



UNIVERSITY OF CALGARY
FACULTY OF SCIENCE
DEPARTMENT OF PHYSICS AND ASTRONOMY
COURSE OUTLINE

1. **Course:** PHYS 397 Applied Physics Laboratory Fall 2017

Instructor: Dr. Ania Harlick | SB 533 | (403) 220-8648 | anna.harlick@ucalgary.ca | Office Hours: MW 11:15 – 12:30

Lecture Sections: LEC 1 | WF 15:00 - 15:50 | KNB 133

Laboratories: LAB 1 | T 9:00 – 11:50 | ST 029
 LAB 2 | T 14:00 – 16:50 | ST 029
 LAB 3 | R 9:00 – 11:50 | ST 029

Tutorials: TUT 1 | F 10:00 - 10:50 | ST 029
 TUT 2 | F 11:00 - 11:50 | ST 029
 TUT 3 | F 14:00 - 14:50 | ST 029

Course Website: d2l.ucalgary.ca

Departmental Office: SB 605, 403-220-5385, phasugrd@ucalgary.ca

2. **Prerequisites:** Prior completion of or concurrent registration in Physics 223 or 255 or 259 is highly recommended.
3. **Grading:** The University policy on grading and related matters is described sections [F.1](#) and [F.2](#) of the online University Calendar. In determining the overall grade in the course, the following weights will be used:

COMPONENT	PERCENTAGE VALUE	COMMENTS
Assignments (6)	20%	See: Assignment Schedule
Laboratory Experiments and Reports (10)	40%	See: Laboratory Schedule
Laboratory Exam	15%	Scheduled during week of Nov. 27 th , in laboratory
Final Exam	15%	Scheduled by the Registrar
Class Activities (Top Hat & Peer Review)	10%	Top Hat [3%] : in class and post class questions, 50%/50% participation and correctness split Peer Review [7%]: in-tutorial and in-class feedback on practice and actual presentations.

Percentage to letter grade conversion scale:

> = 95 %	A +	> = 80 %	B +	> = 65 %	C +	> = 50 %	D +
> = 90%	A	> = 75 %	B	> = 60 %	C	> = 45 %	D
> = 85 %	A -	> = 70 %	B -	> = 55 %	C -	< 45 %	F

4. **Missed Components of Term Work:** The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in [Section 3.6](#). It is the student's responsibility to familiarize himself/herself with these regulations. See also [Section E.6](#) of the University Calendar.

5. **Scheduled out-of-class activities:** NA

REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY. If you have a clash with this out-of-class-time-activity, please inform your instructor as soon as possible so that alternative arrangements may be made for you.

6. **Course Materials:** *An Introduction to Uncertainty in Measurement*, L. Kirkup & B. Frenkel, Cambridge University Press, 2006

Online Course Components: Lecture notes (outlines and scanned class notes), assignments, laboratory instructions, and supporting lecture material will be posted on the course D2L website.

7. **Examination Policy:** Registrar scheduled final examination is closed book. Calculators may be used for the final examination. Students should also read the Calendar, [Section G](#), on Examinations.

8. **Approved Mandatory and Optional Course Supplemental Fees:** None

9. **Writing across the curriculum statement:** In this course, the quality of the student's writing in laboratory reports will be a factor in the evaluation of those reports. See also [Section E.2](#) of the University Calendar.

10. **Human studies statement:** Students in the course are not expected to participate as subjects or researchers. See also [Section E.5](#) of the University Calendar.

11. **OTHER IMPORTANT INFORMATION FOR STUDENTS:**

(a) **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under [Section K](#). Student Misconduct to inform yourself of definitions, processes and penalties.

(b) **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).

(c) **Student Accommodations:** Students needing an Accommodation because of a Disability or medical condition should contact Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities available at http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.pdf. Students needing an Accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, preferably in writing, to the Associate Head of the Department of Physics and Astronomy, Dr. David Feder, by email (dfeder@ucalgary.ca) or by phone (403.220.3638).

(d) **Safewalk:** Campus Security will escort individuals day or night (<http://www.ucalgary.ca/security/safewalk/>). Call 220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

(e) **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). As one consequence, students should identify themselves on all written

work by placing their name on the front page and their ID number on each subsequent page. For more information see also <http://www.ucalgary.ca/secretariat/privacy>.

- (f) **Student Union Information:** [VP Academic](#) Phone: 220-3911 Email: suvpaca@ucalgary.ca.
SU Faculty Rep: Phone: 220-3913
Email: science1@su.ucalgary.ca, science2@su.ucalgary.ca and science3@su.ucalgary.ca
Student Ombuds Office: 403 220-6420
Email: ombuds@ucalgary.ca; <http://ucalgary.ca/provost/students/ombuds>

- (g) **Internet and Electronic Device Information:** You can assume that in all classes that you attend, your cell phone should be turned off unless instructed otherwise. Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.

- (h) **U.S.R.I.:** At the University of Calgary, feedback provided by students through the Universal Student Ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses (www.ucalgary.ca/usri). Your responses make a difference - please participate in USRI Surveys.

12. OTHER COURSE RELATED INFORMATION:

(a) Course Description

Basic laboratory electronics, vacuum systems, and optical devices. Introduction to experimental control, data collection, and analysis. Fundamentals of error analysis and error propagation.

(b) Course Learning Outcomes

Upon completion of the course, students will be expected to:

- operate a voltmeter, ammeter, and oscilloscope to measure current, voltage, resistance, and phase in simple AC/DC circuits;
- explain how a voltmeter, ammeter, oscilloscope function;
- solve voltage dividers in DC circuits;
- design and implement high, low, bandpass, and notch filters using combinations of resistors, inductors, and capacitors;
- expand functions in Fourier series;
- explain the operation and design of a high vacuum system;
- explain significant interactions between photons and matter;
- identify and describe major experimental techniques;
- collaborate with a group of peers to complete an experiment;
- identify and classify sources of experimental uncertainties;
- propagate experimental uncertainties according to GUM;
- explain uncertainties present in their experiment and quantify the overall uncertainty;
- describe the impact of uncertainties on their results and interpretations;
- present their experimental results in the form of a written laboratory report;
- present their experimental results in the form of an oral presentation;
- give constructive feedback on a presentation and analysis of data;

(c) Course Learning Incomes

Students entering PHYS 397 will be expected to:

- apply calculus, trigonometry, and algebra to solve problems;
- catalog and discuss fundamental interactions between systems;
- explain how interactions between systems affect motion;
- state and apply principles of momentum and energy conservation;

(d) Additional Information

- i. Results from the laboratories will be presented in the following manner:
 - a) First nine laboratory experiments (Density, DC Voltage, Oscilloscope, Waves, Hall Effect, RLC Resonance, Spectroscopy, Fourier Transform and X-ray Diffraction) will require submission of a laboratory report. Reports are due **in the beginning** of the **following** experiment.
 - b) Results of the last laboratory (Vacuum) will be presented in form of ignite style presentation (details on D2L and during classes).
- ii. Tutorials are designed to help with preparations to the laboratories. They will provide opportunities to acquaint with the equipment as well as ask questions about pre-labs and current laboratory reports. Two tutorials (Friday, October 6th and Friday, October 13th) are scheduled as practice sessions for presentations and peer review.
- iii. Laboratory exam will consist of three new experiments related to the experiments done during the semester. It is meant to test skills in designing simple experiments, setting up equipment and collecting data necessary for measurements. Details on the exam will be provided during the week of November 20th in the class and during tutorial.
- iv. Final Exam will ask students to write a laboratory report (Theory, Data Analysis, Uncertainty Analysis, Discussion and Conclusions) for data and objectives provided. The data will be drawn from one of the experiments conducted during the semester. Each student is allowed one two sided, letter size sheet of paper with **hand written** notes.

(e) Assignment Schedule

ASSIGNMENT	RELEASED	DUE [IN-CLASS OR IN-OFFICE BY 15:00]
Assignment 1 [Uncertainty]	Friday, Sept 15 th	Wednesday, Sep 27 th
Assignment 2 [DC Current & Phasors]	Friday, Sep 29 th	Friday, Oct 13 th
Assignment 3 [AC Current & Magnetism]	Friday, Oct 13 th	Friday, Oct 27 th
Assignment 4 [Review Paper]	Wednesday, Oct 25 th	Wednesday, Nov 22 nd
Assignment 5 [Spectroscopy]	Friday, Oct 27 th	Friday, Nov 3 rd
Assignment 6 [Fourier]	Wednesday, Oct 30 th	Wednesday, Nov 15 th

(f) Lab Schedule & Course Syllabus

WEEK	LABORATORY EXPERIMENT		LECTURES	TUTORIAL EXERCISE
11 Sep - 15 Sep	---	W	Introduction/Measurement and Uncertainty	---
		F	Uncertainty Propagation	
18 Sep - 22 Sep	Introductory Lab (Density)	W	Ohm's Law and Kirchoff's Rules	Digital Multimeters Wiring and Uncertainty
		F	Voltage Dividers and Thevenin's Equivalence	
25 Sep - 29 Sep	Voltage Sources and Voltage Dividers	W	AC Circuit Analysis	Introduction to Oscilloscope
		F	AC Circuit Analysis	
2 Oct - 6 Oct	AC measurements and Sources	W	Traveling Waves	Presenting and Peer Review
		F	Superposition and Phasors	
9 Oct - 13 Oct	Traveling Waves	W	Magnetic Forces and Fields	Presenting and Peer Review
		F	Hall Effect and Magnetic Hysteresis	
16 Oct - 20 Oct	Hall Effect and Magnetic Hysteresis	W	RC Filters	RC Filters
		F	RLC Resonance	
23 Oct - 27 Oct	RLC Resonant Circuits	W	Library Orientation (TFDL)	Interferometers
		F	Spectroscopy and Interferometers	
30 Oct - 3 Nov	Spectroscopy	W	Fourier Series	X-ray spectrometer
		F	Fourier Series	
6 Nov - 10 Nov	Fourier Series	W	X-ray diffraction	NO TUTORIAL
		F	NO LECTURE	
13 Nov - 17 Nov	X-Ray Diffraction	W	Vacuum	Vacuum Components and Systems
		F	Experimental Methods	
20 Nov - 24 Nov	Vacuum Technology	W	Laboratory Exam Preparation	Laboratory Exam Review
		F	Presenting and Peer Review	
27 Nov - 1 Dec	Laboratory Exam	W	Presentations	---
		F	Presentations	
4 Dec - 8 Dec	Make Up Laboratories	W	Presentations	---
		F	Review	

Department Approval _____ Date _____