Experimental Physics I Syllabus

Department of Physics and Atmospheric Science

PHYC3000 Fall 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 Instructor(s)

Name	Email	Office Hours
Chongyin Yang	c.yang@dal.ca	Thursdays, 1:00–2:00 pm, Dunn 320. Other times available by appointment via email.
Yue Cao	yue.cao@dal.ca	Available by appointment via email, Dunn 316

Course Description

This course introduces students to electronics and measuring techniques. Topics include digital electronics: logic gates, clocks, shift registers, counters, memory; analog electronics; R.C.L. circuits, operational amplifiers; electronic systems: A/D and D/A chips, computer chips, and displays. The course also introduces students to modern data acquisition methods (including LabVIEW), skills which will be applied in the design and execution of experiments that illustrate fundamental concepts in physics. This course is open to Honours students only.

NOTES: This course has no final examination.
Student evaluation is through the performance on 5 assignments, 2 tests, 5 laboratory periods, 7 LabVIEW tutorials, and a final term project.

Course Prerequisites

PHYC 2150.03 and PHYC 2515.03, or permission of the instructor.

Course Exclusions

Credit cannot be obtained for both PHYC 3000A and PHYC 3340A

Student Resources and Course Materials

There is no required textbook for this course. All lecture notes will be made available to students.

Suggested references: "Introductory electronics for scientists and engineers", 2nd Edition, by R. E. Simpson, Allyn and Bacon, Inc. 1987, ISBN 0-205-08377-3. It is out of print. There is a copy in the lab room 107 and a copy in the Physics office for approximately 2 h loan in exchange for your Dal card. The class notes are very detailed, complete with some examples. Additional examples can be found online.

Course Structure

Course Delivery

In-person.

Lectures alternating with laboratories
Wednesday 11:30 am – 2:30 pm, starting with a lecture on Sept 9th 2026
LSC Common Area 234 (lectures) and Dunn room 107 (laboratories).

LabVIEW Lectures and tutorials, and project
Friday 11:30 am – 2:30 pm, starting on Sept 11th, 2026
LSC Common Area 234 (7 lectures and tutorials) and Dunn room 107 (6 lab sessions for the project)

Learning Objectives

1) To understand basic concepts in analog electronics.

2) To know how to use a digital multimeter, an oscilloscope with probes, function generator, a protoboard, and their limitations.

3) To design and build simple electronic circuits on a protoboard.

4) To test and trouble shoot the circuits using equipment listed in 2)

5) To perform PC interfacing with laboratory instruments with the objective of measuring a physical parameter such as temperature, magnetic field, light irradiance as a function of time.

Assessment

Component	Weight	Notes
Electronics component		
• Assignments (best 4 out of 5):	25 %	Normally due 7 days later.
• Laboratories (5 sessions):	5 %	
• Two tests 15 % each:	30 %	Circuit construction/troubleshooting
• Sub total:	60 %	
LabVIEW component		
• Tutorials (7):	7 %	
• Experimental physics project and term paper:	33 %	
• Sub total:	40 %	
TOTAL:	**100 %**	

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

*(*for graduate courses, be sure to include the graduate 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

- Late assignment (8:36 onward) will receive a mark deduction of 10 %/24 hour and after 48 hours a mark of zero.
- If one week, an assignment is not submitted and the submission of the *Student Declaration of Absence form* is not submitted then the assignment will count as zero toward the calculation of the final grade.

- Collaboration on assignments: It is expected that students discuss together assignments problems on how to solve problems! However, your submitted assignment represents your own work.
- Note that a total of two (2) *Student Declaration of Absence forms* can only be used throughout the term.
- If a test cannot be done at the schedule time and the *Student Declaration of Absence form* is submitted via email to c.yang@dal.ca, then the test will be rescheduled at a mutually agreed time. Otherwise, a grade of zero will be attributed to the test.
- A missed (or fraction thereof) LabVIEW tutorial will receive a mark deduction of 1 % toward the final grade.
- A missed LabVIEW tutorial must be made up before the next tutorial. Otherwise, a penalty of 4 % toward the final grade will apply.
- An *electronic copy* of the LabVIEW term paper should be submitted to c.yang@dal.ca before Wed Dec 18th at 17:00 AST.
- Late LabVIEW submission (17:01 AST onward) will receive a mark deduction of 10 %/24 h.

Course Policies related to Academic Integrity & Artificial Intelligence

It is an academic offense to copy someone else solution. It is very easy to tell if copying occurred. Allegation of copying will be submitted to an Academic Integrity Officer of the Faculty of Science for evaluation and possible sanction. Minimum sanction: Zero on the assignment (6.25 % toward the final grade) which must be included in the calculation of the final grade and 5 % grade penalty toward the final grade. When caught, cheating is costly.

Course Content

1 Introduction to electronics measuring techniques.

Module 1: Direct Current (DC) Circuits

1.1 Ohm's and Kirchhoff's Laws, and Circuit Analysis
1.2 Voltage Divider and Thevenin's Theorem
1.3 Circuit Loading and Input and Output Resistance
1.4 Instruments

Module 2: Charging and discharging of a capacitor

2 Charging and Discharging of a Capacitor

Module 3: Alternative Current (AC) Circuits

3.1 Introduction to AC Circuits
3.2 Circuits and the Bode Plot
3.3 LRC Resonant Circuits
3.4 Measurement of |A| and Phase Angle
3.5 The Scope Probe - Another Form of an RC Circuit
3.6 Transformers

Module 4: Diodes and their Applications

4 Diodes and Their Applications

Module 5: Operational Amplifiers

5.1 Introduction to Op-Amps and Circuit Analysis
5.2 Non-Inverting Op-Amp and Difference Op-Amp
5.3 Current Op-Amp and "Math" Op-Amps
5.4 Op-amp Comparator and the Schmitt Trigger
5.5 Low Pass, High Pass, and Band Pass Filters Revisited
5.6 Second Order Low Pass Op-Amp Filter
5.7 Second Order Sallen Key Low Pass and High Pass Filters
5.8 Chebyshev, Butterworth, and Bessel Filters
5.9 Op-Amp Imperfections - Input Bias Current and Input Offset Voltage
5.10 Op-Amp Imperfections: The Op-Amp Frequency Response and the Common Mode Gain

2 Introduction to graphical programming using LabVIEW and computer interfacing to laboratory instruments and sensors.

The topics are:

2.1 The LabVIEW environment.
2.2 The Hall effect and virtual instrument.
2.3 Temperature sensors and data loggers using the LabVIEW structures.
2.4 Curve fitting and data analysis using arrays and clusters.
2.5 LabVIEW strings; the language of computer interfacing.
2.6 The stepping motor controller using the National Instrument Data Acquisition (DAQ) card.
2.7 Fluke 45 DMM and the IEEE 488 (GPIB) parallel communication port.
2.8 Sampling of time varying signals using the DAQ Card. The sampling theorem.

Syllabus Appendix

Syllabus Appendix: Student Supports & University Statements, Policies, and Guidelines