



## SC/CHEM 3090 (3 credits) Introduction to Polymer Chemistry

### Term

Winter 2019

### Time and Location

Lectures (CB115) MWF 8:30 am – 9:30 am

### Prerequisite

SC/CHEM 2020 Organic Chemistry

Students are also strongly encouraged to review basic physical chemistry/thermodynamics principles.

### Course Instructor

Dr. Thomas Baumgartner

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Office: LSB 431B

Office hours (LSB 213): by appointment

### Course Description

This course serves as an introduction to polymer chemistry. The course deals with fundamental aspects with special focus on polymer synthesis, polymerization mechanisms, polymer architectures, properties, and characterization.

The following topics will be covered over the semester:

- Background to Polymer Chemistry, Nomenclature, Classifications
- Principles of Polymer Synthesis (Step- and Chain-Polymerization, concepts, parameters, variables)
- Radical, Ionic, Ring-Opening Polymerization mechanisms, variations, and other specialized methods
- Liquid-Crystalline Polymers and Block Copolymers
- Polymers in Solution (features, parameters, characterization methods)
- Bulk Properties of Polymers in the Solid State (liquids, glasses, elastomers, crystalline polymers, physical characterization)
- $\pi$ -Conjugated Polymers (background, features, band theory, optical properties, applications)

## Purpose and Objectives of the Course

The purpose of the course is to introduce fundamental aspects of polymer chemistry and build upon knowledge gained in previous organic, inorganic, physical and analytical chemistry courses. Particular attention will be paid to the synthetic aspects of polymers, the understanding of polymers physical properties and of the structure–property relationships. Students will also be introduced to the functional properties of conjugated polymers and their practical applications.

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

1. communicate effectively with chemists in the field using proper nomenclature;
2. propose means to prepare different types of polymers with control over the composition of the polymer, its microstructure and its molecular weight;
3. determine and rationalize the properties of polymers;
4. explain which and how analytical tools can be used to elucidate the chemical structure of polymers;
5. read, understand and summarize important points from the polymer literature.

## Textbooks

Much of the course will be based on the following **highly recommended** text book:

R. J. Young, P. A. Lovell, *Introduction to Polymers*, 3<sup>rd</sup> Edition, CRC Press; ISBN: 978-1-439891-95-7

A few additional aspects are covered in a separate **recommended** textbook:

A. E. Tonelli, *Polymers from the Inside Out: An Introduction to Macromolecules*, Wiley-Interscience  
ISBN: 0-471-38138-1

Both textbooks (the first one only in the 2<sup>nd</sup> edition) are on reserve at the Steacie Library and are available for a 2-hour loan.

## Organization of the Course

Much of the lectures will be delivered by the Course Instructor but will require active participation of the students in the form of discussions. Supplementary slides with pertinent figures will be posted ahead of the class on Moodle. It is the student's responsibility to sign up for an account. See <https://moodle10.yorku.ca/moodle/> 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.

Problem sets (3)	10% (total)
Mid-term exam (total of two, held during class)	50% (25% each)
Final exam (2 h)	40%

No make-up mid-term exam will be available. The missed marks will be distributed equally among the other tests/exams only if a valid reason is provided to the Course Instructor, such as the official Registrar's Office "Attending Physician's Statement" filled out by a registered medical doctor, M.D. within 7 days of the missed test. A simple doctor note will NOT be accepted. If the proper document is not produced by the student and/or if the Course Instructor deems the reason not valid, the student who did not write the test will receive a zero for that missed test. A deferred final exam, if needed, would likely be held on or about August 17. All students should be familiar with the "New Missed Exam Policy" document available on the Chemistry website (<http://www.chem.yorku.ca>)

Problem sets will be assigned and posted on Moodle on a regular basis to facilitate learning of concepts presented in class. Those problem sets will NOT be graded but are still a fair (10%) component of the final grade. Every **fully completed** problem set turned in on time is worth 100%, as long as a reasonable effort was demonstrated by the student (even if the answers to the questions are not right).

### **Grading Scheme, Assignment Submissions, Lateness Penalties, Academic Integrity**

The grading scheme for the course conforms to the 9-point grading system used in undergraduate programs at York (e.g., A+ = 9, A = 8, B+ = 7, C+ = 5, etc.). Assignments and Mid-term exams will bear a corresponding number grade (e.g. A+ = 90 to 100, A = 80 to 90, B+ = 75 to 79, etc.)

(For a full description of York grading system see the York University Undergraduate Calendar - <http://calendars.registrar.yorku.ca/2010-2011/academic/index.htm>)

Proper academic performance depends on students doing their work not only well, but on time. Accordingly, the assignments must be received on the due date specified for the assignment, which are to be handed at class on the due date. Assignments should NOT be deposited in the Course Instructor's mailbox. **Assignments received later than 9:20 AM on the due date will result in no credit (0%).** This is so that the answer set can be posted as soon as possible to help you prepare for mid-term exams and for the final exam. Exceptions to the lateness penalty will be entertained by the Course Instructor only when supported by written documentation (see above). The grading scheme will be adjusted accordingly.

### **Important Dates**

January 4	First class
January 30	First Mid-term (held in class)
February 16 – 22	Reading Week (no class)
March 6	Second Mid-term (held in class)
April 3	Last class
April 5 – 20	Final exam (students MUST not make commitments that would prevent them from writing the final exam at the date determined by the Registrar's Office)

### **Important Course Information**

Students must make themselves aware of 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<sup>a</sup> and printed, and the Registrar's Office issues a list of Religious Observance Days.<sup>b</sup>

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

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

### **E-mail Communications**

All course-related questions and issues will be addressed during class or during office hours. Any administrative questions and issues will likely be best addressed by the Undergraduate Program Assistants in the Chemistry Building (CB 124). E-mail communications should ONLY be used in case of emergencies and should have "CHEM 3090" as subject line. All messages received WITHOUT this tag will be ignored and deleted. Messages will be replied to within 24-48 hours, except during weekends or holidays.