Physics 256-X: University Laboratory

Summer 2017
MWF: 1 pm – 3 pm
TCCW 207
Office hours: MWF by appointment

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Required Text: University Physics 1 Lab Manual (supplied in class)
Needed supplies: a bound notebook for recording data, etc.

General Education Goals

This course addresses WKU general education expectations in science along with the associated lecture course. In particular, in this laboratory part of this course you will:

1. Demonstrate an understanding of the methods of science inquiry will be assessed through a hypothesis testing laboratory exercise.
3. Apply scientific principles to interpret and make predictions in one or more of the sciences will be assessed on predicting the outcome of an experiment.

Course Learning Outcomes

By the end of the semester, you should be able to:

1. Measure physical quantities using tools from simple scales to sophisticated data acquisition (LabView) employing proper procedures for the given tool and keeping good records.
2. Identify the appropriate methods (e.g. equations, diagrams) for analyzing data and carry it out correctly, including producing and fitting graphs.
3. Write technical reports that use appropriate language and are structured in typical format, such as including an abstract, introduction, experiment/procedures, data/results and conclusion.
4. Demonstrate improved conceptual understanding of foundational physics concepts.
5. Identify, minimize and quantify uncertainty in measurements, estimate uncertainties in calculated results, and compare with other results.
6. Develop experimental procedures to carry out an investigation to test a hypothesis.
7. Effectively function in teams to accomplish different tasks.
8. Report having a positive learning experience in the course.

Format

Pre-class questions: Each week before coming to class, you will need to complete a series of pre-class questions on Blackboard before noon am on class days. These will generally be open ended questions to help you be prepared for class and to give me feedback on where the class so I can make adjustments as needed. They will generally be available the full week before lab, and you will not be allowed to participate in the laboratory activities if you fail to complete them. Grading will be on effort; I will look for evidence that you have given the question thought rather than whether you got the "right" answer.

Laboratory sessions: You will work with an assigned partner to carry out investigations, collect data, and analyze results. Some weeks you and your partner will need to make decisions about what procedures you will follow; you will be given goals and information about equipment, but there will be some flexibility in exactly how to carry out the experiment. You will work with manual equipment and computerized data acquisition (LabView) and analyze data with a graphical package (Igor Pro). Some weeks there will be additional activities during the lab session to develop different laboratory skills

Reports: After each laboratory, you will write up and turn in a technical report describing your experiments, results and conclusions. These are to be done individually. We will build up to writing full reports over the first part of the semester, and your reports will be evaluated according to the attached rubric. Unless prior arrangements are made, these will be due by 9:00 am the day of the next lab meeting. You may turn them in earlier, in which case there will be the possibility of receiving feedback sooner.

The formal report should be prepared using a computer word processor. All data taken in the experiment should be recorded in tabular form, either in the body of the report or as an appendix. (Note: very large data sets that would require multiple pages per table may be simply represented in graphical form.). Each table should have a title, and should have headings for the rows and columns. Correct units should be indicated for the data by writing the units with the headings in the table. Single data items need not be represented in a table but they should be labeled and have the correct units listed. An example of any calculations used in the experiment should be included in the lab report. You should show the equations that you used, with at least one example where these equations have the correct numbers (with units) substituted in.

Do your own work: One of the goals is to help you develop technical writing skills, so all written work you submit MUST be your own work (properly cited short quotations excepted). Sections of text similar enough to other's work to not have arisen by chance is not acceptable. On first offence, reports may be subject point penalties. On second and subsequent offenses students may be reported to the Office of Student Conduct, and repeated offenses may result in a failing grade in the course. Students who are concerned about grammar and formatting encouraged to bring drafts of their work to the Physics Help Center in TCCW 125b, the Writing Center in Cherry Hall/Cravens Library or other similar resources for assistance in ensuring lab reports are properly written and formatted. At the instructor's discretion, students needing such assistance may be required to show proof of having a tutor review their work before submitting it.

Groups: Partners will be assigned the second week of class and will likely be re-assigned later in the semester, so you get to work with different people. Being able to work with a variety of people is an important skill. I expect you to make every effort to work out any difficulties among themselves; if after you make an intentional effort to resolve any problems they still persist, please let me know so I can mediate. Each person is responsible for their own work, including reports. You should take terms doing different jobs, as everyone will be personally responsible for having developed the designated laboratory skills at the end of the semester.

Absence policy

You are expected to attend lab every week and participate in carrying out the experiments. Reports containing data that you did not collect are unacceptable. If you know in advance you will have to miss class for a legitimate reason, contact your instructor in advance for arrangements to be made. If you miss for legitimate, unexpected reasons (such as illness), you must contact your instructor as soon as you can to arrange an opportunity to make up the work.

Laboratory Notebooks

As in good scientific practice, you should keep a good record in your notebook of your experiments. Each day you should start on a new, dated page, and your notes should have several clearly indicated sections:

Overview and procedures followed: You should first write down some notes about the lab in general, such as the physics principles to be explored and the general approach. You should record what you do in the lab at sufficient detail that you can reconstruct a description at a later time such that someone could follow the general procedure you did. There will be times that you and your partner will make choices about how to collect data, and will need to clearly describe how you did id.

Data: Record all data taken by writing it down, printing numbers and pasting them in, or printing graphs, depending on the quantity and medium.

Calculations: Time permitting, you should carry out all the calculations in your notebook before leaving the laboratory. This way, if you encounter problems you can get assistance or re-take data.

Before you leave the laboratory room, show your notes from the day for your instructor to sign.

Final Examination

A final laboratory exam will be held the last week. This will be on elements of the experiments and skills from the semester, and will count the equivalent of two reports.

Grading Policy

Your grade for Physics 256 will be based on your performance on the laboratory reports, pre-lab questions, homework and final exam according to the usual distribution, 90-100=”A”, 80-89=”B”, 70-79=”C”, 60-69=”D” and below is failing. If the final score is close to the cutoff between two letter grades, the instructor reserves the right to adjust the final grade up or down based on non-quantifiable factors such as effort and attitude.

Student Disability Services

In compliance with University policy, students with disabilities who require academic and/or auxiliary accommodations for this course must contact the Student Accessibility Resource Center located in Downing Student Union, 1074. The phone number is 270.745.5004 [270.745.3030 V/TTY] or email at sarc@wku.edu. Please do not request accommodations directly from the professor or instructor without a faculty notification letter (FNL) from The Student Accessibility Resource Center.

Schedule of labs

The laboratory order and expectations for reports will be as follows:

Day	Topic	Writing practice/submission
5/15	Introduction & Measurement Lab	grade examples
5/17	Position & Velocity	Data, graphs, questions
5/19	Acceleration	Complete data section (data, data tables, calculations, graphs, description/questions answered.
5/22	Free Fall	Complete data section including obtaining uncertainties and conclusion section.
5/24	Force Lab	Experimental procedure, Data and analysis, and Conclusion sections
5/31	Flotation and measurement	Introduction, Experimental procedure, data and analysis, conclusion sections
6/5	Friction	Introduction, procedure, data/analysis, conclusions and references submitted for **peer review, revision.**
6/7	Momentum & Impulse	Introduction, procedure, data, conclusions, references and citations
6/12	Conservation of Energy	Complete report (add abstract)
6/14	Spring Motion	Complete report.
6/19	Damped Harmonic Motion	Complete report.
6/21	Thermal Cycle	Complete report.
6/26	Lab final	

Grading Rubric for Physics 256: Lab reports will be graded out of 20 points using the following rubric. If a section is not applicable to a particular laboratory exercise, no points will be deducted.

Component	Points	Description
Identifying information	Report contains a title, name of author and partners, and date of experiment.	
	-2	Missing two or more: title, author, partners and date.
	-1	Missing title, author, partners or date.
	0	Contains title, author, name(s) of partner(s) and date of experiment.
Abstract	A brief summary of what was done, principle results, and conclusion.	
	-4	No abstract.
	-2	Abstract does not really summarize paper.
	-1	Abstract is incomplete in what was done, principle results or conclusion, OR contains extraneous or overly detailed information.
	0	Abstract succinctly summarizes report.
Introduction	Identifies the goals of the work and provides a succinct summary of physics ideas (including equations to be used) and any relevant previous work.	
	-3	Does not provide goals, physics principles nor relevant previous work.
	-2	Provides only goals, physics principles, or previous work.
	-1	Incomplete goals, physics principles or previous work.
	0	Identifies goals of the lab, summarizes the physics principles involved, and briefly discusses relevant information from previous work.
Experimental Description	A succinct description of the procedures employed to collect and analyze data.	
	-4	Missing description of what was done.
	-2	Significant information missing from description of what was done.
	-1	Incomplete description of what was done OR long/unfocused description.
	-1	Reads as instructions instead of what was done.
	0	Description of procedures that is sufficient that the reader can understand and repeat key elements of experiment w/o being excessively long or including unimportant details.
Data presentation	Numerical values of measurements and calculations are presented throughout all sections of the report in appropriate format and with appropriate information.	
	-4/-2	Report lacks any (some important) measured and/or calculated values presented numerical or graphically.
	-1	Data that would be better presented in a table is presented in text or lists.
	-2/-1	Units missing on all/some numerical values that should have units.[1]
	-2/-1	Uncertainties missing on all/some numerical values that should have units.
	-2/-1	Numerical values presented without any indication of what they are.[1]
	-1	Excessive (meaningless) numbers of digits provided for numerical values.
	0	Sufficient data and calculations presented, identified, and include appropriate units and uncertainties .

[1] Units and identifying information are preferably provided in column headings (and in some cases row headings as well) when numerical values are presented in tables.

Graphs	Well-constructed graphs are included as appropriate.	
	-4/-2	Missing all/some graphs needed to support the report's conclusions.[2]
	-2 /-1	Axis of graphs do not legibly identify quantities, including units,
	-2 /-1	Errors in formatting graph in Igor Pro (or similar programs): using lines for discrete data points or markers for fits, omitting error bars for quantities that have uncertainties (e.g. average values), poor choices for scaling.
	0	All needed graphs are present, are completely labeled, are scaled appropriately, and use good choices for markers, lines, and error bars.
Calculations and description	Calculations are carried out appropriately and adequately described.	
	-3	No description of the analysis.
	-2	Description of analysis confusing and difficult to understand.
	-1	Description of analysis incomplete or contains irrelevant information.
	-2/-1	Errors in calculations.
	0	Description of calculations, including appropriate equations, adequately describes what was done.
Results and conclusions	Identifies main results, compares with expectations and identifies possible sources of error.	
	-5	No results and conclusions.
	-4	Results and conclusion vague/incomplete and does not really discuss the specific results of the lab.
	-2	Does not compare numerical, calculated and/or theoretical results.
	-1	Errors in comparing or interpreting comparison of results.
	-1	Introduces data/results for first time in conclusion section.
	-2	Does not identify possible sources of error OR attributes them to non-specific causes such as "Human Error."
	0	States the main result of the experiment, compares numerical result to expected/theoretical value with a percent difference and measurement uncertainties, and identifies likely causes of error.
General	Report is original, readable, written in appropriate style, and proper credit given for any elements derived from other works.	
	-10	Significant parts of the report are plagiarized (derived from another work without crediting original author).
	-10	Report is based on data not taken by the author (without prior permission).
	-5	A significant amount of the report is derived from another person's work even if credit is given.
	-2/-1	Report not written in a professional manner: poorly organized/structured, uses slang or informal English (including contractions), and/or changes voice/tense.
	-2/-1	Report contains grammatical and/or spelling errors.
	0	Report is well written and organized, is based on original work, and proper credit given to any parts taken from or derived from another's work.
	+1/+2	At instructor's discretion, bonus points may be given to reports that clearly exceed expectations.

[2] If there are multiple data runs that are quite similar, it is only necessary to include a representative sample.