CHM 1104H: Separation Science
Fall 2020 Course Syllabus

Course Staff:

Instructor:	Prof. Aaron Wheeler
Office:	Lash Miller 629
Phone:	416-946-3864
E-mail:	aaron.wheeler@utoronto.ca

Virtual Lectures and Virtual Office Hours: Virtual lectures will be given synchronously via 'Bb Collaborate' on Tuesdays and Thursdays from 11:00 AM – 12:00 PM (Eastern Time Zone), beginning on Sept. 10th and ending on Dec. 8th. A recording of each virtual lecture will be available asynchronously shortly after it is completed. Virtual office hours will also be given synchronously via Bb Collaborate (without recording) in the hour that immediately follows each virtual lecture (i.e., on Tuesdays and Thursdays from 12:00 PM – 1:00 PM, Eastern Time Zone) or by appointment.

Recordings of virtual lectures (and other course materials) belong to your instructor, the University, and/or other sources, and are protected by copyright. Do not download, copy, or share any recording (or other course material) without the explicit permission of the instructor. For questions about recording and use of videos in which you appear please contact your instructor.

Course Description: This course provides theoretical and practical background useful for engaging in cutting-edge chemical separations in chemistry, biology, medicine, engineering, research, and industry. The course covers general separations concepts and principles, with an emphasis on liquid chromatography and its various modes, including partition chromatography, ion chromatography, enantiomer chromatography, size exclusion chromatography, and affinity chromatography. Other topics include materials and instrumentation, gas chromatography, supercritical fluid chromatography, electrophoresis and related techniques, and a host of miscellaneous separation (e.g., TLC, FFF, CF) and extraction (e.g., LLE, SPE, SPME) modalities.

Student Learning Outcomes: By the end of this course, you will be familiar with each of the modes of separation science that are used in the modern research laboratory. You will have explored the theory behind each of these modes, and will be ready to apply this experience in practical settings, whether they be in the academic research laboratory, the industrial quality control/assessment laboratory, or anywhere in between.

Required Texts:

- *Principles of Instrumental Analysis*, Skoog, Holler and Crouch, 6th Edition (Thomson & Brooks/Cole) or 7th Edition (CENGAGE Learning)
- *Introduction to Modern Liquid Chromatography*, Snyder, Kirkland, Dolan, 3rd Edition (Wiley) – available electronically at the library

Prerequisite Courses: This course assumes you have a basic familiarity with analytical chemistry techniques for instrumental analysis. For students at the St. George campus, this typically means successful completion of an undergraduate level analytical chemistry course, but exceptions may be granted by the instructor.

Topics and Virtual Lecture Notes:

1. General Separations Concepts and Principles
2. Liquid Chromatography Instrumentation
3. Liquid Chromatography Modes
4. Gas & Supercritical Fluid Chromatography
5. Capillary & Gel Electrophoresis
6. Miscellaneous Techniques (TLC, LLE, SPE, FFF, and others)

The six topics listed above correspond to six sets of virtual lecture notes. Each virtual notes-file, which you are encouraged to download, will be posted to the course website prior to the corresponding virtual lecture(s). Each group of two topics constitutes a "module" that will be addressed chronologically throughout the semester – specifically, module 1 (topics 1-2) in Sept-Oct, module 2 (topics 3-4) Oct-Nov, and module 3 (topics 5-6) in Nov-Dec. Each module is associated with a problem set, a virtual laboratory exercise, and a term test.

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 below:

- Syllabus and Course Schedule
- Virtual Lectures (via Bb Collaborate)
- Virtual Lecture Notes
- Problem Sets and Keys
- Old Tests and Keys
- Virtual Lab Assignments
- Term Tests and Keys

Marking Scheme: Your mark in this course will come from six graded assignments (indicated below): three virtual laboratory exercises and three term tests. Each assignment has (nominally) the same 'weight' or 'importance,' but because anyone can have a bad day (and can make a bad mark on that day), the lowest mark will be dropped from consideration. Thus, your final mark will be an average of your grades on the five assignments that you score best on, such that each counts 20% toward the final mark.

Assignment	**Date and Time (all times Eastern)**
Virtual Laboratory Exercise 1	October 6, 5:00 PM
Term Test 1	October 8, Time TBD
Virtual Laboratory Exercise 2	November 3, 5:00 PM
Term Test 2	November 5, Time TBD
Virtual Laboratory Exercise 3	December 8, 5:00 PM
Term Test 3	Date & Time TBD

Virtual Laboratory Exercises: On quercus, you will find three virtual laboratory exercise files, each corresponding to one of the course modules. The first two exercises use the "HPLC Simulator" software package (http://www.multidlc.org/hplcsim/hplcsim. html), and the third uses the "PeakMaster" software package (https://web.natur.cuni.cz/~gas/peakmaster.html). You are welcome to complete the virtual lab exercises at any time until they are due on October 6, 5:00 PM Eastern Time Zone (exercise 1), November 3, 5:00 PM Eastern Time Zone (exercise 2), and December 8, 5:00 PM Eastern Time Zone (exercise 3). If you do not submit by the designated dates and times, your mark will be 'zero.'

Term Tests: There are three term tests, each corresponding to one of the course modules, which will be administered and completed online. The first two tests have been scheduled for October 8 and November 5; the third has not been scheduled but will occur after the final virtual lecture on December 8. The time, duration, and format of these tests has not been set, yet – we will discuss these points in the virtual lectures and will decide them together. Failure to participate in term tests will result in a grade of 'zero'; the only acceptable excuse is an illness or other medical emergency, as addressed below.

Problem Sets and Old Tests: You are encouraged to download three problem sets, each corresponding to one of the course modules. The problem sets will not be collected or marked, but working them is highly recommended to prepare for the tests. Likewise, a set of old tests and keys has been posted, which may also be useful for preparation, but note that the format for the tests this year (which will be given online) will be quite different than what was given in previous years.

Absences: You are advised to participate in the virtual lectures, but attendance will not be marked or collected. On the other hand, completion of the virtual lab exercises and participation in the term tests is mandatory; absences are only excusable because of illness or other medical emergency. In such a case, ***before the date/time that the assignment is due***, you must (i) contact the instructor by email or other means, and (ii) declare the condition using the "Absence Declaration Tool" on ACORN (https://www.acorn.utoronto.ca/) which is found in the "Profile and Settings" menu.

Online Considerations: Specific guidance from the U of T Vice-Provost, Students regarding student technology requirements is available here: https://www.viceprovoststudents.utoronto.ca/covid-19/tech-requirements-online-learning/. This course requires the use of computers, and of course sometimes things can go wrong when using them. You are responsible for ensuring that you maintain regular backup copies of your files, use antivirus software (if using your own computer), and schedule enough time when completing an assignment to allow for delays due to technical difficulties. Computer viruses, crashed hard drives, broken printers, lost or corrupted files, incompatible file formats, and similar mishaps are common issues when using technology, and are not acceptable grounds for a deadline extension.

As we engage with each other online, please consider the University's statement on etiquette: “The University of Toronto is committed to equity, human rights and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another’s differences. U of T does not condone discrimination or harassment against any persons or communities.”

Academic Integrity: You are welcome (and encouraged) to discuss course content and to work problem-sets and old tests with your classmates. But the assignments that will be graded (including the virtual laboratory exercises and term tests) in this course should be completed by you and you alone, according to the university's policies on academic integrity.

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student’s individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously; this is particularly important during the pandemic, in which our interactions are largely (or completely) online. The University of Toronto’s Code of Behaviour on Academic Matters (https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to (on the following page):

In papers and assignments:

1. Using someone else's ideas or words without appropriate acknowledgement
2. Submitting your own work in more than one course without the permission of the instructor
3. Making up sources or facts
4. Obtaining or providing unauthorized assistance on any assignment

On tests and exams:

1. Using or possessing unauthorized aids
2. Looking at someone else's answers during an exam or test
3. Misrepresenting your identity

In academic work:

1. Falsifying institutional documents or grades
2. Falsifying or altering any documentation required by the University

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see https://www.academicintegrity.utoronto.ca/).