PHYS 122L **Introductory Physics Laboratory** **FALL 2019**

DRAFT – SYLLABUS -- DRAFT

Place and Time:

Lecture: Physics 226, Tu 1:00 - 1:50 pm
Lab: Physics 110, 2:00 – 4:45 pm, Tu **or** Th (depending on registration)

Instructor: Dr. Cody Goolsby-Cole
Email: cagc@umbc.edu
Office Hours: M & W 2:10-3:00 PM; Th 1-1:50 PM in Physics 226A (Physics Tutorial Center)

Teaching Assistant: Arman Setser
Email: asetser1@umbc.edu
Office Hours: Physics 226A, Coming Soon

Course Description: This 3-credit lab course is based on the physical phenomena associated with the PHYS 121-122 lecture-course sequence. The laboratory includes planning a measurement, setting up and working with equipment, and recording data. Students will learn to analyze data, compare theory with experiment, and estimate and report errors. Students will learn to present results in a complete, concise, and clearly written report.
Prerequisite: PHYS 121 or PHYS 121H
Corequisite: PHYS 122 or PHYS 122H

I will assume that you have the Physics background provided by PHYS 121 and PHYS 122. We will use concepts from these classes on a daily basis. I will assume that you have a working knowledge of calculus that includes derivatives, and formulas for algebraic and trigonometric functions.

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, etc. Nevertheless, keep in mind that clear understanding of the principles involved is essential. Busy-work without understanding is worthless.

Here is a formal list of objectives:

- 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. It is an integral part of every laboratory measurement. It is not the main purpose of the lab, but 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 how to fit theoretical curves (usually 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: you prepare a report for your manager in industry, a dissertation as a graduate student, a research paper in academia. Fair or not, a badly written reports is dismissed, no matter how great the work itself would be otherwise.)

Required Course Materials:

1. ***Lab Notebook***, available at the bookstore. You must buy the specified lab-research notebook; the top page is permanently bound to the notebook, while the duplicate page is perforated, making it easy to tear out and submit it to the lab TA at the end of each lab section while still keeping an official copy. The lab TA will staple your duplicate pages to your lab report before returning the graded report to you. Please make sure that you have turned in your duplicate data pages at the end of each section to your lab TA. Lab reports without the data pages will be subject to a 30% grade reduction. (Ask a clerk, if you are not sure what to buy.)
2. An ***Introductory Physics textbook*** you can consult 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.
3. 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 <u>not</u> an acceptable reason for a late report.

Course Management

I will use ***Blackboard*** to manage the course. Assignments, class 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.

We will also enter your grades into Bb so that you will be aware of your standing in the course at any time. ***It is your responsibility to keep up to date with the course materials and announcements posted on Blackboard.***

Course Grade

9 lab reports, 80 points each	720
2 homeworks, 80 points each	160
Quiz Average	80
Final presentation (in pairs)	80

I drop the lowest score from either a homework or a lab report. With that, the achievable total is 960.

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

A = 89.9% and above	B = 89.9% to 79.9%	C = 79.9% to 69.9%
D = 69.9% to 59.9%	F = 59.9% or below	

In principle, everyone can get an A. I will not grade the class on a curve. This is the absolute grading scale I will use.

"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

Weekly Quizzes
50 min quiz given in class each lab week. Open-book (LabPack) but *not* open notes. Collaborate with your lab partner or larger groups. Complete in your two-copy lab notebook (submit copy, you keep original). Prepare by reading the associated lab and reviewing relevant physics principles using your PHYS 121 or PHY 122 materials.

Homework
Two homework assignments based on Ch. 0 of LabPack and the first and second weeks of class and lab time. Find on BB under *Course Materials*. Expect to spend an average of at least 4-6 hr on each homework assignment. Plan to start early so that you can get help in office hours. Homework counts for a significant chunk of your course grade and *it helps to build essential skills for lab reports*; completing a homework very late or poorly will leave you ill-prepared to achieve passing grades on your lab reports.

For any solution that requires calculation in Excel, include a printout of the results with the main answer circled or highlighted. Include handwritten comments on your printout to make it easier to follow. For other questions, homework solutions can be handwritten, but write clearly and be organized. You are encouraged to collaborate, but eventually each student must have her/his own unique solution.

Working in the lab
Ordinarily you'll work with one partner. Be on-time; at the beginning of lab there's typically a ~5 min orientation to the apparatus that you shouldn't miss, plus labs generally require the whole lab period.

Late penalties: up to 15 min late: 10%, 15-30 min late: 20%, 30 min+ late: too late to participate (possible makeup lab with appropriate excuse.) Bring your two-copy lab notebook. Record all raw data and any variations from the standard procedure. Submit the copy before leaving. You'll complete most of your data analysis after lab, but time permitting, get started on it during lab. It's easy to get help and you might realize you missed some data. Email yourselves the Excel file for any analysis that you began.

Lab reports
To receive full credit for a lab report, you must attend the lab, take data, submit the yellow 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). Additionally, you must upload an electronic copy of your lab report to the course blackboard site prior to submitting the written report. ***You must do both: upload an electronic version via Blackboard and submit a hardcopy for grading.*** If one of the two is missing, you will get a zero score for the lab.

You should allow enough time to complete these tasks before coming to the lab. You CANNOT email me or the TA lab reports, we will delete these emails upon receipt.

Reports must be typed using a word processor and should conform to the format supplied in the sample report in the Lab Pack. It must be spell-checked and written in clear English. (Publishers return manuscript without review, if 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***. 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. ***Copying someone else's work is cheating***.

Refer to *Lab Report Grading Guide* under Course Documents in Blackboard for detailed grading criteria. Here are some of the important elements:

- All analysis detailed in the Lab Pack
- All conceptual questions are answered in the analysis/conclusion
- "Quality of language" means it is objective, precise, and concise (in addition to being proper English). Avoid rambling and vague phrases like "human error"
- Logical organization and flow
- Error evaluation in your report:
- Apply what you learned in lecture-- always include error, correct sig figs, etc.
- Describe the error method: "s.d. of mean", "added in quadrature", "I used ___ function in ___ program"
- In the APPENDIX, include error propagation formulas (esp. ones that use partial derivatives). You can also attach Excel tables (printed out or pasted in). If you do some extended analysis, derivations can go here, too.
- ILE can usually be stated once: "All values in this table..."
- Figures and Tables:
- No ambiguity-- include labels, captions and units!
- When plotting data, it should come with error bars. This can be individual measurement error, or it can be error from the least squares fit (Z parameter). Always specify.

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

$$\text{Final Score}(t) = \text{Original Score} * \exp(-0.1t)$$

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 approximately 10% reduction and a one-week-late assignment receives approximately 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 an assignment. The saying "better late then never" is valid.) The grade of the assignment is rounded up to the nearest integer.

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 do not constitute valid reasons for requesting make-up. At my discretion, I'll request written verification of the cause of your absence and arrange for you to make up the lab during the week of 18-22 Nov.

Oral presentations: You will give a 15-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.

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.

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

Inclement Weather

In case of inclement weather or other emergency, this class follows campus policy. You should check the main UMBC Webpage to see whether UMBC is closed and classes are cancelled.

Everyone should use your best judgment regarding travel to and from campus. Safety should be the main concern. If you cannot get to class because of adverse weather conditions, you should contact me as soon as possible. Similarly, I will notify you of any cancellation and schedule change as soon as possible, using email and Blackboard Announcement.

SCHEDULE

Week	Dates	Activity	Assignment
1	Aug 29	No lab	
2	Sept 3 & 5	Class: course policies, data collection and analysis, errors, Continued in lab.	HW#1
3	Sept 10 & 12	Class: More on data analysis, Excel, making plots Continued in lab.	HW#2
4	Sept 17 & 19	Group A: 1. Atwood's machine Group B: 2. The Ballistic Pendulum	LR#1
5	Sept 24 & 26	Group A: 2. The Ballistic Pendulum Group B: 1. Atwood's machine	LR#2
6	Oct 1 & 3	Group A: 3. Simple Harmonic Motion Group B: 4. Angular Momentum	LR#3
7	Oct 8 & 10	Group A: 4. Angular Momentum Group B: 3. Simple Harmonic Motion	LR#4
8	Oct 15 & 17	Group A: 5. Velocity of Sound Group B: 6. Heat Capacity and Latent Heat	LR#5
9	Oct 22 & 24	Group A: 6. Heat Capacity and Latent Heat Group B: 5. Velocity of Sound	LR#6
10	Oct 29 & 31	Group A: 7. DC Circuits and Ohm's law Group B: 8. The Current Balance	LR#7
11	Nov 5 & 7	Group A: 8. The Current Balance Group B: 7. DC Circuits and Ohm's law	LR#8
12	Nov 12 & 14	Both Groups: 9. The Ratio of e/m for the Electron	LR#9
13	Nov 19 & 21	Lab make-up, preparation for presentations	None
14	Nov 26 & 28	No meetings	None
15	Dec 3 & 5	Student Presentations	