PHY2049L is a one-credit lab course and requires two hours of laboratory participation per week. Its experiments address topics within the field of “Electricity, Magnetism and Optics”, and thus serve as an experimental counterpart to topics discussed in the lecture courses including PHY2044, PHY2054, PHY2049. Many topics will be treated earlier in lab syllabus than in lecture, therefore it is essential to read assigned lab manuals before coming to the lab.

The main purpose of physics laboratory is to provide “hands-on” experiences of various physical principles. Theory of a physical principle will be introduced for each experiment, and the predicted results from theory will be tested by experimental measurements. You will learn in this course how a problem in experimental physics is tackled: how to organize the investigation, collect data, analyze the data, draw conclusions and present the results in a written form.

Course Policies for General Physics Labs:

1. Final grades
   Final grades are calculated as 80% of the average lab reports and 20% of the average quizzes.

2. Total number of labs in a semester
   (a) There are 12 labs in spring and fall semesters. Students are allowed to drop their lowest grade.
   (b) There are 10 labs in summer A and B semesters. No drop is allowed.

3. Lab reports
   (a) Grading scale of lab reports:
<table>
<thead>
<tr>
<th>Grade</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>19.0---20</td>
</tr>
<tr>
<td>A-</td>
<td>18.0---19.0</td>
</tr>
<tr>
<td>B+</td>
<td>17.0---18.0</td>
</tr>
<tr>
<td>B</td>
<td>16.0---17.0</td>
</tr>
<tr>
<td>B-</td>
<td>15.0---16.0</td>
</tr>
<tr>
<td>C+</td>
<td>14.0---15.0</td>
</tr>
<tr>
<td>C</td>
<td>13.0---14.0</td>
</tr>
<tr>
<td>C-</td>
<td>12.0---13.0</td>
</tr>
<tr>
<td>D+</td>
<td>11.0---12.0</td>
</tr>
<tr>
<td>D</td>
<td>10.0---11.0</td>
</tr>
<tr>
<td>D-</td>
<td>9.0 ---10.0</td>
</tr>
<tr>
<td>F</td>
<td>&lt; 9.0</td>
</tr>
</tbody>
</table>
   (b) Students are expected to write lab reports individually from beginning to end. Lab reports copied from others including scanned pages from lab manuals are unacceptable.
   (c) Lab report should be turned in one week after the experiment is done. Points will be deducted for late lab reports in the following manner: One week late - one point, Two weeks late - three points, Three weeks or more late - ten points.
   (d) The lab will be closed during the final week of the semester. All lab reports must be turned in by the deadline which is listed just below Table 1 in the syllabus of PHY2049L.
   (e) Required format for lab report
   - Title of experiment, date experiment performed, report submission date, your name, lab section and lab instructor.
   - The purpose of the experiment.
   - A short summary of the theory underlying the experiment.
   - Experimental method and apparatus including circuit diagram in some experiments.
   - Presentation of your results including raw data and analyzed data in the forms of tables, graphs, photos, fitting plots, etc., comparison of experimental results with theoretical predictions, and error analysis.
   - Discussions and conclusions.
   - Answers to the questions listed at the end of the lab manual for each experiment.
4. **Quizzes**  
   (a) Students will take 4 closed book quizzes in each semester. Student can drop the lowest quiz, the final quiz score is the average of three quizzes. The quizzes are meant to check students’ understanding of physics concepts of previous lab reports, which might be either written or hand-on quizzes.  
   (b) Instructor will announce the quiz schedule. The quiz will be given at the beginning of the lab, therefore, it is important to be on time for each class.  
   (c) No makeup quiz is allowed unless you have a written document such as a letter from your doctor showing that you are unable to come to the lab for taking the quiz.  
   (d) Quizzes will be graded on a 20 point scale.

5. **Lab performance and maintenance**  
   (a) Students are expected to go through each lab section in the lab manual before class.  
   (b) Students should conduct the non-computerized experiments individually.  
   (c) Students should conduct the computerized experiments in a group and share the data collected. Students should follow the instructions given in the lab manual and do the preparation first, making sure that the lab setup is correct before collecting data.  
   (d) Students should check the collected data with their instructor before leaving the lab. If time permits, students are strongly encouraged to complete all required analysis and calculations for the experiment before leaving the lab.  
   (e) Students by no means should change computer settings, or use computers for any other purposes such as typing or printing lab reports.  
   (f) Students must report to their instructor any damage or loss of equipment.  
   (g) No food is allowed in the lab. Before leaving the lab students should turn off power of electronic devices, put lab instruments in order, take away drinking water bottle, paper towels, etc.

6. **Lab makeup policy**  
   (a) The lab equipment is changed once a week in spring and fall semesters, twice a week in summer semesters. Students are allowed to makeup a lab before the lab equipment is changed. Students should get permission from their instructor to makeup a lab in another lab section. The lab report should be turned in to the instructor of the original lab section along with an approval written by the instructor of the lab section in which the makeup lab is done.  
   (b) To makeup a lab after the lab equipment is changed students must have a good reason such as illness (with doctor’s letter), unpredicted event such as car accident (with police report), etc.
Computerized Experiment

Many experiments in PHY2049L are computerized using PASCO 850 universal interface and Capstone software.

1. **PASCO 850 Universal Interface**

   PASCO® 850 Universal Interface is a USB (Universal Serial Bus) multi-port data acquisition interface designed for use with any PASCO sensor and PASCO Capstone™ software. Users can plug a sensor into one of the twelve input ports on the interface, perform the necessary setup in the PASCO Capstone program, and then begin collecting data. PASCO Capstone software records, displays and analyzes the data measured by the sensor.

   The 850 Universal Interface comes with a USB cable for connecting to a computer, and a power supply (AC adapter with power cord) that converts input of 100 to 240 V AC to output of 20 V DC at 6 A.

   The 850 Universal Interface has three built-in signal generator/power outputs. One provides up to 15 watts of power and the other two provide 500 milliwatts of power each. The interface can output direct current (DC) or alternating current (AC) in a variety of waveforms such as sine, square, and sawtooth.

2. **PASCO Capstone Software**

   PASCO Capstone software is required for the 850 Universal Interface.

   Setup PASCO 850 interface and capstone software:
   (a) With PASCO 850 Interface power off make its connections to computer and to sensors required for each experiment.
   (b) Turn on PASCO 850 Interface and computer.
   (c) Log in computer using password PHY2048L for lab 1 or PHY2049L for lab 2.
   (d) Start PASCO Capstone by double clicking the symbol on computer.

   The Workbook page appears as shown in Fig. 2.

![Figure 1 PASCO 850 Universal Interface](image)
More information on PASCO 850 Universal Interface and Capstone software can be found at:

http://www.pasco.com/prodCatalog/UI/UI-5000_850-universal-interface/
http://www.pasco.com/capstone/

Figure 2  Workbook Page from Capstone
Hover the cursor over an icon, button, or other element to see a descriptive Tool Tip.