	**Full LR#4**
7	July 29	Group A: Velocity of Sound Group B: Heat Capacity and Latent Heat	**Short LR#5**
8	July 31	Group A: Heat Capacity and Latent Heat Group B: Velocity of Sound	**Full LR#6**
9	Aug. 5	Group A: DC Circuits and Ohm's law Group B: The Current Balance	**Short LR#7**
10	Aug. 7	Group A: The Current Balance Group B: DC Circuits and Ohm's law	**Full LR#8**
11	Aug. 12	Both Groups: The Ratio of e/m for the Electron	**Short LR#9**
12	Aug. 14	Student presentations	**None**