Physics 229, Fall 2023

INTRODUCTION TO EXPERIMENTAL PHYSICS

Course Number: 12780, Section A01
Course Instructor: Andrew MacRae (macrae@uvic.ca)
Office Hours:
In Person: *Thursdays 1-2:30pm*
Online (Zoom): *Available upon request*
Lectures: Monday and Thursday 10:00-10:50, ECS 104
Lab Sections: (All Labs held in Elliott 139)

B01: Monday/Thursday 11:30-1:20
Instructor: *Swapnil Daxini (sdaxini@uvic.ca)*

B03: Wednesday/Friday 1:30-3:20
Instructor: *Jamal Mohammad Khani (mohammadkhanijamal@uvic.ca)*

B04: Monday/Thursday 6:30-8:20
Instructor: *Sathiyamoorthy Moorthy (email TBA)*

Assignment Grader: Omar Hassan *(hassano1@uvic.ca)*

General Description

Physics 229 is a broad introduction to a broad subject: experimental physics. The material for this course will be split into two parts: **electronics** (about 2/3 of the course) and **data analysis** (about 1/3 of the course). As this is a course in experimental physics, a large portion of your work will be in the lab. This course should be thought more as a lab with a lecture supplement rather than a lecture with a lab supplement.

Course Delivery

Both the lab and lecture component of this lab will be taught face-to-face. The two lectures per week will cover most - *but not all* of the material. Some of the material that you will learn will come from the labs. I will try to keep a balance of presenting new material and providing worked examples.

Lecture attendance is not required but is strongly encouraged. In previous years, I have given an optional tutorial session directly after class, from 10:50 to 11:20. I will continue this tradition if there is interest.

There will be a midterm exam on October 23 and final exam during the December exam period. If you score higher on the final than the midterm, the final exam mark will be used for both. The first into lab session will be September 8 (B03) and September 14 (B01, B04). Quizzes, assignments, and course material will be accessible on Brightspace. There will be one online quiz per week. These short quizzes are worth a total of 5% of your final grade and are meant as a refresher of the week's material - you may attempt them as often as you would like.

Laboratory and Course Materials

There is no official textbook for this course but there is an official set of course notes available to you at no cost on Brightspace. The Lab manual is required and can be purchased at the UVic bookstore. The cost of your lab manual includes a soldering project that will be distributed to you in the lab.

Course Assessment

Labs:	35%
Assignments	15%
Quizzes	5%
Midterm	10%
Final Exam	35%

The final percentage will correspond to a letter grade assigned as follows:

A+ 90-100	A 85-90	A- 80-85
B+ 77-80	B 73-77	B- 70-73
C+ 65-70	C 60-65	D 50-60
F 0-50%	N (Fail, did not complete course requirements by end of term)	

Course Prerequisites

Must have Math 101 AND either (Phys 110 & Phys 111) or (Phys 120 & Phys 130)

Unforeseen Circumstances

I will accommodate all reasonable delays due to unforeseen medical/life/personal circumstances. Please see me if you have any concerns that may prevent you from completing the course material by a posted deadline.

Course Outline

PART I: ELECTRONICS & LAB INSTRUMENTATION

Module 1: Passive Electronics

1a: Fundamental quantities. Ohm's, Joule's and Kirchhoff's, Thevenin's laws.
1b: Analysis of DC Circuits. Real vs. Ideal Sources
1c: Time dependence. Capacitance, Inductance and Reactance. Complex numbers.
1d: Analysis of AC circuits. Frequency Domain approach. Bode Diagrams.

Module 2: Active Electronics

2a: Electronic properties of matter: Conductors, Insulators & Semiconductors
2b: Diodes and Transistors
2c: Amplifiers
2d: Operational Amplifiers: opamp designs.

Module 3: Digital Electronics

3a: Digital electronics and binary representation
3b: Logic gates: memory, counting and arithmetic.
3c: Digital to Analog (DAC) & Analog to Digital Conversion (ADC)
3d: Data acquisition: interfacing sensors with systems.

PART II: MEASUREMENT AND ANALYSIS

Module 4: Theory of Measurement

4a: What is measurement? Measurement as estimation of true value.
4b: How uncertainties propagate.
4c: Statistical viewpoint of measurement
4d: Systematic error and data rejection.

Module 5: Data Analysis

5a: Statistics and Counting
5b: Curve Fitting