



## COURSE OUTLINE

### 1. **Course:** PHYS 397, Applied Physics Laboratory I - Fall 2022

Lecture 01 : MW 15:00 - 15:50 in SB 142

| <b>Instructor</b>  | <b>Email</b>                | <b>Phone</b> | <b>Office</b> | <b>Hours</b>    |
|--------------------|-----------------------------|--------------|---------------|-----------------|
| Dr Timothy Friesen | timothy.friesen@ucalgary.ca | 403 220-6123 | SB 513        | Thurs. 1 - 2 pm |

To account for any necessary transition to remote learning for the current semester, courses with in-person lectures, labs, or tutorials may be shifted to remote delivery for a certain period of time. In addition, adjustments may be made to the modality and format of assessments and deadlines, as well as to other course components and/or requirements, so that all coursework tasks are in line with the necessary and evolving health precautions for all involved (students and staff).

#### **In Person Delivery Details:**

PHYS 397 will be offered entirely in-person. Details on each of the course components can be found below.

#### **Re-Entry Protocol for Labs and Classrooms:**

To limit the spread of COVID-19 on campus, the University of Calgary has implemented safety measures to ensure the campus is a safe and welcoming space for students, faculty and staff. The most current safety information for campus can be found [here](#).

#### **Course Site:**

D2L: PHYS 397 L01-(Fall 2022)-Applied Physics Laboratory I

Please use the D2L discussion boards for all questions on course content or logistics.

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

#### **Equity Diversity & Inclusion:**

The University of Calgary is committed to creating an equitable, diverse and inclusive campus, and condemns harm and discrimination of any form. We value all persons regardless of their race, gender, ethnicity, age, LGBTQIA2S+ identity and expression, disability, religion, spirituality, and socioeconomic status. The Faculty of Science strives to extend these values in every aspect of our courses, research, and teachings to better promote academic excellence and foster belonging for all.

The Physics and Astronomy EDI Committee acknowledges there are persistent barriers that prevent such accessibility and hinder our progress towards EDI. Our representatives (faculty, postdocs, graduate and undergraduate students) are committed to addressing any concerns and work towards proactive solutions that enact necessary change within the department. To submit anonymous questions, comments or concerns regarding EDI related issues, please reach out to our Associate Head EDI, Claudia Gomes da Rocha ([claudia.gomesdarocho@ucalgary.ca](mailto:claudia.gomesdarocho@ucalgary.ca))

### 2. **Requisites:**

See section [3.5.C](#) in the Faculty of Science section of the online Calendar.

#### **Prerequisite(s):**

Physics 229 or 325.

### 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:

| Course Component                     | Weight | Due Date (duration for exams) | Modality for exams | Location for exams |
|--------------------------------------|--------|-------------------------------|--------------------|--------------------|
| Experiments and reports <sup>1</sup> | 44%    | Ongoing                       |                    |                    |
| Lab notebook                         | 3%     | Ongoing                       |                    |                    |
| Detector project <sup>2</sup>        | 35%    | Ongoing                       |                    |                    |
| Peer evaluations                     | 3%     | Ongoing                       |                    |                    |
| Lab exam <sup>3</sup>                | 15%    | Ongoing                       |                    |                    |

<sup>1</sup> Deadlines for lab reports will be 1 week after the start of the lab.

<sup>2</sup> The project grade will be divided across the following components: Annotated literature review - 5%, Proposal - 5%, First Draft - 5%, Peer review - 5%, Letter to the editor - 5%, Final Paper - 10%.

<sup>3</sup> Lab exams will occur during your lab section the week of November 28th.

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.

|                           | A+   | A    | A-   | B+  | B   | B-   | C+   | C   | C-  | D+   | D    |
|---------------------------|------|------|------|-----|-----|------|------|-----|-----|------|------|
| <b>Minimum % Required</b> | 95 % | 90 % | 85 % | 80% | 75% | 70 % | 65 % | 60% | 55% | 50 % | 45 % |

The University of Calgary offers a [flexible grade option](#), Credit Granted (CG) to support student's breadth of learning and student wellness. Faculty units may have additional requirements or restrictions for the use of the CG grade at the faculty, degree or program level. To see the full list of Faculty of Science courses where CG is not eligible, please visit the following website: <https://science.ucalgary.ca/current-students/undergraduate/program-advising/flexible-grading-option-cg-grade>

#### 4. **Missed Components Of Term Work:**

The university has suspended the requirement for students to provide evidence for absences. Please do not attend medical clinics for medical notes or Commissioners for Oaths for statutory declarations.

In the event that a student legitimately fails to submit any online assessment on time (e.g. due to illness etc...), please contact the course coordinator, or the course instructor if this course does not have a coordinator to arrange for a re-adjustment of a submission date. Absences not reported within 48 hours will not be accommodated. If an excused absence is approved, one possible arrangement is that the percentage weight of the legitimately missed assignment could also be pro-rated among the components of the course. This option is at the discretion of the coordinator and may not be a viable option based on the design of this course.

If you feel sick, or think you might be sick, DO NOT come to the lecture/tutorial/laboratory. Please contact the instructor and your TA as soon as possible to inform them that you will not be able to attend your lab. You will not be penalized for missing a lab due to illness and arrangements will be made on a case-by-case basis. You should also inform your group of the situation as soon as you can.

#### **Missed Laboratory**

If you expect you will miss a scheduled laboratory session please email your assigned TA and CC the course instructor as soon as possible. It is imperative to inform your group and your TA as soon as possible so that alternative arrangements can be made.

If you unexpectedly miss your scheduled laboratory session, please email your TA and CC the course instructor within 48 hours after the date of the missed lab. Students are NOT allowed to attend a lab section different than their own without prior approval.

#### 5. **Scheduled Out-of-Class Activities:**

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

#### 6. **Course Materials:**

Assignments, laboratory documents, and supporting lecture material will be posted on the course D2L website.

In order to successfully engage in their learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

- A computer with a supported operating system, as well as the latest security, and malware updates;

- A current and updated web browser;
- Webcam/Camera (built-in or external);
- Microphone and speaker (built-in or external), or headset with microphone;
- Current antivirus and/or firewall software enabled;
- Stable internet connection.

For more information please refer to the UofC [ELearning](#) online website.

## 7. Examination Policy:

There is no registrar scheduled final exam in this course.

The laboratory exam will be an individual in-person evaluation of lab skills and knowledge.

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.

- Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **ten business 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 submit the Reappraisal of Graded Term work [form](#) to the department in which the course is offered within 2 business days of receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. See sections [I.1](#) and [I.2](#) of the University Calendar
- 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:

- 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](#)) and the Campus Mental Health Strategy website ([Mental Health](#)).
- SU Wellness Services:** For more information, see their [website](#) or call [403-210-9355](#).
- Sexual Violence:** 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](mailto:svsa@ucalgary.ca)) or phone at [403-220-2208](#). The complete University of Calgary policy on sexual violence can be viewed [here](#).
- Misconduct:** Academic integrity is the foundation of the development and acquisition of knowledge and is based on values of honesty, trust, responsibility, and respect. We expect members of our community to act

with integrity. Research integrity, ethics, and principles of conduct are key to academic integrity. Members of our campus community are required to abide by our institutional [Code of Conduct](#) and promote academic integrity in upholding the University of Calgary's reputation of excellence. Some examples of academic misconduct include but are not limited to: posting course material to online platforms or file sharing without the course instructor's consent; submitting or presenting work as if it were the student's own work; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; borrowing experimental values from others without the instructor's approval; falsification/fabrication of experimental values in a report. Please read the following to inform yourself more on academic integrity:

[Student Handbook on Academic Integrity](#)  
Student Academic Misconduct [Policy](#) and [Procedure](#)  
[Faculty of Science Academic Misconduct Process](#)  
[Research Integrity Policy](#)

Additional information is available on the [Student Success Centre Academic Integrity page](#)

e. **Academic Accommodation Policy:**

It is the student's responsibility to request academic accommodations according to the University policies and procedures listed below. The student accommodation policy can be found at: <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Accommodation-Policy.pdf>

Students needing an accommodation because of a disability or medical condition should communicate this need to Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities: <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Accommodation-for-Students-with-Disabilities-Procedure.pdf>.

Students needing an accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, by filling out the [Request for Academic Accommodation Form](#) and sending it to Dr. David Feder by email [phas.ahugrd@ucalgary.ca](mailto:phas.ahugrd@ucalgary.ca) preferably 10 business days before the due date of an assessment or scheduled absence.

f. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIP). 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.

g. **Student Union Information:** [SU contact](#), Email SU Science Rep: [sciencerep1@su.ucalgary.ca](mailto:sciencerep1@su.ucalgary.ca), [Student Ombudsman](#)

h. **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.

i. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or [non-academic misconduct](#), in addition to any other remedies available at law.

## Additional Information

### Course description

The goal of this course is to develop experimental physics skills including experimental control, data collection and analysis, experimental uncertainty, and scientific communication. Laboratory experiments cover a range of topics including oscillations and waves, basic electronics, and vacuum systems.

### Lectures

Monday and Wednesday lectures will be used to cover physics topics needed for the labs as well as report writing

and scientific communication skills. See the schedule below for an overview of the topics each week.

## Tutorials

Friday Tutorial sessions will give you a first introduction to the apparatus for the following week's lab. A TA will be present to answer questions and provide clarifications about the following week's lab and ensure you are prepared. You will be expected to be fully prepared and be familiar with the apparatus before starting each laboratory experiment.

## Laboratory Experiments and Reports

Laboratory experiments and reports will be completed in groups of 2 or 3. These groups will stay the same throughout the term unless adjustments are required. Laboratory reports are due **1 week from the start of the lab**. Reports are completed as a group with equal contributions from each group member.

Laboratory manuals will be available on D2L. Each individual student must read over the laboratory exercise, understand the concepts, procedure, and how to use the apparatus before their lab. Each laboratory exercise is accompanied by Pre-lab Questions that each student must complete **individually** and submit to D2L before the start of their lab.

## Laboratory notebook

Each student is expected to keep a laboratory notebook (electronic or hard copy). Prior to leaving each laboratory a **pdf** copy of your notes must be submitted to the relevant notebook folder on D2L. These notes must be in pdf format, either converted from another digital format (eg. Excel or Word) or as a scan/picture of your notes.

Taking detailed notes is a critical element of experimental physics. These notes should include a detailed record of the steps performed (in this case anything not clearly laid out in the lab manual), important parameters, observations, challenges encountered, or anything else that may be relevant. All data should be kept, even if it is believed to be taken with errors. You never know what data may be useful or what parameters you may need to refer to in your report.

## Scintillation Detector project

In addition to the regular weekly labs, you and your group will complete a term project based on portable scintillator detectors. You will propose and execute an experiment using these detectors and write an academic paper with your findings. This is intended as a group research project and you will be required to seek out primary sources and learn new physics concepts outside of class. Some supporting materials will be provided and support will be provided by the instructor and your lab TAs.

The first step will be to conduct a literature review by seeking out and reading background materials in preparation for your envisioned project. An annotated list of references will be due on **October 10<sup>th</sup> at 21:59**. Each reference must include a concise summary of each reference and explanation of its value or relevance. This will be an individual assignment.

Following the "Scintillation detectors" lab your group will be assigned times with a pair of detectors. During these times you are free to take the detectors out of the lab and experiment with them on your own. During this time you and your group will develop an experimental proposal that must be submitted by **October 24<sup>th</sup> at 21:59**. A TA will review your proposal and provide feedback.

You will complete your proposed experiment and write it up as a scientific paper. The first draft of the paper must be submitted by **November 14<sup>th</sup> at 21:59**.

**Peer review:** The course instructor will act as a journal editor and assign your paper to anonymous reviewers that will include other students as well as a TA. Details on how to act as a peer reviewer will be discussed during lectures. The peer reviewers' comments will not affect your project grade. The reviewers' comments, however, will be graded on their feedback. Peer reviews will be returned on November 21<sup>st</sup>. 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 5<sup>th</sup> at 21:59**.

The grades for the Scintillator detector project will be broken down as follows (as a percentage of final course grade):

|                             |    |
|-----------------------------|----|
| Annotated literature review | 5% |
| Proposal                    | 5% |
| First draft                 | 5% |

|                      |     |
|----------------------|-----|
| Peer review          | 5%  |
| Letter to the editor | 5%  |
| Final paper          | 10% |

## Peer evaluation

Experimental physics is almost never done alone and working effectively together in a group is a key skill (as it is outside the lab!). The majority of the grade components in PHYS 397 are from group work but each of those grades will be weighted by a peer evaluation from your group members. During the term you will fill in peer evaluations of each of your group members as well as a self-evaluation. Completion of all peer evaluations throughout the term will be worth 3% of your final grade.

These evaluations will then be used to weigh your final Experiments and reports and Detector project grades.

## Lab exam

The laboratory exam will consist of a set of lab skill and content questions. The exam will be in your laboratory time slot during the week of Nov. 28<sup>th</sup> in your regular lab room. Further details on the exam will be provided following Reading week and there will be a review tutorial session on the Friday preceding the Lab exams.

## Course Schedule

| Week starting | Laboratory experiment   | Lecture Content (Monday + Wednesday)                      | Friday Tutorial      | Detector project deadlines                       |
|---------------|-------------------------|---|----------------------|--|
| 2022-09-05    | No labs                 | Intro (Wed. Sept. 7th)                                    | Pendulum             |  |
| 2022-09-12    | Pendulum I              | Measurement uncertainty, library introduction             | No tutorial          |  |
| 2022-09-19    | Pendulum II             | Report writing, scintillation detectors                   | DC circuits          |  |
| 2022-09-26    | Scintillation detectors | Cosmic rays, DC circuits                                  | Holiday, no tutorial |  |
| 2022-10-03    | DC circuits             | DC circuits   | Voltage dividers     |  |
| 2022-10-10    | Voltage dividers        | AC waveforms and phase                                    | AC measurements      | Annotated literature review.<br>Tuesday 21:59.   |
| 2022-10-17    | AC measurements         | Oscilloscope and AC circuits                              | RLC circuits         |  |
| 2022-10-24    | RLC resonant circuits   | Switches and logic  | Switches             | Experimental proposal.<br>Monday 21:59.          |
| 2022-10-31    | Switches                | Detector project discussion                               | Open detector time   |  |
| 2022-11-07    | Reading Week            |   |                      |  |
| 2022-11-14    | Vacuum Technology       | Peer review discussion, vacuum systems                    | Open detector time   | First draft.<br>Monday 21:59.                    |
| 2022-11-21    | Make-up labs            | CERN antimatter factory virtual tour, lab exam discussion | Lab exam review      | Peer review.<br>Monday 21:59.                    |
| 2022-11-28    | Lab exams               | Final paper and letter to editor discussion               | No tutorial          |  |
| 2022-12-05    | No labs                 | Wrap up   | No tutorial          | Final paper + Letter to Editor.<br>Monday 21:59. |

## Course Incomes:

Students coming into PHYS 397 will be expected to:

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

## 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

Electronically Approved - Sep 02 2022 15:43

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**Department Approval**