PHYS 122L   Introductory Physics Laboratory   Spring, 2017

SYLLABUS

Instructor: **Dr. Laszlo Takacs**
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Place and Time:
Lecture   Sondheim Hall 205, Tu 1:00-1:50 pm
Lab   PHYS 110, Tu **or** Th (depending on registration),
                              2:00-4:45 pm
Office hours: Tu and Th 2:00-4:45 pm; find me in the lab or in my office.

Teaching assistant: TBA

Required Course Materials:

Lab Pack, sold by the bookstore. Make sure to obtain the "Spring 2017" version, not an earlier one. They are different. (If it's not on the shelf, ask the desk. They can print out a copy for you.)

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

An *Introductory Physics textbook* for reference.

Course Objectives

This is the first physics lab during your studies at UMBC. Therefore, there will be much emphasis on how to carry out and report a measurement, data evaluation, and other technical issues. Nevertheless, keep in mind that clear understanding of the principles involved is essential. Busy-work without understanding the physics behind it is worthless. 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, much of your time will be spent on error evaluation. No lab report is complete without an estimated error for every 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 <u>before</u> each lab.

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 your 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. Consult a general physics textbook 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.

4. Lecture slides, notes, corrections, addenda are posted in Blackboard.

5. You need 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 you are using. Both Word and Excel have extensive Help systems. If you used a spreadsheet for data evaluation, 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 an acceptable reason for a late report.

Lecture

Tuesday's lectures are mandatory. Some subjects will be new, such as the theory and practice of error evaluation, the principles of wave motion, and how to write lab reports. I will also discuss the upcoming measurements shortly. Any operational issue or frequently seen problem with the lab reports will be discussed there. If you miss a lecture, you may miss some essential guidance. Reviewing the slides in Blackboard is not a sufficient substitute.

Course grade

You will get credit for the following assignments:
9 lab reports, 100 points each   900
2 homeworks: 100 points each   200
Final presentation (in pairs)   100

The total is 1200. I will drop the lowest score, either a homework, a lab report, or the presentation. With that, the achievable total is 1100.

Grades will be assigned according to the following scale (with possible minor corrections):

A = 960 or above (87.3%)
B = 860-959 (78.2%)
C = 760-859 (69.1%)
D = 620-759 (56.4%)

"Incomplete" is given only in exceptional cases. In order to be considered for an "I", you must have completed at least 8 of the 12 assignments and have C or better standing at the time of incapacitation.

Course Policies

Homework

Homework assignments for the first two weeks will be posted in Blackboard. It is your responsibility to obtain a copy. For any solution that requires calculation in Excel, you must include a printout of the results with the main answer circled or highlighted. You should also include handwritten comments on your printout to make it easier to follow your work. For other questions, homework solutions can be handwritten, but please, write clearly and be organized. "Solutions" scribbled on the margin of the assignment page are not acceptable. You can work together, but eventually each student must have her/his own unique solution.

Submit **complete solutions**, not just final results without justification. The correct answer without the work will receive NO credit. Partial credit is given for partially correct attempts with proper documentation.

Notice that the homework assignments account for a substantial portion of your final grade, as much as a weekly lab report. They are <u>hard and long</u>, comparable to writing a lab report. Take them seriously, leaving sufficient time (at least 6 hours) to complete each. It is not wasted time: all the skills developed with the homework are needed later for real data evaluation.

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 they are too little too late, unless you did your share already. The summary in lecture is used only to give you an opportunity to ask questions. Good preparation is key to correct and efficient work in the lab.

Working in the lab

Arrive to the lab on time. Usually two students work together, thus being late from the lab hurts your partner and potentially gives you credit for work you were not involved in. Therefore, the following late policy will be strictly enforced:

5-15 min: your lab grade is reduced by 10%.

15-30 min: your lab grade is reduced by 30%.

If you are late by more than 30 min, you are dismissed from the lab. If you have a proven legitimate reason, you are eligible to make up the measurement; otherwise you will get no credit.

Work in the lab in an orderly manner. You will not do any particularly dangerous experiment, but accidents can happen, if you are careless. Use common sense and be careful with shooting balls, pouring hot water, and high voltage. Keep the isles clear so that people can move around safely.

Usually two different measurements will be set up in the lab. Half the class – Group A – will

work on one measurement, Group B will work on the other. Next week you do the other measurement. Whether you are in Group A or B will be decided before the first lab. It is important to remember your group as you need to prepare for the next measurement accordingly. See the schedule at the end of this Syllabus for the order of measurements.

Lab reports

To receive full credit for a lab report, you must attend the lab, take data, submit the duplicate copy of your record, and hand in a **hard copy** of your written report within one week after you do the experiment (normally at the beginning of the next lab.) Do NOT email your report to me or to the TA; we will delete such emails upon receipt, unless you have prior authorization due to some special circumstance. Printer problems are not acceptable as a reason.

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 in the Lab Pack. It must be spell-checked and written in clear English. (Publishers return manuscript without review, if the language is full of 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*.

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.

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 will 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, but do not be the first example.

Late submissions (both homework and lab report.) Material can be turned in to the physics office, room 220 in the Physics Building, to the TA, or to me. They must be marked with the date and time of submission by the person receiving them. The score of a late assignment will be reduced according to the formula:

$$\text{Final Score(t)} = \text{Original Score} * 2^{-t/7},$$

where t equals the number of full or partial calendar days by which the assignment is late. (According to this formula, being late by one day means less than 10% reduction, thus a single printer issue is not the end of the world. Of course, being late every time costs you a full grade. A one-week-late assignment receives 50% 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 assignments. "Better late then never" is valid. The grade of the assignment is rounded up to the nearest integer. Plan to be always on time and get full credit.)

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 <u>well before</u> 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 make 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, lecture slides, lab notes, and announcements will be posted on Blackboard. Take a look at the course 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. In case an announcement is urgent, I will also email you. We will also enter your grades into Bb so that you can evaluate your standing in the course at any time. Let me know as soon as possible, if a grade is not recorded correctly.

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 two weeks of classes, before actual labwork begins.

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Course schedule

Week #	Dates	Activity	Assignment
1	Jan 31-Fe 2	Lecture: course policies, error analysis I, Excel, making plots. Continued in lab.	Hw#1
2	Feb 7-9	Lecture: error analysis II, more on Excel. Continued in lab.	Hw#2
3	Feb 14-16	Group A: Atwood's machine Group B: The Ballistic Pendulum	LR#1
4	Feb 21-23	Group A: The Ballistic Pendulum Group B: Atwood's machine	LR#2
5	Feb 28-Mar 2	Group A: Simple Harmonic Motion Group B: Angular Momentum	LR#3
6	Mar 7-9	Group A: Angular Momentum Group B: Simple Harmonic Motion	LR#4
7	Mar 14-16	Group A: Velocity of Sound Group B: Heat Capacity and Latent Heat	LR#5
8	Mar 21-23	Spring Break	None
9	Mar 28-30	Group A: Heat Capacity and Latent Heat Group B: Velocity of Sound	LR#6
10	Apr 4-6	Group A: DC Circuits and Ohm's law Group B: The Current Balance	LR#7
11	Apr 11-13	Group A: The Current Balance Group B: DC Circuits and Ohm's law	LR#8
12	Apr 18-20	Both Groups: The Ratio of e/m for the Electron	LR#9
13	Apr 25-27	Lab make-up, preparation for presentations	None
14	May 2-4	Preparation for presentations	None
15	May 9-11	Student presentations	None
16	May 16	No lecture or lab, last chance to submit report	None