1. **Course:** PHYS 397, Applied Physics Laboratory I -- Fall 2018

<table>
<thead>
<tr>
<th>Instructor Name</th>
<th>Email</th>
<th>Phone</th>
<th>Office</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>L01: (MW 15:00 - 15:50 in TRB 101)</td>
<td>Anna Harlick</td>
<td><a href="mailto:anna.harlick@ucalgary.ca">anna.harlick@ucalgary.ca</a></td>
<td>403.220-8648</td>
<td>SB 533</td>
</tr>
</tbody>
</table>

LEC 1  MW 15:00 - 15:50  Ti Studio A/B
LAB 1  T 9:00 - 11:50  ST 029
LAB 2  T 14:00 - 16:50  ST 029
LAB 3  R 9:00 - 11:50  ST 029
TUT 1  F 10:00 - 10:50  ST 029
TUT 2  F 11:00 - 11:50  ST 029
TUT 3  F 14:00 - 14:50  ST 029

**Course Site:**
D2L: PHYS 397 L01-(Fall 2018)-Applied Physics Laboratory I

**Department of Physics & Astronomy:**
Office: Science B 605  
Phone: 403 220-5385  
Email: phasoffice@ucalgary.ca

**Note:**  
Students must use their U of C account for all course correspondence.

Phys 397 is a course that covers introduction to experimental control, data collection and analysis, fundamentals of experimental uncertainty and error propagation, and scientific communication. The laboratories cover a range of topics, from spectroscopy, through basic electronics, waves and vacuum systems.

2. **Requisites:**

See section 3.5.C in the Faculty of Science section of the online Calendar.

**Prerequisite(s):** Physics 227 and one of Physics 223 or 255 or 259.

3. **Grading:**

The University policy on grading and related matters is described in F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:
<table>
<thead>
<tr>
<th>Component</th>
<th>Weighting [%]</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory Experiments and Reports</td>
<td>40</td>
<td>see: Laboratory Schedule</td>
</tr>
<tr>
<td>Assignments</td>
<td>15</td>
<td>see: Assignment Schedule</td>
</tr>
<tr>
<td>Writing Project</td>
<td>20</td>
<td>see: Writing Project</td>
</tr>
<tr>
<td>Laboratory Exam</td>
<td>10</td>
<td>scheduled during week of December 3rd, in lab</td>
</tr>
<tr>
<td>Peer Review</td>
<td>10</td>
<td>feedback on presentations (5%) and paper (5%)</td>
</tr>
<tr>
<td>Laboratory Preparation Exercises</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

The conversion between a percentage grade and letter grade is as follows.

<table>
<thead>
<tr>
<th>Minimum % Required</th>
<th>A+</th>
<th>A-</th>
<th>B+</th>
<th>B-</th>
<th>C+</th>
<th>C-</th>
<th>D+</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>95%</td>
<td>90%</td>
<td>85%</td>
<td>80%</td>
<td>75%</td>
<td>70%</td>
<td>65%</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>55%</td>
<td>50%</td>
<td>45%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This course has a registrar scheduled final exam.

4. **Missed Components of Term Work:**

The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in *Section 3.6*. It is the student's responsibility to familiarize himself/herself/themself with these regulations. See also *Section E.3* of the University Calendar.

Missed laboratories can be make up during the week of November 26th (during regular lab slots) and individual reports on those labs have to be submitted within 7 days of the make up laboratory date. Bearing extenuated circumstances only one experiment can be made up.

Missed assignments can be submitted within 24 hours from the due date, with 20% penalty.

5. **Scheduled out-of-class activities:**

There are no scheduled out of class activities for this course.

6. **Course Materials:**

Recommended Textbook(s):


The textbook is a recommendation as it is a great, concise guide to uncertainty and introduces related concepts and terminology in a clear and consistent manner. Laboratory write-ups, with theoretical backgrounds and class notes will be posted on D2L

7. **Examination Policy:**

Notes from "Laboratory Exam Review" session are permitted during the "Laboratory Exam".

Students should also read the Calendar, *Section G*, on Examinations.

8. **Approved Mandatory and Optional Course Supplemental Fees:**

There are no mandatory or optional course supplemental fees for this course.

9. **Writing across the Curriculum Statement:**

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also *Section E.2* of the University Calendar.
10. **Human studies statement:**

   Students will not participate as subjects or researchers in human studies.

   See also Section E.5 of the University Calendar.

11. **Reappraisal of Grades:**

    A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See Section I.3 of the University Calendar.

   1. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **15 days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall immediately submit the Reappraisal of Graded Term work form to the department in which the course is offered. The department will arrange for a reassessment of the work if, and only if, the student has sufficient academic grounds. See sections I.1 and I.2 of the University Calendar.

   2. **Final Exam:** The student shall submit the request to Enrolment Services. See Section I.3 of the University Calendar.

12. **OTHER IMPORTANT INFORMATION FOR STUDENTS:**

    a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, [Mental Health Services Website](https://www.ucalgary.ca/wellnesscentre) and the Campus Mental Health Strategy website (Mental Health).

    b. **SU Wellness Center:** The Students Union Wellness Centre provides health and wellness support for students including information and counselling on physical health, mental health and nutrition. For more information, see [www.ucalgary.ca/wellnesscentre](http://www.ucalgary.ca/wellnesscentre) or call 403-210-9355.

    c. **Sexual Violence:** The University of Calgary is committed to fostering a safe, productive learning environment. The Sexual Violence Policy ([https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf](https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf)) is a fundamental element in creating and sustaining a safer campus environment for all community members. We encourage students who have experienced some form of sexual misconduct to talk to someone about their experience, so they can get the support they need. The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (svsa@ucalgary.ca) or phone at 403-220-2208.

    d. **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under Section K. Student Misconduct to inform yourself of definitions, processes and penalties. Examples of academic misconduct may include: submitting or presenting work as if it were the student's own work when it is not; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; collaborating in whole or in part without prior agreement of the instructor; borrowing experimental values from others without the instructor's approval; falsification/fabrication of experimental values in a report. **These are only examples.**

    e. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](https://www.ucalgary.ca/policies/files/policies/student-misconduct-policy.pdf).

    f. **Academic Accommodation Policy:** Students needing an accommodation because of a disability or medical condition should contact Student Accessibility Services in accordance with the procedure for accommodations for students with disabilities available at [procedure-for-accommodations-for-students-with-disabilities.pdf](https://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities.pdf).

    Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Associate Head of the Department of Physics & Astronomy, Dr. David Feder by email phas.ahugrd@ucalgary.ca or phone 403-220-8127. Religious accommodation requests relating to class, test or
exam scheduling or absences must be submitted no later than **14 days** prior to the date in question. See Section E.4 of the University Calendar.

g. **Safewalk:** Campus Security will escort individuals day or night (See the Campus Safewalk website). Call 403-220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

h. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see Legal Services website.

i. **Student Union Information:** VP Academic, Phone: 403-220-3911 Email: suvpaca@ucalgary.ca. SU Faculty Rep., Phone: 403-220-3913 Email: sciencerep@su.ucalgary.ca. Student Ombudsman, Email: suvpaca@ucalgary.ca.

j. **Internet and Electronic Device Information:** Unless instructed otherwise, cell phones should be turned off during class. All communication with other individuals via laptop, tablet, smart phone or other device is prohibited during class unless specifically permitted by the instructor. Students that violate this policy may be asked to leave the classroom. Repeated violations may result in a charge of misconduct.

k. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction (USRI) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.

### Laboratory and Class Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Laboratory Experiment</th>
<th>Lectures</th>
<th>Friday Lab Preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Sep</td>
<td></td>
<td></td>
<td>Introduction to uncertainty and measurements</td>
</tr>
<tr>
<td>- 7 Sep</td>
<td><strong>Introductory Lab (PENDULUM)</strong></td>
<td><strong>M Introduction/Uncertainty Propagation/Laboratory Reports</strong></td>
<td></td>
</tr>
<tr>
<td>10 Sep</td>
<td>- 14 Sep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 Sep</td>
<td></td>
<td><strong>W Spectroscopy</strong></td>
<td>Interferometers</td>
</tr>
<tr>
<td>- 21 Sep</td>
<td><strong>Spectroscopy</strong></td>
<td><strong>M Library Introduction (TFDL 440)</strong></td>
<td></td>
</tr>
<tr>
<td>24 Sep</td>
<td>- 28 Sep</td>
<td><strong>W X-ray diffraction</strong></td>
<td>X-ray Spectromenter</td>
</tr>
<tr>
<td>1 Oct</td>
<td><strong>Hall Effect and Magnetic Hysteresis</strong></td>
<td><strong>M Hall Effect and Magnetic Hysteresis</strong></td>
<td>Multimeters and Wiring</td>
</tr>
<tr>
<td>- 5 Oct</td>
<td><strong>Voltage Sources and Voltage Dividers</strong></td>
<td><strong>W Peer Review Process</strong></td>
<td>Resistors in Series and in Parallel</td>
</tr>
<tr>
<td>8 Oct</td>
<td></td>
<td><strong>M NO LECTURES</strong></td>
<td></td>
</tr>
<tr>
<td>- 12 Oct</td>
<td><strong>AC Measurements and Sources</strong></td>
<td><strong>W Phasors</strong></td>
<td>Introduction to Oscilloscope</td>
</tr>
<tr>
<td>15 Oct</td>
<td>- 19 Oct</td>
<td><strong>M Phasors</strong></td>
<td></td>
</tr>
<tr>
<td>19 Oct</td>
<td><strong>Waves and Superposition</strong></td>
<td><strong>M Fourier Series</strong></td>
<td>Peer Review Practice</td>
</tr>
<tr>
<td>22 Oct</td>
<td><strong>Fourier Series</strong></td>
<td><strong>W Fourier Series</strong></td>
<td></td>
</tr>
<tr>
<td>- 26 Oct</td>
<td><strong>AC Circuits Analysis</strong></td>
<td><strong>M Fourier Series</strong></td>
<td></td>
</tr>
<tr>
<td>26 Oct</td>
<td><strong>Fourier Series</strong></td>
<td><strong>W RCL Resonance</strong></td>
<td>Charging and Discharging of Capacitors</td>
</tr>
<tr>
<td>- 2 Nov</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Nov</td>
<td><strong>RLC Circuit</strong></td>
<td><strong>M Scientific Communications</strong></td>
<td></td>
</tr>
</tbody>
</table>
Lab Write-ups

Lab write-ups are prepared by the Department of Physics and Astronomy and will be posted on Desire2Learn. Each student should bring either hard or digital copy of the write-up to the lab.

Pre-labs

Pre-labs are to be completed and submitted individually in the beginning of the lab, prior to starting the experiment.

Lab Group work

When you come to the first lab session, your lab section will be organized into groups of 2 or 3 (3 is preferred). Your group will remain the same during the term. The group will work as a team, sharing tasks such as setting up apparatus, taking measurement data, and keeping a running record of the experiment. No group member should be an idle “third wheel” during the session. The intention is to finish the data taking in the 3-hour period, and also move ahead as much as possible with a single write-up for the group. Keep in mind, that at the end you will have to take an individual laboratory exam, which will test your proficiency with the equipment and measurement techniques, so you have to ensure that you have a chance to learn.

Raw Lab Notes

Prior to leaving the laboratory a copy of you results (excel file or a scan/picture of your notes) are to be submitted to your dropbox on D2L.

Lab reports

First nine laboratory experiments will require submission of a laboratory report.

Final Laboratory reports are due in the beginning of the lab, one week after the date of lab completion. Group members will meet during that week, perhaps electronically, to accomplish this. (It is possible for students to book group study space in the TFDL or EEEL). Use a word processor to write your lab report.

Each member of the group will receive the same mark. A caution: Teamwork within a single lab group is expected. However, your group should work independently of other lab groups. Unduly similar reports received from different groups could result in charges of academic misconduct against the students involved.

Results of the last laboratory experiment (Vacuum Systems) will be presented in a form of ignite style presentation (details on D2L and during class)

Lab grades

As your term work items (labs, electronic response scores and midterm test) accumulate, your marks will be posted on the Physics 397 grades website. Check this posting regularly. Missing or incorrectly posted term work scores should be reported to your TA not later than two weeks after they have been posted.

<table>
<thead>
<tr>
<th>Assignment #</th>
<th>[%] Value</th>
<th>Topic</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>Uncertainty</td>
<td>on September 17th, 2018</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Bibliography</td>
<td>on September 26th, 2018</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>Annotated Bibliography</td>
<td>on October 10th, 2018</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Phasors</td>
<td>on October 24th, 2018</td>
</tr>
</tbody>
</table>
Writing Project

You will rewrite one of your laboratory reports (any of Laboratories 2 - 8) as a formal report resembling scientific paper. This paper should include proper introduction, theoretical background, results, analysis and citations. In addition to being evaluated by a TA, the paper will be assigned anonymous peer reviewers in class who would provide reasonable critique. The instructor will act as an edition, ensuring anonymity of the process.

The choice of the laboratory has to be communicated to the instructor by submitting the paper outline (by e-mail, cc-ing all members of the group) no later than **NOVEMBER 2nd, 2018.** NOTE: This outline is graded as one of the assignments. Not everyone can write a report on the same laboratory and the topic choice is granted on the first come, first serve basis.

The first submission of the paper will be due on **NOVEMBER 19th, 2018.**

The papers with all the comments will be returned to students on **NOVEMBER 26th, 2018.**

The final paper, accompanied by the letter to the editor that includes responses to reviewers' comments and justification of the choices whether or not to include them, is due on **DECEMBER 7th, 2018.**

The paper is worth 20% of the final grade, with 5% being awarded for the first draft (one due on November 19th) and 15% awarded for the final product (10% for the final paper, 5% for the letter to the editor).

The reviewer's comments will not affect your grade. The reviewers comments, however, will be graded on their feedback under "Peer Review" section of the grading scheme.

Laboratory Exam

Laboratory exam will consist of three new experiments related to the experiments done during the semester. It is meant to test skills in designing simple experiments, setting up equipment and collecting data necessary for measurements. Details on the exam will be provided during the week of November 26th in class and during laboratory preparation sessions.

COURSE INCOMES

Students coming into PHYS 397 will be expected to:

- apply calculus, trigonometry, and algebra to solve problems;
- make physically motivated approximations;
- catalog and discuss fundamental interactions between systems;
- state and apply principles of momentum and energy conservation;
- explain how interactions between systems affect motion;
- recognize and apply basic principles of electromagnetism;

**Course Outcomes**

- Operate a voltmeter, ammeter, and oscilloscope to measure current, voltage, resistance and phase in simple AC/DC circuits
- Explain how measurement devices function including voltmeters, ammeters, and oscilloscopes
- Characterize and construct simple passive DC and AC circuits including voltage dividers, high, low, bandpass, and notch filters
- Explain the operation of laboratory instrumentation used in physics research
- Collaborate in a group to execute laboratory experiments.
- Demonstrate proper laboratory techniques including data acquisition, analysis of data and uncertainty, and safe operation of equipment
- Clearly and accurately communicate concepts and arguments in writing