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# Syllabus

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January 2, 2020

## OFFICIAL DESCRIPTION

Develops the core practical experimental and computational skills necessary to do Physics. Students tackle simple physics questions involving mathematical models, computational simulations and solutions, experimental measurements, data and error analysis

**Prerequisite:** PHY132H1/152H1, (MAT135H1,MAT136H1)/MAT137Y1/MAT157Y1

**Co-requisite:** PHY231H1/250H1/252H1/254H1/256H1/ENV235H1

**Exclusion:** PHY225H1

**Distribution Requirement Status:** Science

**Breadth Requirement:** The Physical and Mathematical Universes (5)

No computational experience is required. Students should be familiar with data and file manipulation. The first half of the course is dedicated to learning programming in Python; in the second part students apply programming to modeling physical systems and to analyze experimental data.

## CONTACTS

Professor: Christopher Lee ([clee@atmosp.physics.utoronto.ca](mailto:clee@atmosp.physics.utoronto.ca))

TA: Nishant Bhatt([nishant.bhatt@mail.utoronto.ca](mailto:nishant.bhatt@mail.utoronto.ca))

TA: Alex Cabaj ([acabaj@physics.utoronto.ca](mailto:acabaj@physics.utoronto.ca))

TA: Subin Kim ([skim@physics.utoronto.ca](mailto:skim@physics.utoronto.ca))

TA: Saeed Oghbaey ([oghbaeys@physics.utoronto.ca](mailto:oghbaeys@physics.utoronto.ca))

## MEETING TIMES

Lab sessions are held according to the class schedule, on Monday 3–6pm and Friday 9am–12pm. There is only one section in this class, and lab experiments cannot be performed outside of these times.

## MARKING SCHEME

Python Problem Sets (2)	10% (4% and 6%)
Python Exercises (5)	30% (6% each)
Instrumental Exercises (2)	10% (5% each)
Experiments (10 weights)	50% (50% each)

Each Python Exercise includes a pre-lab quiz worth 5% of the assignment mark (1.5% of the course in total). Each Experiment weight includes a pre-lab quiz worth 5% of the weight (2.5% of the course in total). Pre-practical quizzes are due at the end of the first session of each experiment, and are **not accepted late**.

All other submissions are due **at 11:59pm one week after the end of the in-class session**). Penalty for late submission is 5% subtracted from the grade per day of lateness, rounded up to the largest number of days. No submissions accepted after 7 days late.

If you feel a mistake was made in the grading of your assignment (e.g. addition of marks error, or you believe your answer is right even if its marked wrong) then you may request a re-grade of a specific assignment. In order to do so, you must re-hand in your assignment to your TA with a detailed note explaining what you would like re-graded and why. You may only request a re-grade within 2 weeks of the date the grades are returned.

## SCHEDULE

### INTRODUCTION

#### Session 1.

In the introductory lecture I'll talk about the structure of the lab, including the schedule and marking scheme. I'll introduce the TA's and assign students to groups led by each TA. You will get a chance to form partnerships (or be assigned partners) and look through the class material. If there is time remaining in the session we'll look at very basic Python programming, starting with installing Python on your laptop and showing you the Python setup on the workstations.

### INTRODUCTORY EXERCISE

#### Session 2,

5% of the course grade (combined with PyLab 1)

In the introductory exercise you'll get a chance to perform a relatively simple experiment without the need to use Python for the data analysis. The TA's will provide guidance on the experiment and on the content of the lab books and reports you will write and submit for every lab you complete.

Assignment	Date
Intro Exercise	January 17, 23:59

Table 1: Due dates for the introductory experiment as of Dec 20th, 2019.

## PYTHON TUTORIALS

Session 2 and 3,

10% of the course grade.

Over 6 hours, we'll cover enough of the Python programming to get you started writing programs to analyze the experimental data you collect in the lab experiments. This includes starting from rudimentary Python features (numbers, strings, functions), and ends with a template for the data analysis you will perform in many of the experiments.

There will be two computational assignments for you to complete in this component, worth 10% of grade in total.

Assignment	Date
CompAssign1	January 24, 23:59
CompAssign2	January 31, 23:59

Table 2: Due dates for the Python assignments as of Dec 20th, 2019.

## PYTHON EXERCISES

Session 4 through 9,

25% of the course grade.

In 5 experiments, you will collect data on simple experimental setups (circuits, radioactive decay, spring-mass systems) and analyze the data using Python. This component of the course will give you 3 weeks to improve your Python programming skills and better understanding of the uncertainties in lab experiments how to propagate those uncertainties through your analysis.

Assignment	Date
Pre-Pylab1	January 20, 18:00
Pre-Pylab2	January 24, 12:00
Pre-Pylab3	January 27, 18:00
PyLab1	January 27, 23:59
Pre-Pylab4	January 31, 12:00
PyLab2	January 31, 23:59
Pre-Pylab5	February 03, 18:00
PyLab3	February 03, 23:59
PyLab4	February 10, 23:59
PyLab5	February 14, 23:59

Table 3: Due dates for the Python experiments as of Jan 1st, 2020.

## INSTRUMENTS AND WIRING

Session 11 and 12,

10% of the course grade.

In 2 sessions, you will examine the behaviour of two *real* lab instruments. In one session, you will use an oscilloscope to measure a variety of electronic signals and learn the features and limitations of the instrument. In the

second session, you will use a multimeter in a sensitive electronic circuit, and learn how the multimeter affects the measurements and understand its limitations.

*Due dates for the instrument and wiring experiments varies by group.*

## EXPERIMENTS

Session 13 through 24,

50% of the course grade.

In 11 sessions, you will complete work worth 10 *weights* by selecting from a range of experiments, where each session is equivalent to 1 weight (5%). You will have 1 session at the start of each experiment to explore the equipment and conduct trial experiments with the setup, then you will have 1–3 sessions to complete the experiment. Each experiment will include a pre-lab quiz as part of the grade, and you will submit a lab-book/report for each experiment you complete.

*Due dates not set until assigned to individual groups.*

## DETAILED SCHEDULE

Sections are: L0101 (M 3–6, F 9–12)

Important dates: Monday January 6th classes begin, Monday–Friday February 17–21 break (no classes), Friday April 3 classes end.

MONDAY		FRIDAY	
Jan 6th	1	10th	2
Introduction to PHY224. Administrative (groups, partnerships formed) Python Tutorial I		Introductory Exercise: Ohm's law	
13th	3	17th	4
Python Tutorial II		Python Tutorial III	
20th	5	24th	6
Python Exercise 1: Linear data fitting, Ohm's law		Python Exercise 2: Non-linear data fitting, Radioactive decay	
27th	7	31st	8
Python Exercise 3: Non-linear data fitting, Blackbody radiation		Python Exercise 4.1: Numerical Integration methods, Oscillation of a spring-mass system with damping	
Feb 3rd	9	7th	10
Python Exercise 4.2: Numerical Integration methods, Oscillation of a spring-mass system with damping		Python Exercise 5: Random numbers and uncertainties	
10th	11	14th	12
Overflow Session		Instruments and Wiring Oscilloscope	
17th		21st	
Reading Week		Reading Week	

MONDAY		FRIDAY	
24th	13	28th	14
Instruments and Wiring Oscilloscope		Experiments, session 1	
Mar 2nd	15	6th	16
Experiments, session 2		Experiments, session 3	
9th	17	13th	18
Experiments, session 4		Experiments, session 5	
16th	19	20th	20
Experiments, session 6		Experiments, session 7	
23rd	21	27th	22
Experiments, session 8		Experiments, session 9	
30th	23	Apr 3rd	24
Experiments, session 10		Experiments, session 11	

## COURSE EVALUATIONS

The University of Toronto is committed to ensuring the quality of its academic programs, its teaching, and the learning experiences of its students. An essential component of our commitment to teaching excellence is the regular evaluation of courses by students. For a two week period at the end of the semester you will be allowed to follow a link that is sent to you by U of T and evaluate this course. It will only take 10 or 15 minutes to answer the questions and enter your typed thoughts about the course. Your answers and thoughts are anonymous, but are very important to me. I promise you that when the results become available to me, I will read every comment and scrutinize the responses to see if it can help me improve the course or my teaching in the future.

During the evaluation period, I will monitor the response rate and advertise it during lab sessions. If, by the end of the course evaluation period, at least 65% of the students enrolled in this course complete the course evaluations, then every student in the course will have 1% added to their final course mark. If fewer than 65% of students complete the course evaluations, then no bonus point will be added for any student.

## STUDENTS WITH DISABILITIES OR ACCOMMODATION REQUIREMENTS

Students with diverse learning styles and needs are welcome in this course. If you have an acute or ongoing disability issue or accommodation need, you should register with Accessibility Services (AS) at the beginning of the academic year by visiting <http://www.studentlife.utoronto.ca/as/new-registration>. Without registration, you will not be able to verify your situation with your instructors, and instructors will not be advised about your accommodation needs. AS will assess your situation, develop an accommodation plan with you, and support you in requesting accommodation for your course work. Remember that the process of accommodation is private: AS will not share details of your needs or condition with any instructor, and your instructors will not reveal that you are registered with AS.

## RELIGIOUS ACCOMMODATION

As a student at the University of Toronto, you are part of a diverse community that welcomes and includes students and faculty from a wide range of cultural and religious traditions. For my part, I will make every reasonable effort to avoid scheduling tests, examinations, or other compulsory activities on religious holy days not captured by statutory holidays. Further to University Policy, if you anticipate being absent from class or missing a major course activity (such as a test or in-class assignment) due to a religious observance, please let me know as early in the course as possible, and with sufficient notice (at least two to three weeks), so that we can work together to make alternate arrangements.

## SPECIFIC MEDICAL CIRCUMSTANCES

If you become ill and it affects your ability to do your academic work, consult me right away. Normally, I will ask you for medical documentation in support of your specific medical circumstances. The University's Verification of Student Illness or Injury (VOI) form is recommended because it indicates the impact and severity of the illness, while protecting your privacy about the details of the nature of the illness. You can submit a different form (like a letter from a doctor), as long as it is an original document, and it contains the same information as the VOI. For more information, please see <http://www.illnessverification.utoronto.ca>. If you get a concussion, break your hand, or suffer some other acute injury, you should register with Accessibility Services as soon as possible.

## ACCOMMODATION FOR PERSONAL REASONS

There may be times when you are unable to complete course work on time due to non-medical reasons. If you have concerns, speak to me or to an advisor in your College Registrar's office; they can help you to decide if you want to request an extension or accommodation. They may be able to provide you with a College Registrar's letter of support to give to your instructors, and importantly, connect you with other resources on campus for help with your situation.

## MENTAL HEALTH AND WELL-BEING

As a student, you may experience challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation, financial concerns, family worries and so forth. These factors may affect your academic performance and/or reduce your ability to participate fully in daily activities. Everyone feels stressed now and then – it is a normal part of university life. Some days are better than others, and there is no wrong time to reach out. There are resources for every situation and every level of stress.

There are many helpful resources available through your College Registrar or through Student Life (<http://studentlife.utoronto.ca> and <http://www.studentlife.utoronto.ca/feeling-distressed>). An important part of the University experience is learning how and when to ask for help. Please take the time to inform yourself of available resources.

## ACADEMIC INTEGRITY

All students, faculty and staff are expected to follow the University's guidelines and policies on academic integrity. For students, this means following the standards of academic honesty when writing assignments, collaborating with fellow students, and writing tests and exams. Ensure that the work you submit for grading represents your

own honest efforts. Plagiarismâ€”representing someone else’s work as your own or submitting work that you have previously submitted for marks in another class or programâ€”is a serious offence that can result in sanctions. Speak to me or your TA for advice on anything that you find unclear. To learn more about how to cite and use source material appropriately and for other writing support, see the U of T writing support website at <http://www.writing.utoronto.ca>. Consult the Code of Behaviour on Academic Matters for a complete outline of the University’s policy and expectations. For more information, please see <https://www.artsci.utoronto.ca/current/academic-advising-and-support/student-academic-integrity> and <http://academicintegrity.utoronto.ca>

## COURSE MATERIALS, INCLUDING LECTURE NOTES

Course materials are provided for the exclusive use of enrolled students. Do not share them with others. Do not put any of the materials into the public domain or provide the materials to a person not enrolled in the course or to a third party company. The University supports copyright enforcement related to course material, and licensed third party material appears in the lecture notes with additional restrictions.

## QUERCUS

This course uses the University’s learning management system, Quercus, to post information about the course. This includes posting readings and other materials required to complete class activities and course assignments, as well as sharing important announcements and updates. The site is dynamic and new information and resources will be posted regularly as we move through the term, so please make it a habit to log in to the site on a regular, even daily, basis. To access the course website, go to the U of T Quercus log-in page at <https://q.utoronto.ca>. Once you have logged in to Quercus using your UTORid and password, you should see the link or "card" for "PHY392: Physics of Climate". You may need to scroll through other cards to find this. Click on the "PHY392: Physics of Climate" link to open our course area, view the latest announcements and access your course resources. There are Quercus help guides for students that you can access by clicking on the "?" icon in the left side column. SPECIAL NOTE ABOUT GRADES POSTED ONLINE: Please also note that any grades posted are for your information only, so you can view and track your progress through the course. No grades are considered official, including any posted in Quercus at any point in the term, until they have been formally approved and posted on ACORN at the end of the course. Please contact me as soon as possible if you think there is an error in any grade posted on Quercus.

## PRIVACY/FIPPA STATEMENT

Personal information is collected pursuant to section 2(14) of the University of Toronto Act, 1971 and at all times it will be protected in accordance with the Freedom of Information and Protection of Privacy Act. Please note that this course requires presentations of one’s work to the group. For more information, please refer to <http://www.utoronto.ca/privacy>.