



SC/CHEM 3070 3.0 Industrial and Green Chemistry

Term	Fall 2022	
Location and Time	Lectures (ACE 002)	T/R 14:30 – 15:50
Prerequisite	SC/CHEM 2021 3.0	Organic Chemistry

Course Director and Instructors

Prof. Gino G. Lavoie, Course Director (Module 1: Introduction and Scale Issues)

Prof. Pierre Potvin (Module 2: Reaction Chemistry)

Prof. Gerald Audette (Module 3: Legal and Regulatory Affairs)

Office Hours

Potvin (pgpotvin@yorku.ca): T 12–1PM and R 3–4PM in CB 406.

For instructors Lavoie (glavoie@yorku.ca) and Audette (audette@yorku.ca), please send an email to schedule a mutually-convenient time.

Please note that you may be required to wear a medical-grade mask to enter the office of the instructors. Bring your own if asked.

Course Description

The chemical industry has become a huge complex of operations that range from large multinational corporations to small, locally owned factories. Collectively, they manufacture materials and products that compose at least some part of almost every item used in our society today.

This course serves as an introduction to industrial and green chemistry. Various aspects related to the production of chemicals on a large scale will be presented, ranging from a general introduction of the chemical industry to specific manufacturing and legal issues.

The following topics will tentatively be covered over the semester.

1. Introduction (Lavoie)
 - a. History of the chemical industry
 - b. Top chemical companies
 - c. Top 100 chemicals
 - d. Economics of chemical processes
2. Scale Issues (Lavoie)
 - a. Scaling-up issues: from laboratory scale, to pilot-plant scale, to industrial/commercial scale
 - b. Physical limitations of large-scale processes
 - c. Reactor types: Batch vs. semicontinuous/semibatch vs. continuous reactors
 - d. Process optimization

3. Reaction Chemistry (Potvin)
 - a. Large-scale sources of raw materials (coal, natural gas, petroleum, N₂, O₂, sulfur) and their processing into products of importance to the chemical industry
 - b. Specific processes of importance: Claus, Haber, Oxo, Monsanto, Oswald, etc.
 - c. Elaboration of end products from two main feedstocks (ethylene and aromatics), including many polymers and consumer goods
 - d. Energy consideration, energy management, green chemistry principles and examples
4. Legal and Regulatory Affairs (Audette)
 - a. Standards: Quality management, good manufacturing/laboratory practice, standard operating procedures, with a particular emphasis on the ISO 17025 laboratory accreditation standard
 - b. Intellectual property issues (Patents and Trade Secrets)
 - c. Regulatory issues & corporate responsibility

Purpose and Objectives of the Course

The purpose of the course is to introduce fundamental aspects of industrial and green chemistry. Particular attention will be paid to scaling-up issues, which includes reactor type, reactor size, reaction condition, catalysis, conversion, selectivity and purification/separation, waste management, and more.

At the end of the course, the students should be able to:

1. communicate effectively with industrial chemists using proper nomenclature;
2. speak to how the chemical industry developed and who the major chemical manufacturers, as well as what the top-produced chemicals are;
3. elaborate on scale-up issues and other issues faced by large-scale manufacturers;
4. describe various types of processes and reactor types;
5. expand on the various types of catalysts and their role in the production of chemicals;
6. explain the economics of a large-scale chemical process;
7. describe some new trends in chemical industry;
8. analyse processes in terms of green chemistry principles and quantitatively evaluate them;
9. expand on legal issues related to the production and sale of chemicals; and
10. read, understand and summarize important points from trade journals.

Organization of the Course

The course will be taught by three Course Instructors (Profs. Lavoie, Potvin and Audette). A number of pedagogical approaches will be used to meet the objectives of the course. Much of the lecture material will be delivered by the Course Instructors but will require active participation of the students. Lecture notes will be posted on eClass. It is the student's responsibility to sign up for an account. See <https://eclass.yorku.ca/> for details.

Evaluation

The level of proficiency in the material will be assessed through problems sets and exams. The final grade for the course will be based on the following items weighted as indicated.

Term Paper (deadline: Oct. 6)	15%
Video Presentation (deadline: Dec. 6)	20%
Midterm 1 (Lavoie) (Oct. 18)	25%
Midterm 2 (Potvin) (Nov. 17)	25%
Midterm 3 (Audette) (Dec. 6)	15%

If you miss any midterm, the respective instructor(s) will assess you through either an **oral or written make-up exam** (at their discretion) during the final exam period.

Important Dates

Sept. 8	First class and start of Module 1 (taught by Prof. Lavoie)
Oct. 6	Start of Module 2 (taught by Prof. Potvin)
Oct. 6	Term Paper Deadline (midnight)
Oct. 8–14	Reading Week
Oct. 18	First Midterm Test – Module 1 (80 min; held in class)
Nov. 11	Last day to drop the course without receiving a grade
Nov. 13–Dec. 7	Course withdrawal period (to receive a grade of “W” on transcript)
Nov. 15	Start of Module 3 (taught Prof. Audette)
Nov. 17	Second Midterm Test – Module 2 (80 min; held in class)
Dec. 6	Last Class and 3 rd Midterm Test on Module 3 (held in class)
Dec. 6	Video Presentation Deadline (midnight)
Dec. 8 –23	Final examination. Students who missed one of the midterm tests are expected to be available at all times during the Fall examination period and therefore should not make travel plans within that period.

Textbooks/Course Kit

There is no textbook required for CHEM 3070. However, three textbooks have been placed on reserve at the Steacie Library should you wish to consult them:

Survey of industrial chemistry by P. J. Chenier (2002)
Introduction to industrial chemistry by H. L. White (1986)
An introduction to industrial organic chemistry by P. Wiseman (1979)

Other documents, such as the ones listed below, will be available to the students through to the eClass webpage.

Industrial organic chemicals, 3rd Ed. By H. A. Wittcoff (2013)
Handbook of industrial chemistry by M. F. Ali et al. (2014)
Green chemistry: an introductory text by M. Lancaster (2002)

E-mail Communications

All course-related questions and issues will be addressed during class. Any administrative questions and issues will best be addressed by the Undergraduate Program Assistant in the Chemistry Building (CB 124). E-mail communications with the course instructors (Lavoie: glavoie@yorku.ca; Potvin: pgpotvin@yorku.ca; Audette: audette@yorku.ca) must have “CHEM 3070” as subject line. No formal office hours have been set for this course. Students are however welcome to contact the instructor directly to schedule a meeting.

Assignment Submissions and Lateness Penalties

Proper academic performance depends on students doing their work not only well, but on time. Accordingly, the term papers and video presentations must be received on the due date specified. Term papers and video presentations received after the deadline will be penalized by taking 20% off the maximum mark per 24-hour period of lateness (including Saturdays and Sundays). Exceptions to the lateness penalty resulting from illness will be entertained by the instructors only when supported by official written documentation. Students are responsible for contacting their instructors in advance if they encounter technical difficulties in this course project as it will not be considered an acceptable reason for a late submission.

The **term paper** is to be submitted in electronic format through two modules:

- Turnitin module on eClass
- Crowdmark module through Crowdmark.com

Students can only submit once and the two files must be **identical** in content; submitting different versions constitutes academic dishonesty (see below). Supporting documentation may be requested and other means of plagiarism detection may be used.

The term paper must be submitted with margins of no more than 1" on each side, using double-lined spacing and containing 600–700 words, exclusive of title, tabular material, captions and references. Students will be expected to adhere to high standards of professionalism in their submitted papers. Spelling and grammar must be checked. All data, figures and artwork (both in high resolution), and other source materials must be duly attributed. Plagiarism will be sanctioned to the fullest extent in accordance with University and Faculty policies.

Topics for the **term paper** are available to browse from day one. Students will be able to select their chemical of choice, on a first-come first-serve basis, **starting at 9AM on Thursday, September 15**. The paper must be submitted through both Turnitin and Crowdmark by **midnight on Thursday, October 6**. The grading rubric is available on eClass.

Topics for the **video presentation** are available to browse from day one. Students will be able to select their topic of choice, on a first-come first-serve basis, **starting at 9AM on Thursday, October 6**. The video must be submitted by **midnight on Tuesday, December 6**. The grading rubric is available on eClass.

Academic Integrity

Assessments, whether in person or online, are intended to be individual pieces of work. Collaborating with other students is not permitted. Please note the instructors have full access to Chegg and other similar websites and will be used if needed to prosecute academic misconduct. Please also note that online proctoring software could be used (should the part of the course need to be delivered remotely/online). Any decision on this matter will be clearly communicated to all students before an assessment.

Numerous students in Faculty of Science courses have been charged with academic misconduct when materials they uploaded to third-party repository sites (e.g. Course Hero, One Class, Chegg, etc.) were taken and used by unknown students in later offerings of the course. The Faculty's Committee on Examinations and Academic Standards (CEAS) found in these cases that the burden of proof in a charge of aiding and abetting had been met, since the uploading students had been found in all cases to be wilfully blind to the reasonable likelihood of supporting plagiarism in this manner. Accordingly, to avoid this risk, **students are urged not to upload their work to these sites**. Whenever a student submits work obtained through Course Hero, Chegg or One Class, the submitting student will be charged with plagiarism and the uploading student will be charged with aiding and abetting.

Note also that exams, tests and other assignments are the copyrighted works of the professor assigning them, whether copyright is overtly claimed or not (i.e. whether the © is used or not). Scanning these documents constitutes copying, which is a breach of Canadian copyright law, and the breach is aggravated when scans are shared or uploaded to third party repository sites.

Students are required to make themselves aware of school policies relating to Academic Integrity, Accessibility, Religious Accommodation, Student Conduct and other matters. Plagiarism and other academic offenses will be sanctioned to the fullest extent in accordance with University and Faculty policies.

You MUST digitally sign on the agreements below on eClass

- **Academic Honesty Agreement:** I understand York University's *Senate Policy on Academic Honesty* and will abide by this policy. The full policy can be found at: <https://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/>.
- The following website (<https://spark.library.yorku.ca/academic-integrity-what-is-academic-integrity/>) is a good resource to learn about "academic integrity". Students are strongly encouraged to go through the self-guided website.
- Note that ignorance of these policies and of academic integrity is not an acceptable excuse for academic misconduct.
- I acknowledge that academic honesty requires that I do not cheat (attempt to gain an improper advantage in an academic evaluation), plagiarize, aid and abet others in academic dishonesty, nor attempt or actually alter, suppress, falsify or fabricate documents.
- Suspected breaches of academic honesty will be investigated and charges shall be laid if reasonable and probable grounds exist and lead to the range of penalties described in the guidelines of the policy.

Online Delivery of the Course

Due to the ever-evolving nature of the COVID-19 pandemic, the course **might** need to shift from in person to online. In this scenario, the following is a list of requirements of what students will need to complete the course.

- **A working and stable internet connection** (high speed greatly preferred) to attend remotely lectures delivered through Zoom. eClass and Crowdmark also require stable internet connections. The instructors cannot accommodate if students run into technical problems relating to your internet connections.
- **Access to the email account linked to the eClass profile** as online assessments through Crowdmark will only be sent to the email address linked to that specific account (where course announcements are also sent). The actual email account is listed on eClass, under Profile (pull-down menu on the top right page).
- **A document scanning app capable of producing PDF files** as exams need to be submitted in PDF format only. This will require you to write your answers on paper, then digitally capture your work in PDF using a document scanning app. Both Apple and Android phones contain native scanning apps that should be used. The instructors will NOT accept camera photos as they tend to be too large in file size, rotated incorrectly, taken at an improper angle and suffer from many image artifacts. Failure to submit your work properly may result in it not being graded.

A sample assessment will be given (if needed) to allow you to practice a submission and to become familiar with our expectations.

For students who may be using a tablet computer with a stylus to annotate provided PDF files:

- Tablet computers such as the Microsoft Surface are able to annotate PDF files using a stylus. Unfortunately, the instructors have run into issues with eClass and Crowdmark whereby the annotations is lost when uploaded for grading, depending on the program used to annotate the PDF files.
- If a tablet computer is used to annotate files, it is the student's responsibility to make sure the annotations show up after the file is uploaded. Otherwise, it will be treated as a missed assessment or as late submission, with penalty as per the course syllabus.

Important Information Regarding Platforms Used for the Course

Several platforms will be used in this course (e.g., eClass, Zoom, etc.) through which students will interact with the course materials, the course director / TA, as well as with one another. Students shall note that:

- **eClass** (also known as Moodle) will be used extensively throughout the course. More information about the platform, its technology requirements and FAQs can be found online at <https://thelp.yorku.ca/moodle>.
- **Zoom** is hosted on servers in the U.S. This includes recordings done through Zoom. If you have privacy concerns about your data, provide only your first name or a nickname when you join a session. The system is configured in a way that all participants are automatically notified when a session is being recorded. In other words, a session cannot be recorded without you knowing about it.
- This course might require the use of online proctoring (e.g., **Proctortrack**) for examinations. In this scenario, students will need to have access to common IT technology (computer with a camera and mic with stable internet connection). Further details will be shared in due course if needed. Students will be required to share any IT accommodation needs with the instructor as soon as possible.

Accessibility

York University is committed to principles of respect, inclusion, and equality of all persons with accessibility needs across campus. The University provides services for students with accessibility needs (including physical, medical, learning, and psychiatric needs) needing accommodation related to teaching and evaluation methods/materials. These services are made available to students in all Faculties and programs at York University.

Students in need of these services are asked to register with accessibility services as early as possible to ensure that appropriate academic accommodation can be provided with advance notice. You are encouraged to schedule a time early in the term to meet with each professor to discuss your accommodation needs. Please note that registering with accessibility services and discussing your needs with your professors is necessary to avoid any impediment to receiving the necessary academic accommodations to meet your needs. Additional information is available at the following websites:

- **Student Accessibility Services:** <https://accessibility.students.yorku.ca>
- **York Accessibility Hub:** <http://accessibilityhub.info.yorku.ca/>

Assistance

Attending university and coping with all the expectations, over and above other responsibilities you may have outside school, can be very challenging. A number of options are available to students, on and off campus, to assist you in your learnings and to help deal and cope with difficult situations. As always, in case of an emergency, students should **call 911**.

- **Academic Advising:** <https://www.yorku.ca/science/academic-advising/> Departments also offer program-specific advising. Check with your Department's Undergraduate Office.
- **Centre for Human Rights, Equity, and Inclusion:** <https://rights.info.yorku.ca>
- **Centre for Indigenous Students Services:** <https://aboriginal.info.yorku.ca/>

- **Good2Talk 24-hour Ontario Student Helpline:** 1-866-925-5454 /Text: GOOD2TALKON to 686868
- **Keep.meSAFE:** <https://myssp.app/keepmesafe/ca/home>
- **Learning Commons** (general academic learning supports including library research, time management, study skills, career planning, etc.): <https://learningcommons.yorku.ca/>
- **Peer Assisted Study Sessions (PASS):** <https://www.yorku.ca/colleges/bethune/get-help/pass/>
- **Peer Tutoring:** <https://www.yorku.ca/colleges/bethune/get-help/peer-tutoring/>
- **Sexual Violence Response and Support:** <https://thecentre.yorku.ca>
- **Student Counselling, Health & Well-being:** <https://counselling.students.yorku.ca/>
- **Support Services for International Students:** <https://yorkinternational.yorku.ca/international-student-support/>
- **Writing Services:** <https://www.yorku.ca/colleges/bethune/get-help/writing/>
- **York University Student Services:** <https://family.yorku.ca/student-services/#SCD>
- **York University Student Well-being Resources:** <https://www.yorku.ca/well-being/resources/students/>

Religious Accommodation

York University is committed to respecting the religious beliefs and practices of all members of the community and making accommodations for observances of special significance to adherents. Should any of the dates specified in this syllabus for an in-class test or examination pose such a conflict for you, contact the Course Director within the first three weeks of class. Similarly, should an assignment to be completed in a lab, practicum placement, workshop, etc., scheduled later in the term pose such a conflict, contact the Course Director immediately. To arrange an alternative date or time for an examination scheduled in the formal examination periods (December and April/May), students must complete and submit an accommodation request form at least 3 weeks before the exam period begins.

<https://secure.students.yorku.ca/pdf/religious-accommodation-agreement-final-examinations.pdf>

(updated on August 31, 2022)