

CHEM 4080 – Advanced Analytical Separation Methods Winter 2022

Professor: Dr. Trevor VandenBoer email: profvdb@yorku.ca
Lecture: PSE321 T/R 11:30-12:45 Office hours: Wednesday 10:00 or by appointment
Prerequisites: CHEM 2021, CHEM 2080, and CHEM 3080

Other Course Information

- Lectures will be delivered in-person and will be recorded using Zoom. These recordings will only be available to students enrolled in the course. Students are encouraged to participate in discussions during class but must understand that the sound could be recorded.
- Office hours will be conducted through Zoom (link below). Students will require their YU Passport login and are encouraged to turn on their camera during office hours.

Office hour: <https://yorku.zoom.us/j/95838451565?pwd=TIlnTWt6RTBWNjlsK2ZSVVJGeTV5UT09>

Structure of Course Evaluation	Marks
Assignments (2 x 8 each)	16
Midterm	10
Dry Lab	8
Participation	3
Encounters	2
Term paper	28
<i>Annotated bibliography</i>	4
<i>Final paper</i>	24
<u>Final exam</u>	33
Total:	100

Dates for Course Evaluation

please note that all dates are tentative given ongoing pandemic disruptions

Tuesday, October 4, 2022	Assignment 1 due date
Thursday, October 18, 2022	Term paper topic choice
Friday, October 21, 2022	Encounter 1 due date
Tuesday, October 25, 2022	Midterm (in-class)
Tuesday, November 15, 2022	Term paper annotated bibliography
Tuesday, November 22, 2022	Assignment 2 due date
Thursday, December 1, 2022	Dry lab due date
Tuesday, December 6, 2022	Term paper due date
Tuesday, December 6, 2022	Encounter 2 due date

Evaluation Details

Assignments:

- Assignments will involve critiques of separations and methods from the literature.
- All assignments will be submitted through CrowdMark.
- Assignments are due at 11:30 am on the date indicated. Late assignments will be accepted with a penalty of 10 % for work received after class on the due date and an additional 10 % per calendar day up to 3 days after the due date. Students who are unable to complete assignments due to illness or other reason will have the value of the assignment added to the weight of the final exam.

Dry lab:

- Students will explore separation conditions using a software-based HPLC instrument and use the simulator to answer questions.
- The dry lab is due at 11:30 am on the date indicated. Late work will be accepted with a penalty of 10 % for work received after class on the due date and an additional 10 % per calendar day up to 3 days after the due date. Students who are unable to complete the dry lab due to illness or other reason will have the value of the assignment added to the weight of the final exam.

Participation

- Participation will be assessed using iClicker REEF.
- iClicker marks are gained based on participation only.
- Clicker questions will be provided in an “assignment” format and can be completed live or while watching the lecture on demand.
- York has free subscription to iClicker REEF, so do not make any purchase even if prompted.
- Ensure your correct student number is associated with your iClicker account. Failure to do so may mean that your participation is not counted.
- Clicker questions can be completed up to 2 weeks after the corresponding lecture (or until the end of classes, whichever comes first).
- To find Clicker questions, search for CHEM 4080/5080. Clicker questions will be found under the “assignments” menu.

Encounters

- Analytical chemistry underlies many things in our daily lives. Students will submit brief reflections on 2 encounters in their lives that have changed through their learning in this course.

Term paper

- Each student will choose a unique analyte/matrix combination. Using literature references, students will contrast and critique existing methods and select and defend the “best” method to analyze for their analyte/matrix. Analyte/matrix combinations will be selected from a list or submitted for approval to Dr. VandenBoer.
- An annotated bibliography of relevant literature will be submitted prior to the term paper.
- Term paper and annotated bibliography are due at 11:30 am on the date indicated. Late work will be accepted with a penalty of 10 % for work received after class on the due date and an additional 10 % per calendar day.

Other Course Information

Email etiquette

- Students must use their YorkU email address.
- Emails must include the course code in the subject line.
- Use professional language in emails, including a salutation and a signature that includes your full name and student number.

Awareness

Students must make themselves aware of York University policies on Academic Honesty/Integrity, Access/Disability, Student Conduct, Religious Observance and other matters. A periodically updated Information Sheet summarizing this information can be downloaded* and printed, and the Registrar's Office issues a list of Religious Observance Days.‡

* <http://secretariat.info.yorku.ca/files/CourseInformationForStudentsAugust20121.pdf>

‡ <http://registrar.yorku.ca/enrol/dates/religious-accommodation-guidelines-2018-2019>

Accessibility and religious accommodations

- Students registered with Accessibility Services must submit accommodation letters via email to Dr. VandenBoer by September 30, 2022.
- Any religious observance conflicts occurring at any point during the term should be communicated by email to Dr. VandenBoer by September 30, 2022.
 - <https://www.yorku.ca/secretariat/policies/policies/academic-accommodation-for-students-religious-observances-policy-guidelines-and-procedures/>
- Note: "Senate policy states that students are expected to monitor their progress in courses, taking into account their personal and academic circumstances, and to make the necessary adjustments to their workload to meet the requirements and deadlines." (from Senate Policy of Students' Responsibilities in the Petition/Appeal Processes). The drop deadline is November 11, 2022.

Academic honesty

- Any student who breaches York's Academic Honesty Policy will be reported. Some offences include:
 - Plagiarism.
 - Students who misrepresent themselves during iClicker activity, a quiz, or examination or provide documentation for absence from any of these that is not legitimate.
 - Students who submit any material for remarking that has been modified in any manner to misrepresent the original assessment.
- Information regarding the consequences for academic dishonesty at York University can be found in the "Academic dishonesty consequences" document on eClass.
- Students are strongly encouraged to familiarize themselves with these policies. Ignorance of the policies is not an acceptable excuse. <https://spark.library.yorku.ca/academic-integrity-what-is-academic-integrity/>

Recommended References

Harris and Lucy. Quantitative Chemical Analysis, 10th Ed. or any other edition of the textbook.

Skoog. Principles of Instrumental Analysis, 7th Ed. or any other edition of the textbook

Course Goals

Develop a comprehensive understanding of the principles of analytical separations, enabling students to:

- i. Develop separation methods for use in the laboratory
- ii. Critically evaluate separation methods described in the scientific literature

Course Content Overview

Unit 1. Introduction to separations and method development

- A. The analytical process
- B. Defining a good method
- C. Essentials in preventing method error: QA/QC
- D. General considerations in selecting an analytical method
- E. Common detection methods

Unit 2. Chemical properties for understanding separations

- A. Acidity and basicity
- B. Partitioning

Unit 3. Sample preparation

- A. Extraction basics
- B. Preparing liquid samples
- C. Preparing solid samples
- D. Preparing gas samples
- E. Incorporating QA/QC in sample preparation
- F. Preparing biological samples

Unit 4. Separation theory

- A. Separation basics
- B. Optimizing resolution
- C. Solid phase extraction

Unit 5. Partition based analytical separations

- A. Gas chromatography
- B. Liquid chromatography
- C. Ion chromatography
- D. Size-exclusion chromatography
- E. Affinity chromatography

Unit 6. Mobility based separations

- A. Ion mobility spectrometry
- B. Capillary electrophoresis

Unit 7. Sampling

- A. Sampling strategy
- B. Sample collection
- C. Incorporating QA/QC

Unit 8. Special topics in analytical separations (as time allows)