# Experimental Physics II Syllabus

## Department of Physics and Atmospheric Science

### PHYC 3010 Winter 2026

*Dalhousie University operates in the unceded territories of the Mi'kmaw, Wolastoqey, and Peskotomuhkati Peoples. These sovereign nations hold inherent rights as the original peoples of these lands, and we each carry collective obligations under the Peace and Friendship Treaties. Section 35 of the Constitution Act, 1982, recognizes and affirms Aboriginal and Treaty rights in Canada.*

*We recognize that African Nova Scotians are a distinct people whose histories, legacies, and contributions have enriched the part of Mi'kma'ki known as Nova Scotia for over 400 years.*

## Course Instructors

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## Course TA

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## Course Description

This course is designed to give the students a chance to do a combination of both set and non-set experiments to expose them to the challenges of experimentation and to give experience in overcoming these challenges. Original approaches by the students are encouraged. As each student only completes four experiments, the goal is for them to achieve a deep understanding of a few physical phenomena.

*Course Prerequisites*

PHYC 3000 with a minimum grade of B, or permission of the instructor.

## Student Resources

Resource for the course will be provided on Brightspace. This included a detailed lab manual with resources and references.

There are excellent technologists in the Department who are available to help you

Jon MacDonald: Electronics, computer and software issues, Dunn 206B
Andy George: Materials and experimental equipment, Dunn B10
Kevin Borgel and Dean Grijm: Liquid nitrogen and Machine Shop, Dunn B01A and B18

## Course Structure

*Laboratories*

Attendance is mandatory for all lab sessions. A student declaration of absence must be submitted if you are unable to attend. If the time allocated during the regular lab sessions is not sufficient to finish an experiment, arrangements can be made to have access to the lab outside of the scheduled lab periods. However, assistance by the instructors during these times cannot be guaranteed.

The students' first three experiments will be chosen from a list of five experiments where the apparatus has been tested and is nearly ready to go. Students explore different aspects of experimental physics and data analysis. The second half of the term is dedicated to a project approved by the instructor well in advance of its start.

*Lab Notebooks*

Lab work will be documented in Microsoft OneNote Class Notebook.

*Lab Schedule*

| Week | Date | | Report Due Dates |
|---|---|---|---|
| 1 | Jan 07 | Introduction | |
| 2 | Jan 12 | Experiment 1 | |
| 3 | Jan 19 | Experiment 1 | |
| 4 | Jan 26 | Experiment 2 | Experiment 1 lab brief |
| 5 | Feb 02 | Experiment 2 | Project proposal |
| 6 | Feb 09 | Experiment 3 | Experiment 2 lab brief |
| | Feb 16 | Reading Week | |
| 7 | Feb 23 | Experiment 3 | |
| 8 | Mar 02 | Project | Experiment 3 lab brief |
| 9 | Mar 09 | Project | Peer review |
| 10 | Mar 16 | Project | Student presentations |
| 11 | Mar 23 | Project | |
| 12 | Mar 30 | Project | |
| 13 | Apr 06 | Project - last day of lab | Project report |
| | Apr 11 to 27 | EXAM PERIOD | Student presentations TBD |

## Assessment

Grading will base on both individual and group work, as indicated in the table below. Electronic lab books will be marked weekly. The lowest three grades will be dropped. After each of the first two experiments, each student will submit a lab brief. The first lab brief will be dropped if the student improves on the second brief. The goal of the lab briefs is to help the students develop their scientific writing and the presentation of their data in preparation for the lab report and project report. Each lab group will submit a lab report after their third experiment. The lab reports will undergo a peer review process. The peer evaluation grade will be based on the student's critique of one of their peer's lab reports. Students will present their report during in-class presentations following the peer review process.

| | Grade | Method 1 | Method 2 |
|---|---|---|---|
| Notebooks | Group | 5% | 5% |
| Peer evaluation | Individual | 5% | 5% |
| Lab brief 1 | Individual | 15% | - |
| Lab brief 2 | Individual | 15% | 30% |
| Lab report | Group | 20% | 10% |
| Project report | Group | 20% | 30% |
| Oral Presentation | Group | 10% | 10% |
| Poster presentation | Group | 10% | 10% |
| | | 100% | 100% |

Conversion of numerical grades to final letter grades follows the Dalhousie Grade Scale

| | | | |
|---|---|---|---|
| A+ (90-100) | B+ (77-79) | C+ (65-69) | D (50-54) |
| A (85-89) | B (73-76) | C (60-64) | F (0-49) |
| A- (80-84) | B- (70-72) | C- (55-59) | |

## Course Policies on Missed or Late Academic Requirements

- For each missed lab session: - 5% on the corresponding report
- For each day late on lab brief or lab report: - 10 %
- Late peer review: - 5%

## Course Policies related to Academic Integrity

The lab reports that you submit reflect your understanding and your problem-solving and communication skills. A recent report on *cognitive offloading* by *Kosmyna et al.* at MIT[1] find that users who habitually use AI to perform tasks that require critical thinking gradually accrue a *cognitive deficit*. The use of artificial intelligence (AI), including large language models such as ChatGPT to write your reports **is forbidden** as the use of these tools to short-circuits the development of your communication skills. The use in AI in fitting and analyzing your data is discouraged. However, you may use AI to help in writing code for the data analysis (*e.g.,* to create a code snippet to aid in plotting your data, such as the examples provided in the lab manual). **You must disclose** any use of AI explicitly in your code as well as in your lab briefs or reports.

## Learning Objectives

The following is a detailed list of learning outcomes for PHYC 3010 based on those recommended by a report from the American Association of Physics Teachers.[2]

### Constructing Knowledge

- Generate scientific questions
- Understand limitations of experiments
- Devise falsifiable models or hypotheses
- Identify the most important physics concepts in an experiment
- Disseminate results in an ethical and professional manner

### Modelling

- Choose an appropriate conceptual framework
- Ability to switch between multiple models
- Understand assumptions, limitations, and simplifications in a model
- Understand the need for instrument calibration
- Be able to estimate both input and output parameters of a model using appropriate units

### Designing Experiments

- Take into account the type, amount, and accuracy of data needed to test a model or hypothesis
- Read the literature to understand existing models and best experimental designs

[1] https://www.media.mit.edu/publications/your-brain-on-chatgpt/

[2] J. Kozminski, *et al.* "Recommendations for the Undergraduate Physics Laboratory Curriculum", Tech. Rep. (Subcommittee of the AAPT Committee on Laboratories, 2014).

- Define the scope of a project so goals can be reasonably achieved with limited resources
- Design and construct apparatus for experimental investigations, accounting for constraints (time, resources, etc.)
- Troubleshoot and refine measurements
- Understand equipment limitations, including potential systematic errors
- Think systematically and apply physical principles to experiment design
- Reflect on results and improve experimental design
- Work effectively in small groups
- Plan and guide complex projects from initial formulation to completion

**Developing Technical and Practical Lab Skills**

- Demonstrate understanding of measurement equipment and its limitations to make accurate and precise measurements
- Make measurements using several standard techniques
- Demonstrate ability to use computer interfacing for data acquisition
- Maintain a professional-level lab notebook
- Explain the operation of scientific equipment in terms of fundamental physical principles and quantitatively describe its performance criteria

**Analyzing and Visualizing Data**

- Perform computer-assisted data analysis
- Select appropriate graphical representations and extract information from plots
- Perform uncertainty analysis using professional standards
- Identify when and how to exclude data

**Communicating Physics**

- Construct a scientific argument using standard elements of technical communication, including tables, plots, and figures
- Develop scientific arguments from clearly stated questions to evidence evaluation and formulation of sound conclusions
- Demonstrate ethical presentation and reporting of evidence

# University Policies and Statements

Dalhousie University policies and statements are posted on Brightspace together with a copy of syllabus.