

General Physics Laboratory Syllabus

Teaching Assistant (TA): Refer to <http://www.phy.olemiss.edu/~broberts/> for specific TA information;

Contact: Room 104: <http://www.phy.olemiss.edu/~broberts/> for specific TA information;

Required: General Physics Laboratory Manual, 2007 - 2008 Edition; Composition Notebook; calculator, pen.

Laboratory Physicist: Ms. Beth Roberts

Contact: Room 103A or 104 ~ Tuesday, Wednesday, and Thursday from 10:00 to 11:00 AM

Professor of Record: Refer to <http://www.phy.olemiss.edu/~broberts/> for specific professor information;

Contact: Refer to <http://www.phy.olemiss.edu/~broberts/> for specific professor information;

COURSE OBJECTIVES

- To reinforce lecture material by performing experiments that emphasize fundamental concepts of physics.
- To learn the proper use of equipment.
- To learn experimental lab techniques.
- To gain an appreciation of the inherent uncertainties of all measurements.
- To improve skills in the recording of data and the writing of scientific reports.
- To understand and perform simple data analysis.

MATERIAL TO BE COVERED Experiments 1 through 14 (one experiment per week), lab calendar is posted at:

www.phy.olemiss.edu/~broberts

ATTENDANCE is required. A grade of zero is given for each assignment missed (*i.e.*, Pre-lab, Quiz, Report, Exam).

GRADE INFORMATION

Each assignment is an *individual* effort. Detailed information regarding assignments and lab policy is provided in your lab manual on page 1 through page 4. Late assignments are penalized; refer to lab policy on pages 1 through 4.

- *Pre-Lab* – A Pre-Lab is included in your lab manual for each experiment; turn it in at the beginning of class. It will be checked for completion only. If it is incomplete or late there is a 10-point penalty on the corresponding quiz grade.
- *Quiz* – A timed quiz is given for each experiment at the beginning of class.
- *Report* – A report is written for each experiment and turned in at the beginning of the next class. Equations may be neatly hand written in *ink* rather than typed.
- *Exam* – 2 math exams (due as specified on page 2 of the lab manual) and 2 practical exams (performed during the semester; dates to be announced).

Final Grade – Quiz Average, 10%, Report Average, 60%, Exam Average, 30%.

Letter Grade - ≥ 90 , **A**; ≥ 80 , **B**; ≥ 70 , **C**; ≥ 60 , **D**; < 60 , **F**.

If revisions are necessary you will be notified in writing prior to implementation of the new policy.

General Physics Laboratory Syllabus

General Physics Laboratory has the following objectives:

- To reinforce lecture material by performing experiments that emphasize fundamental concepts of physics.
- To learn the proper use of equipment.
- To learn experimental lab techniques.
- To gain an appreciation of the inherent uncertainties of all measurements.
- To improve skills in the recording of data and the writing of scientific reports.
- To understand and perform simple data analysis.

To accomplish these objectives, you will need to do the following for each experiment:

- *Before lab:*
 - i.* Read the *Advance Reading* material specified for each experiment. Each experiment refers you to particular topics, concepts, and/or terms in your textbook. Consult the *Table of Contents* or *Index* of your text to locate the information. Some experiments also require reading lab manual appendices.
 - ii.* Read and understand the *Theory* section from your lab manual. Read the *Procedure*.
 - iii.* Complete the *Pre-Lab* from your lab manual. The *Pre-Lab* will prepare you for, and enhance your understanding of, the experiment you are to perform. Turn this in at the *beginning* of lab.
- *Coming to lab:* Bring your lab manual, lab notebook (*must* be a composition notebook), pen, and scientific calculator. You will not be allowed to participate without your lab manual!
- *Beginning the lab:* A quiz is given at the *beginning* of class. If you arrive late, you may not have time to complete the quiz. Questions for the quiz will focus on the current experiment and are taken from the *Advance Reading*, *Theory* and *Pre-Lab* material.
- *During the lab:* Your TA (Teaching Assistant) will give an introduction (summary of the physics concepts and theories being investigated, equipment use, and safety rules) for each experiment. You and your partner will perform the procedure as a team. *Data* (all information and observations obtained during lab) will be recorded in your lab notebook in *ink*. Note that units for physical quantities will be important all semester. Always record the units! You will need organized data to write your report. Data tables will not generally be provided for you; make appropriate tables and charts as needed. If you make a mistake, draw a single line through the error(s) and then record again close by. *Do not* attempt to obliterate the error(s). (Note that when taking exams you will *not* have a partner! Be certain that you understand experiment procedures by changing responsibilities as you perform each experiment. Refer to page 2 for further information regarding exams.) Data must be initialed by your TA when you finish the experiment. You will need to organize your equipment and close computer software and folders prior to asking the TA to initial your data. Be sure you have and understand all pertinent information before leaving lab.
- *After lab:* Write an individual *Lab Report* (lab reports must be typed). The lab report format is provided on page 4. Most reports will *require* the insertion of one or more tables. Equations may be neatly handwritten in *ink*. Turn this in at the *beginning* of the next lab (during summer terms: 2 days after the experiment).
- *Next class meeting:* Turn in your *Pre-Lab* for the current experiment and your *Lab Report* for the previous experiment at the *beginning* of class.

General Physics Laboratory Syllabus

Resources

These requirements may seem a little overwhelming. The Physics and Astronomy Department offers support to help you succeed. Your Lab Physicist, TA, and Professors have office hours to help you with physics questions. When you require help with lab, your best resource will be your TA or Lab Physicist. However, the Department of Physics and Astronomy also provides “The Physics Learning Center” (*a.k.a.* Tutoring Room) located in Lewis Hall, Room 104. A tutoring schedule is posted early in the semester. Tutors are not available during final exams. Tutors are upper division physics majors, physics graduate students, Lab Physicists, and Professors. Note that tutoring involves helping students understand physics concepts and the proper methods for solving particular types of physics problems. Tutoring does not involve giving students an answer, as it is the process and understanding that is most important.

Self-help materials are also provided (computers with tutorials and software, physics videos, and laser disks). Please ask for assistance with equipment if needed.

Printing is not available for students in this department. It is advised that you write and print your lab report at least a day before your lab meets so that unexpected problems don't affect your grade. Late reports are penalized; refer to *General Physics Lab Policy*, page 3.

The Lab Physicist and each TA for General Physics has a website where relevant and useful information can be found. Your TA will inform you of the URL for their website. Your Lab Physicist website includes links to experiment information, the lab calendar and changes to the calendar, tutoring schedule, tutorials, and miscellaneous information. It is strongly advised that you visit your Lab Physicist web site at least weekly! The URL for your Lab Physicist is:

<http://www.phy.olemiss.edu/~broberts/>

General Information

Quiz – (100 pts. each) Quiz questions are designed to encourage you to arrive prepared for the current experiment.

Exams – There will be at least 2 math exams (100 pts. each) and 2 practical exams (200 pts each); refer to your TA syllabus for additional information. All exams are individual efforts.

The first math exam is a take-home test; the test is included in this lab manual, Appendix D. It is *due at the beginning of the 2nd class*. The second math test will be *given at the beginning of the 2nd class*. It is very important that you refresh your math knowledge, as it is a required tool for this level of physics.

The practical exams are designed to determine how well you have met the course objectives (*i.e.*, your understanding of physics concepts, proper use of equipment, lab techniques, recording of data, and data analysis) after all relevant tasks have been completed (*i.e.*, *Advance Reading, Theory, Pre-Lab, Quiz, Procedure, Lab Report*).

Lab Report – (100 pts. each) Refer to the *Lab Report Format* on page 4. Laboratory reports should be written in the passive voice and in the third person. For example, you would write “the measurement was taken” rather than “I made the measurement.” You are trying to convey how a physics concept, principle, or theory was investigated, whether or not it was consistent with the theory, and relevant sources of uncertainty inherent in the method of investigation. You do not need to write a textbook, just a clear and concise report. Lab reports must be typed.

Please spell-check and proof-read your report; proper grammar and spelling are important. Always show your work, explain your reasoning, and include the units!

Specific information for particular sections of your report can be found in the appendices (*e.g.*, the correct equation to use when comparing values for the *Results* section, sources of uncertainty for the *Discussion of Results* section, analyzing graphs for the *Equations/Graphs* section).

General Physics Laboratory Syllabus

Attendance is mandatory.

You must attend the section for which you registered. Attending another section due to academic events or illness **requires** written permission from your *Professor of Record* for physics laboratory (or the person designated by this professor). Have the permission slip signed by the TA for the section you attend due to absence, then give it to your TA when you return to your regular section. A grade of zero is given for each missed assignment (*i.e.*, pre-lab, quiz, report, exam) for which there is no permission slip. These grades will not be adjusted.

Three (3) absences for the semester will result in failing the class (a grade of F).

Honor

You will be part of a team while performing an experiment. However, each assignment (*i.e.*, pre-lab, quiz, report, exam) is an individual, not team, effort. A grade of zero will be given to every participant of unauthorized duplication. These grades will not be adjusted. Your *Professor of Record* may apply more severe penalties. Other forms of dishonesty may carry a more severe penalty.

Punctuality

We encourage you to be on time and prepared for class. Each *Quiz* and *Exam* is timed, and you may not be able to finish if you arrive late.

Late lab reports will be penalized as follows:

1. Up to 24 hours late, the penalty is 10 points.
2. 24 to 48 hours late, the penalty is 30 points.
3. No credit will be given after 48 hours.

Important Items to Know and Remember

- You must bring your lab manual to each class.
- Record data in your lab notebook in *ink*. Always record the uncertainty of each measurement and the unit for the quantity you measured or calculated.
- There is a 10-point penalty if you do not bring your lab notebook to class.
- *Always* show your work, explain your reasoning, and include units.
- Certain skills must be mastered each semester. Physics 223 requires proper *graphing* and *analysis of graphs* and correct use of the *free-body diagram solution method*. Physics 224 also requires proper *graphing* and *analysis of graphs*. The first time these skills are required each semester you will have one opportunity to correct mistakes; a grade of *incomplete, I*, will be given. If the corrections are turned in *on time*, points deducted for these mistakes will be returned. If corrections are *not* turned in on time, you will receive a grade of zero for that report.
- You must demonstrate your ability to correctly use measuring devices after they have been introduced (*e.g.*, vernier caliper, triple-beam balance).

General Physics Laboratory Syllabus

Lab Report Format

TITLE

FOCUS (10%) – In your own words:

- State the theory and the objective that are the focus of the experimental procedure.
- Define all terms relevant to the experiment.
- Explain the principles and/or theories that were investigated and how the investigation was accomplished. This does not mean to re-write the procedure! Consider, for example, *Experiment 7: Coefficients of Friction*: “To accomplish this investigation, one is required to pull the object at a constant velocity. The acceleration, and thus the net force, equals zero permitting determination of the frictional force.” Reference your results where appropriate (e.g., “Refer to Table 1, below”).
- Explain mathematical relationships in the context of how and why they were used in the investigation. Mathematical relationships would include terms such as “directly proportional to” or “sinusoidal”, not the equations themselves.

EQUATIONS/ GRAPHS (15%) –

- This section will include all equations used, the way they were used, and what the equations represent. As all calculations used should be in your lab notebook, please reference this resource. Be certain you include all equations used both for the procedure *and* for the report.
- Graphing data will require you to use *Graphical Analysis* software. Analyze each graph; refer to *Appendix B* for free download information and instructions. Attach graphs to the end of the report.

RESULTS (15%) –

- Present select, organized information, in a format provided by your TA. This is typically a table format where data, or quantities derived from data, are inserted and compared. Label each table (e.g., Table 1) and include a descriptive caption. This section emphasizes the theory and/or the objective of the experiment. You may be required to assume the responsibility of selecting the relevant information as the semester progresses.

DISCUSSION OF RESULTS (25%) –

- Discuss your results with respect to the theory and objective of the investigation (you stated both in the *Focus* section). Are your results consistent with the theory? Relate this analysis to your discussion of uncertainty and any assumptions necessary for the procedure. Note that a single experiment will not prove or disprove a theory. Theories are accepted or rejected on the basis of a large body of evidence.
- State sources of uncertainty and ways to reduce them. As stated in *Appendix A* “Systematic Error” and “Personal Error” are not valid sources of uncertainty! You will want to consider the method(s) used for the experiment, as well as any assumptions involved that may not be valid. Consider the *Coefficients of Friction* experiment: the wood surfaces are not consistently smooth (rougher in some places than others).
- Discussion topics will be supplied by your TA. Discussion topics are intended to connect concepts and theories from various experiments that have been performed.

QUESTIONS (25%) –

- Type the questions that follow each experiment. Answer the questions in your own words, using complete sentences. Always show your work, explain your reasoning, and include units.

DATA (10%) –

- Make a *photocopy* of your initialed data and attach it to the back of your report. (Failure to bring or use your lab notebook will result in a 10-point penalty on your lab report.)