General Information

Course: PHYS 2201, Physics Laboratory I, 1 credit (3 hours laboratory)
Semester: Fall 2009
Laboratory: PHYS 2201.21
Syllabus: http://theflorys.org/David.Flory/Physics_Lab_I_Syllabus_Flory.php

Corequisite: PHYS 2203, University Physics or
PHYS 2101, General Physics I (Technology only)
Requirement: Students must have an FDU WebMail account and access to WebCampus/Bb.

Lab times: Monday, 2:00 pm to 4:40 pm, Becton 203

Instructor: Prof. David Flory
Office: Becton Hall, Room 111 (In the basement)
Office Hours: Mon & Wed 1:00-2:00 pm, Tue 2:30-3:30 pm. Other times by appointment.
Mail Stop: T-BEC2-03
Telephone: 201-692-7064
Email: mailto:flory@fdu.edu
Course Description

Physics experiments drawn from mechanics and thermodynamics. Measurement, data analysis, and error analysis. Written laboratory reports.

This is the required laboratory for PHYS 2101, General Physics I, and PHYS 2203, University Physics I.

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Texts and Materials

Laboratory: *Physics Laboratory Manual, Physics I (PHYS 2201)*
Authors: Physics Staff
Publisher: School of Natural Sciences
University College
Fairleigh Dickinson University

Supplement: *Physics Laboratory Guide*
Author: David Flory, PhD
Publisher: School of Natural Sciences
University College
Fairleigh Dickinson University

Author: John R. Taylor, University of Colorado, Boulder
Publisher: University Science Books


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Laboratory Requirements

Attendance

Attendance in laboratory is required. Completion of all the scheduled experiments in the laboratory is also required which means that a missed laboratory session must be made up. See the *Physics Laboratory Guide* for details on how to arrange for make-up labs.

Students are expected to arrive on time for laboratory. Cell phones and pagers must be turned off in all classes, lab or lecture.

All assigned experiments must be completed in order for the student to receive a passing grade. At the sole discretion of the instructor, the lowest lab grade or one missed lab may be forgiven at the end of the semester. In this event a lower grade may result.

Grades

The laboratory grade will be based on the average grade for the written laboratory reports and on the general quality of the student's work in the laboratory. Extra effort in lab will result in a better grade. Lab quizzes may be given at the discretion of the instructor.

In exceptional or emergency circumstances and at the discretion the instructor, a student who has performed all the scheduled experiments but has not completed the laboratory reports may request a grade of "I" from his or her instructor. If one or more scheduled experiments have not been performed then the instructor must have permission from the course director before an "I" may be awarded because completion will require performing makeup laboratories after the close of the semester and thus requires special permission.

The University has a formal *Grade Appeal Procedure* for appealing a course grade.

Conduct

Students will generally work in teams of two. Each member of a team is expected to participate fully in performing each experiment. Part of the data taken should always be the name(s) of your lab partner(s). However, laboratory reports, like any other written work, must be your own. The raw data you use will be identical to that of your partner(s); your analysis must be independent. Your report must be based on your own data, taken by you in collaboration with your partner(s). Use of another's data without attribution is plagiarism just as use of another's words is plagiarism.

Be prepared. Read the laboratory manual before you arrive to perform a particular experiment. Lack of preparation will result in poor experimental data, lab quizzes and lower grades. Record your data in a neat planned manner. A carefully labeled data table is usually best. Data should be recorded in ink.

Do not leave the laboratory until checked out by your instructor. He or she will check your station before initialing your data sheet. The initialed data sheet indicates that you performed the experiment and properly replaced all equipment. The initials do not imply approval of the actual data. The initialed sheet must be handed in with the lab report as an appendix.
Generally, students are expected to remain in the laboratory for the entire period. If a particular experiment does not require the entire period then calculations should be begun to ensure that the data is valid and the method(s) of analysis understood. A great deal of grief can be avoided by finding problems such as failure to make a measurement before leaving the laboratory.

Students who are well prepared and work rapidly should also be prepared to go beyond the minimum specified in the manual. All experiments have places where the minimum procedure can be expanded upon by increasing the quantity or quality of data or by taking additional measurements. Students who perform the minimum procedure by taking the minimum data in the minimum time should expect to receive a minimum grade; very good or excellent work involves performance beyond the minimum.

**Equipment**

Students are expected to bring a pen, pencil, scientific calculator, and their laboratory manual with them to each laboratory session. Calculators for use in science labs should, at a minimum, be able to handle scientific notation for numbers using exponents and be able to compute the elementary transcendental functions such as \( \sin(x) \), \( \cos(x) \), and \( e^x \). The ability to compute the average and standard deviation of a set of numbers is very useful as is the ability to perform a linear regression. The Texas Instruments TI-89 is recommended.

**Reports**

Lab reports must printed with the original signed data appended. They must be neat, clear and well organized. Each report is to be printed on 8.5" x 11.0" paper. The names of your lab partners must be clearly listed. Word processors such as Microsoft Word, Corel WordPerfect, or OpenOffice.org (OOo) Writer will all work well for writing lab reports. They have the ability to create data tables and can edit complex equations if needed. Programs like Excel, MathCad, MatLab or OOo Calc will perform complex calculations and create good scientific graphs.

Each experiment will have a lab report due one week after completion of the experiment. A one-week extension may be requested. Late reports will have credit deducted. Reports may be rewritten and handed in again. They will be re-graded and the highest grade used. The only condition is that the original report must be submitted along with the re-write.

Fairleigh Dickinson University has an **Academic Integrity Policy** that each student must read and understand. It can be found in the [Academic Regulations](http://www.fdu.edu) section of the Metropolitan Campus Student Handbook on the FDU web site. Students should be aware that material downloaded from the Internet is subject to the same conditions as material copied from any other source. Lab reports must be based on your own data, taken by you in collaboration with your partners. If you did not participate in the taking of the data, use of another's data is plagiarism just as use of another's words is plagiarism.

In the laboratory, students will generally work collaboratively in teams of two or three. Each member of a team is expected to participate fully in performing each experiment. Collaboration in understanding and analyzing the results of an experiment is expected. You should always include the names of your lab partners as part of each report. However, laboratory reports, like any other written work, must be original and your own. The raw data you use will be identical to that of your partners; your analysis and the words used to discuss and analyze it must be independent. Each
member of a team must write their own lab report. Your report must be based on your own data, taken by you in collaboration with your partners. Use of another's data without attribution is plagiarism just as use of another's words is plagiarism.

Laboratory Objectives

The overall objectives of the Physics Laboratory are threefold: (1) to demonstrate and make concrete through actual experience some of the physical phenomena presented in the lecture portion of the course; (2) to present, in an actual laboratory environment, some of the methods and techniques used to investigate physical phenomenon and to test and validate physical law; and (3) to illustrate the role that experiment plays in relation to theory in the physical sciences.

The student should acquire knowledge about and understanding of...[under construction]

Specifically, after completion of the course, the student should be able to:

- Show the way science progresses from observation and classification of phenomena through model building to the development of comprehensive theories that can explain and predict and that can be tested by experiment.
- Discuss the criteria for a successful scientific theory and apply those criteria to the real world.
- Apply the methods and procedures of science through laboratory exercises and observation. Analyze simple experiments and discuss whether they support or confront a theoretical prediction.

Teaching Methods

Physics is taught as a combination of lectures and laboratory work. In the classroom the instructional method is a traditional lecture supplemented with some audio/visual materials.

Questions to the instructor about the course and its content are to be asked in class, during office hours, or using the WebCampus/Bb Discussion Board for the section. This will allow all members of the class to benefit from the answers. Email should be reserved for private questions involving items like individual grades.

In the laboratory the environment is a guided tutorial. Students will be grouped into teams of two or three which work collaboratively to perform the experiments. Each experiment will be introduced by the instructor who will then give individualized help to each team or student. The laboratory manual will provide the framework for the experiment. The instructor will further define the procedures to be followed. Individual initiative and creativity, if appropriate, will be rewarded.

Here are the activities that will result in a good laboratory experience:

- Be prepared before you come to the laboratory. Read the lab manual.
• Collaborate with other students in your group as well as the other students in the lab.
• Think critically when you make any predictions or observations.
• Follow carefully the instructions for each experiment.
• Take careful measurements. Annotate your data. Record all relevant information.
• Analyze the data and formulate your results. The analysis may involve taking averages, making graphs, fitting curves, or doing a linear regression. It will also involve analyzing the errors in the experiment.
• Examine the results to draw a conclusion. Relate the conclusion to the purpose of the experiment.
• Find the experimental uncertainty: that is, find the accuracy and precision of your results wherever possible.

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## Laboratory Schedule

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<td>(Labor Day)</td>
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<td>2</td>
<td>Introduction to Lab Procedure and Error Analysis</td>
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<tr>
<td></td>
<td>Introduction: Errors, Significant Figures, Graphs and Scientific Notation</td>
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<td>4</td>
<td>Free Fall</td>
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<td>5</td>
<td>Concurrent Forces Using a Force Table (FT)</td>
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<td>Uniform Circular Motion and Centripetal Force (CF)</td>
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<td>7</td>
<td>Conservation of Momentum and Projectile Motion: The Ballistic Pendulum (BP)</td>
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<td>Equilibrium of a Rigid Body (ERB)</td>
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<td>Non-Concurrent Forces Using a Force Board (FB)</td>
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<td>Simple Harmonic Motion (SHM)</td>
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<td>Mass Density and Archimedes Principle (MD)</td>
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<td>12</td>
<td>Make up week (Thanksgiving)</td>
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<td>Gas Thermometry (GT)</td>
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<td>Make up</td>
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