Physics 229: Introduction to Experimental Physics

Fall 2017 (A01)

Instructor:

Andrew MacRae (macrae@uvic.ca) Office: Elliott 113 tel: 250-721-7708

Office Hours:

Tuesdays 10:00am-11:00am or by appointment

Lectures:

Mondays and Thursdays, 10:00-10:50am in Elliott 060

Labs:

B01: Mondays and Thursdays, 11:30am-1:20pm in Elliott 139
B02: Mondays and Thursdays, 3:30pm-5:20pm in Elliott 139
B03: Wednesdays and Fridays, 1:30am-3:20pm in Elliott 139
B04: Mondays and Thursdays, 6:30pm-8:20pm in Elliott 139

Course Description:

This course gives an introduction to lab electronics, instrumentation, and experimental techniques. The first part of the course will focus solely on electronics. The second part will get into data acquisition, signal extraction and processing. Special topics such as control theory, frequency domain analysis will be covered as time allows.

Prerequisites:

PHYS 110 and PHYS 111, or PHYS 120 and PHYS 130, MATH 101.

Course Assesment:

Labs:	25%
Assignments:	15%
Midterm Exam:	20%
Final Exam:	40%

Grading:

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)	

Lab Manual:

Available for purchase at the bookstore. Price includes soldering kit available later in the course.

Course Text:
N. Storey, *Electronics, a Systems Approach*, 5th Edition, 2013.

Calculators:
On all examinations the only acceptable calculator is the Sharp EL-510. This calculator can be bought in the Bookstore

Assignments:
There will be ten assignments given out roughly once per week during the semester. Assignments are to be handed in at class one week from the day they were issued.

Late assignments:
If assignments are handed in up to one day late, there will be a 20% penalty. Assignments will not be accepted beyond this point.

Laboratory Assessment:
You will have two periods (four hours total) of lab time to complete each set of experiments. Labs are to be handed in at the beginning period of your next set of experiments (ie. Exp #1 is due at the beginning of Exp #2 Period 1).
A minimum grade of 50% in the laboratory component is required in order to pass the course.

Course Outline:
DC Electronics
- DC circuits and electronic formalism
- Electronic quantities (voltage, current, resistance, inductance, capacitance)
- Kirchhoff's law, Ohm's Law, elementary circuit analysis
- Real vs. ideal circuit elements, circuit loading
- Multimeters and oscilloscopes.

AC Electronics
- Use of complex numbers in electronics (reactance and impedance)
- Capacitors and inductors, RL, RC filters
- Frequency analysis and Bode plots, introduction to Fourier analysis

Active Electronics and Digital Logic
- Semiconductors: diodes and transistors
- Rectification
- Op-amps and applications
- Flip-flops, logic gates and counters

Data Acquisition and Signal Processing
- Analog-to-digital and digital-to-analog conversion
- Signal to noise ratios
- Fundamental and instrumentation noise

Topics in Experimental Physics
- Introduction to error analysis
- Sensors and transducers
- Experimental Design