CHM 1106F – Lab Instrumentation
Fall 2019

Course Staff:

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Lecture Schedule and Format:

Lectures are held on Tuesdays from 1:00-3:00 PM in the Bissell building (140 St. George St.) room 112 (BSL 112), beginning on September 10th and ending on December 3rd. Each lecture will feature two presentations, with a break between them. The lectures will cover the three broad topics of electronics, programming, and optics (more detail below). Course notes (corresponding to the lectures) will be posted on the course website prior to each lecture – you are advised to bring either a hard copy or a digital copy and a reader (laptop or tablet, etc.) to each lecture. ***For the lectures on programming (Oct. 15th, 22nd, 29th), you are advised to bring a laptop*** to get the most out the experience. [If you do not own a laptop, please try to borrow one from a friend or colleague for these three dates.]

Topics Covered:

1. Electronics: voltage and current, resistors, capacitors, inductors, diodes, transistors, op-amps, digital electronics, and microprocessors)
2. Programming: flowcharts, C++ & Python syntax, variables, functions, algorithms, data processing, Jupyter notebook, image processing
3. Optics: light sources, wavelength selectors, detectors, lenses, mirrors, prisms, polarizing optics, microscopy, non-linear optics

Course website:

The course website can be found by logging in to your "quercus" account at https://q.utoronto.ca. You are advised to check the course website often, as content will be updated regularly. Content to be posted on the course website is summarized on the following page.

Course website, continued:

- Course schedule
- Announcements
- Lecture notes
- Assignments and Keys
- Problem Sets and Keys
- Laboratory handouts

Reference Materials:

There is no formal text for this course – the content that you are responsible for will be presented in lectures, labs, and problem-sets. References that may be useful for independent study include:

- *Principles of Instrumental Analysis* by Skoog, Holler, and Nieman
- *The Art of Electronics* by Horowitz and Hill
- *Optics* by Hecht
- *Building Scientific Apparatus* by Moore, Davis, and Coplan
- *Code Complete* by McConnell
- *Python Crash Course* by Matthes
- Physics concepts: http://hyperphysics.phy-astr.gsu.edu/hbase/HFrame.html
- Electrical circuit concepts: http://www.allaboutcircuits.com/
- Electrical circuit emulator: http://www.falstad.com/circuit/
- Introduction to/examples for Arduino: https://playground.arduino.cc/
- Introduction to/examples for Python: https://www.w3schools.com/python/
- Introduction to Light Microscopy: http://www.microscopyu.com/

Problem Sets:

There will be at least three problem sets posted (along with their keys) to the course website, each corresponding to one of the main course topics. The problem sets will not be collected, but working them is the best way to prepare for the graded assignments.

Marking Scheme:

Your mark in this course will come from three graded assignments -- an in-class term-test on electronics, a take-home test on programming, and a final exam on optics. Each of these assignments relates to approximately 1/3 of the course material, and has (nominally) the same 'weight'. But because anyone can have a bad day (and a bad mark on that day), your final mark in this course will be a weighted average of the two assignments for which you made your highest grades at 40% each and the assignment for which you made your lowest grade at 20%. So, for example, if you make a 60 on the term test, a 90 on the take-home test, and an 80 on the final exam, your final mark for the course will be (0.4)(90) + (0.4)(80) + (0.2)(60) = 80.

Marking Scheme, continued:
The in-class term test is on October 8 (1:00-3:00 PM), the take-home test is due on November 14 (to be submitted via the course website by 5:00 PM), and the final exam will be in December (with date and time to be determined later). You are advised to mark these dates and times in your calendar and make every effort to attend them, as *alternate dates (and makeup assignments) will not be offered*. If an emergency or other unavoidable circumstance causes you to miss an assignment, appropriate arrangements should be made with the instructor, ***in advance of the (due) date of that assignment.***

Laboratory Exercises:
A series of six laboratory exercises will be held on select Thursdays throughout the semester (Sept. 26, Oct. 3, 17, & 24, and Nov. 21 & 28). These two-hour exercises will take place in Lash Miller room 206, with start-time to be determined in the first day of lecture. Over the course of the semester, in these exercised you will iteratively design and build modules that (at their conclusion) will form a computer-controlled fluorescence detector for a chromatography system. The lab exercises are voluntary and will not be graded; however, you are strongly encouraged to participate in them! Past students have told us that the labs are useful for understanding the lecture content (noting that questions on the assignments are often taken directly from the lab experiments), and as well are quite fun.

Prior to each laboratory exercise, you should collect the lab-handout (posted on the course website) and bring either a hard copy or a digital copy and a reader (laptop or tablet, etc.) to the lab. [In particular, you are advised to bring a laptop to labs 3, 4, and 6 on Oct. 17 & 24 and Nov. 28.] You should also read the material carefully, to be prepared for the activities that you will be engaging in with your group.

Absences:
Students are advised to attend and participate in all course lectures and lab exercises, but attendance will not be marked or collected. ***Participation in each of the three graded assignments is mandatory***; absences are only excusable because of illness or other medical emergency. In such a case, you must submit a "Verification of student illness" form completed by the medical professional(s) with whom you consulted (http://www.illnessverification.utoronto.ca/) before the (due) date of the assignment. If you need to submit this form for more than one course, contact your college registrar's office for assistance.

Plagiarism:
Plagiarism is a serious offense. Assignments found to be plagiarised will be given a zero. More information about what constitutes plagiarism and how to avoid it can be found at: http://www.chem.utoronto.ca/undergrad/plagiarism.php**.**