Overview

Introductory Physics Lab is taught as a companion to the Foundation in Physics I sequence (PHYS 251-3), which covers the topics of mechanics, fluids, relativity, topics in modern physics, electricity & magnetism. While this course is designed to support the material presented in PHYS252, this lab course is a separate class with separate goals.

Course Learning Goals

- Develop a better conceptual understanding of physical phenomenon through lab experimentation
- Gain initial experience with scientific method of observation, hypothesis construction, experimentation, and hypothesis refinement
- Undertake investigation by inquiry
- Gain experimental skills in error analysis, error propagation, and estimation
- Gain familiarity with experimental equipment including Vernier probes, interface and software
- Technical presentation skills

Gaining a better understanding of physical phenomena is certainly one of the goals of this class, but so it learning something about the experimental process. As much as possible, the design and execution of the experiments in this course will be left up to you.

Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Tuesday Meeting</th>
<th>Lab assignment</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Jan 3)</td>
<td>Lab Signup</td>
<td></td>
<td>email me your desired lab time</td>
</tr>
<tr>
<td>2 (Jan 10)</td>
<td>Error Analysis</td>
<td>Error Analysis</td>
<td></td>
</tr>
<tr>
<td>3 (Jan 17)</td>
<td>No Class!</td>
<td></td>
<td>Lab #1 Due Mon. 1/31 at Noon</td>
</tr>
<tr>
<td>4 (Jan 24)</td>
<td>Help Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Topic</td>
<td>Date</td>
<td>Topic</td>
</tr>
<tr>
<td>------------</td>
<td>---------------</td>
<td>------------</td>
<td>---------------</td>
</tr>
<tr>
<td>5 (Jan 31)</td>
<td>Pendulum</td>
<td>Lab #2 Due</td>
<td>Monday 2/21</td>
</tr>
<tr>
<td>6 (Feb 7)</td>
<td>No Class!</td>
<td></td>
<td>at Noon</td>
</tr>
<tr>
<td>7 (Feb 14)</td>
<td>Help Session</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 (Feb 21)</td>
<td>Diffraction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 (Feb 28)</td>
<td>No Class!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 (Mar 7)</td>
<td>Help Session</td>
<td>Lab #3 due</td>
<td>Mon. 3/14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>at 5PM</td>
</tr>
</tbody>
</table>

This schedule is tentative, and is subject to change as the quarter progresses. Please check the website for the latest information.

**Grading**

Course grades will be based on the completion of the three lab modules. Each lab module is worth a third of your grade. All lab modules will be graded based on your lab notebooks as described below. One of the fundamental goals of this course is to develop the experimental method, and much greater emphasis will be placed on the concepts, methodology, and presentation of the lab results than on the results themselves. Lab grades will be posted to the Blackboard website as soon as they are available.

**Lab Information**

Each lab has a handout, which contains formal instructions (such as they are) for completing the lab assignment. Remember that one of the goals of this course is to encourage creative thinking and problem solving. You should take this information as a guide for what we are looking for, not as definitive instructions for how to complete the labs. Feel free to try out your own ideas, particularly in consultation with a TA. There is no specific "right" way to complete one of these lab assignments, although there are a few things you can do which are certainly "wrong".

- Errors [handout]
- Pendulum [handout]
- Diffraction [handout]

You should choose a lab partner from you lab session to work with for the quarter. It is far better for you to work in a group of either two or three people. Working alone or in a larger group will only be allowed in very special circumstances.

**Lab Notebooks**

As an experimentalist, you should see your lab notebook primarily as a resource for yourself. Your only hope of understanding what you did in an experiment is to have a clear, legible, and understandable record written down in a lab notebook.

Lab notebooks should constitute an honest record of

- the purpose of an experiment (question addressed, physics "law" tested)
- what the experiment looked like and how it was done
- diagram of setup
- notes about how to do experiment
- any data taken, both raw and analyzed or refined
- analysis of data, including estimation of uncertainties
- comparison of analyzed data with hypothesis
- conclusions and speculations (particularly if things didn't work as planned)

More details on producing a clear lab notebook and specific instructions on what should be included can be found here. Even though you are working in groups, each person is responsible, and will be graded on, the content of their own lab book. Data will certainly be shared amongst
the lab partners, and you should work together on developing the analysis method, but the description and analysis narrative should be unique to each student.

Your notebooks will be due on Monday after each lab module, graded, and returned in time for your next scheduled lab session. Please do not be late. It is better for a report to be incomplete than to turn it in late. Late notebooks will receive an automatic 15% deduction, with potentially larger deductions for exceedingly late work.

Revisions

To allow you to correct errors made early in the term, you will be given the chance to revise one section of one lab writeup before the end of the term. This will be re-graded and any improvement will be reflected in your grade for that module. Your grade can only go up from a revision. Any revisions must be received by Monday Mar. 14th at 5PM, which means you can not revise your final lab. Please clearly indicate at the start of the lab which is currently being graded that a revision has been made to a previous lab. **Do not remove the previous page or otherwise cross-out the information.** Simply make a note at the top of the page that this material has been revised, and give the page number where the revised version can be found. You should never remove or destroy information in your lab notebook. Sometimes understanding how you made a mistake can be just as useful as understanding how you got the right answer.

A final word

The challenge of experimentation is to remain both organized and on task on one hand, and to be creatively playing with science on the other. The Introductory Physics Labs are intended to be both challenging and fun, and have been designed to provide you with further insight into the material you will be/have been studying in the Foundations of Physics I course. As budding experimentalists, you are now colleagues. Please let us know what you think!