DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus
Department of Physics and Atmospheric Science
PHYC 3340A
Electronics
Fall 2022

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

We acknowledge the histories, contributions, and legacies of the African Nova Scotian people and communities who have been here for over 400 years.

Instructor: Daniel Labrie   Daniel.Labrie@dal.ca

Office hours*: In person*: Any time after lectures to answer questions related to class materials or assignments.
Team's meeting: An invitation will be sent to the student for a meeting at a mutually agreed time.
E-mail: It will be used only to provide one-line answer to questions. I will respond within 24 hours.

Lectures: MWF 15:35 – 16:25, Dunn room 135.

Electronics Laboratories: 1 workshop and 9 labs, 3 hours each to be held in Dunn room 107.
Mondays 11:35 – 14:25 starting on Sept 19, 2022.

Course delivery: Whenever possible in-person. The Electronics lectures have been recorded and available on the course Brightspace. I strongly encourage you to watch them outside lecture time.
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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.

NOTES: This course has a final examination.
Student evaluation is through the performance on 1 workshop, 9 assignments, 10 Electronics labs, 10 quizzes, 2 tests, and a final examination.

Course Prerequisites

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

Course Exclusion

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

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Learning Objectives

1)   To understand basic concepts in:

- *analog and digital electronics,*

2)   With the assistance of resource people, the student will be able:

- *To design, and build some simple electronic circuits used in a research laboratory*

Course Materials

- *Suggested textbook:*
  "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.

- *Laptop and mobile device (eg, cell telephone) are required for this course.*
  If necessary, the mobile device will be used as a document camera with the laptop to communicate written problem solution on paper to the rest of the class during tutorials.

- *Brightspace course page: PHYC 3340 & PHYC 3000 – Electronics (Sec 1) – 2022 Fall*

Course Content

Time permitting the topics are:

List of modules on Electronics, videos, and class notes within Brightspace

Module 1:   Direct Current (DC) Circuits

Videos: 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

Video: 2 Charging and Discharging of a Capacitor

Module 3:   Alternative Current (AC) Circuits

Videos: 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**

Video: 4 Diodes and Their Applications

Module 5:   **Operational Amplifiers**

Videos: 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

Module 6:   **Oscillators and Monostables**

Video: 6. Oscillators and Monostables

Module 7:   **Combinational Logic**

Videos: 7.1 Boolean Algebra and Gates
7.2 Application of Digital Gates
7.3 Design of a Digital Network and Circuit
7.4 The Digital Die
7.5 The Karnaugh Map
7.6 The Seven Segments Display

Module 8:   **Sequential Logic**

Videos: 8.1 Basic Unit of Memory - The RS Flip Flop (FF) and Its Variations
8.2 Edge-Triggered FFs
8.3 Ripple Counters
8.4 Synchronous Counter
8.5 Counters and Other Digital Circuits

Module 9:   **ADC – DAC Conversion**

Videos: 9.1 ADC and the Sampling Theorem

9.2 DAC and Analog Circuits
9.3 ADC Circuits, and Sample and Hold Circuits
9.4 Commercial ADCs and NI Data Acquisition Cards

Approximate schedule: *Half the term will be dedicated to Analog Electronics while the remaining half of the term will be on Digital Electronics. A detailed week by week schedule is provided on the Brightspace course page.*

Course Assessment

Component	Weight	Date
Electronics component		
• Electronics Workshop:	3 %	Monday Sept 19th from 11:35 – 14:25
• Electronics Laboratories:	5 %	Mondays from 11:35 – 14:25
• Assignments (best 8 out of 9):	15 %	weekly due on Fridays at 15:35
• Quizzes (best 9 out of 10):	10 %	weekly on Wed from 15:35 to 15:50
• Two tests 15 % each:	30 %	to be held on Fri Oct 21st and Mon Dec 5th from 15:35 – 16:25
• Final examination:	37 %	TBD by the registrar
TOTAL:	**100 %**	

Conversion of numerical grades to Final Letter Grades follows the <u>Dalhousie Common Grade Scale</u>

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

Course Policies

- Late assignment will receive a mark deduction of 10 %/calendar day 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. In the event that the *Student Declaration of Absence form* is submitted, all the graded assignments will be used 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, 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 (2.5 % 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.

- If one week, a quiz is not submitted and the *Student Declaration of Absence form* is not submitted then the quiz will count as zero toward the calculation of the final grade. In the event that the *Student Declaration of Absence form* is submitted, all the graded quizzes will be used toward the calculation of the final grade.

- 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, 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) Electronics lab will receive a mark deduction of 1 % toward the final grade.

Assignment Policies

- **Assignments are due on Fridays at 15:35 on the due date.**

- **Late assignments will receive a 10 %/calendar day deduction for two days and then it will not be marked.**

In order to facilitate marking of the assignments, please follow these guidelines:

1) Use 8 1/2" x 11" paper.

2) Write clearly. Can the lecturer read the solution?

3) Start each question on a new sheet of paper.

4) Clearly indicate the question number at the top right-hand corner of the page.

5) Use the same numbering as in the assignment sheet.

6) Whenever applicable, give the answer to three significant digits in either fixed or scientific notation.

7) Show the full solution to the problem; not only the answer. The TA wants to see that you understand the problem.

8) Submit your assignment with a cover sheet clearly showing your name, class number and assignment number.

9) Arrange your answers to the questions in the same order given in the questionnaire. Otherwise, the solutions will not be marked.

10) Submit a *paper copy* for in person class (or a single PDF file if the classes have moved online) where all the solutions are oriented in the *up position*. Otherwise, the solution(s) will not be marked.

11) Please *verify* your paper copy (or PDF file) before submission to make sure that it follows the above guidelines.

- **Your assignment mark is <u>final</u> unless the above guidelines are followed.**

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.
Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).
Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.
Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness
Statement: http://www.dal.ca/cultureofrespect.html

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).
Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)

https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&chapterid=-1&topicgroupid=31821&loaduseredits=False

University Grading Practices

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

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Student Resources and Support

Advising

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports

Library: https://libraries.dal.ca/

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Copyright Office: https://libraries.dal.ca/services/copyright-office.html

Fair Dealing Guidelines https://libraries.dal.ca/services/copyright-office/fair-dealing.html

Other supports and services

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html

Student Advocacy: https://dsu.ca/dsas

Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Safety

Biosafety: https://www.dal.ca/dept/safety/programs-services/biosafety.html

Chemical Safety: https://www.dal.ca/dept/safety/programs-services/chemical-safety.html

Radiation Safety: https://www.dal.ca/dept/safety/programs-services/radiation-safety.html

Scent-Free Program: https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html

Dalhousie COVID-19 information and updates: https://www.dal.ca/covid-19-information-and-updates.html