Western University  
Department of Chemistry

Chemistry 3320B – Polymer Chemistry (Winter 2022 Course Outline)

NOTE: This course outline is subject to change with the evolving COVID-19 pandemic.

Course Description:  A comprehensive treatment of the preparation and uses of polymers and their chemical and physical properties in the solid state and solution.

Instructor:  Dr. Joe B. Gilroy

Office:  MSA 3201

E-mail:  joe.gilroy@uwo.ca

E-mail correspondence will only be considered if it is sent from your @uwo.ca address. Please also include Chem 3320 in your e-mail subject line. I would prefer to discuss chemistry face to face (via Zoom) and ask that you contact me by e-mail for administrative reasons only.

Lectures:  M-W-F 11:30–12:20; via Zoom until Jan. 31, in ChB 9 after that

NOTE: Taking this class means you accept using Zoom for the virtual, synchronous lectures when mandated by UWO.

Tutorials:  Scheduled as needed.

Office Hours:  By appointment (via Zoom)

Course Webpage:  Accessible through UWO OWL - CHEM 3320B 001 FW21

NOTE: You will need to be registered in the course and have a UWO computer account to access this site.

Important Dates:  Midterm test scheduled for Wed. Feb. 16, 7:00–9:00 pm, P&AB 117
Classes are cancelled the week of Feb. 21–25 (Reading Week)
**Evaluation:**

**Chemistry 3371 late policy:** Laboratory reports and assignments handed in late will receive a penalty of 10% per day, with the weekend counting as one day. No submissions will be accepted after graded work has been returned. Academic considerations will only be given to students who get the required approval from the academic counsellors in the Faculty of Science or via Self-Reported Absences.

**Course Attendance:** Course attendance is mandatory for Chem 3320. Information missed during unexcused absences will not be the grounds for academic appeal.

**Evaluated Materials:** All work submitted for a grade in this course must be your personal work (or yours and a team member as appropriate), use of answers obtained externally is prohibited.

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term Test  (Wed. Feb. 16, 7:00–9:00 pm, P&amp;AB 117)</td>
<td>25%</td>
</tr>
<tr>
<td>Assignments</td>
<td>20%</td>
</tr>
<tr>
<td>4 problem sets, 5% each</td>
<td></td>
</tr>
<tr>
<td>(Approximate due dates Jan. 28, Feb. 11, Mar. 4, and Mar. 25; submitted via Gradescope)</td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td>20%</td>
</tr>
<tr>
<td>3 reports, 2 worksheets</td>
<td></td>
</tr>
<tr>
<td>(schedule included below)</td>
<td></td>
</tr>
<tr>
<td>Final Exam (Cumulative, date and time to be announced)</td>
<td>35%</td>
</tr>
</tbody>
</table>

**NOTE:** To pass Chem 3320 it is necessary to obtain a passing grade in the laboratory component (and complete a minimum of 4 laboratory experiments/reports) and the lecture component (term test, assignments, and final examination).

**Midterm Test:** If the midterm test is missed for valid reasons, the weighting of the test will be transferred to the final examination. For those students who cannot write the midterm test on the date indicated because of religious or class conflicts, please contact Dr. Gilroy immediately.

**Final Exam:** If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam). You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).
Course-Based Learning Outcomes:

Upon completion of Chem 3320, students will be able to:

- describe the scientific principles governing polymer synthesis and characterization and apply these principles to problems.

- use their knowledge of polymer chemistry to predict and rationalize properties, mechanisms, and patterns of reactivity.

- apply methodologies in order to conduct polymer synthesis, analyses, or other chemical investigations.

- prepare logical, organized, and concise written reports describing their experimental results in the areas of polymer synthesis and characterization.

- work productively and collaboratively as a team member.

Course Content:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Number of Lectures (Approximate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General introduction and physical properties of polymers</td>
<td>5</td>
</tr>
<tr>
<td>Addition polymerization of alkenes including radical, ionic, and transition metal</td>
<td>5</td>
</tr>
<tr>
<td>NMR spectra of polymers</td>
<td>2</td>
</tr>
<tr>
<td>Condensation polymerizations</td>
<td>1</td>
</tr>
<tr>
<td>Synthesis of π-conjugated polymers</td>
<td>2</td>
</tr>
<tr>
<td>Ring-opening polymerization</td>
<td>2</td>
</tr>
<tr>
<td>Inorganic polymers: silicones and polyphosphazenes</td>
<td>2</td>
</tr>
<tr>
<td>Molecular weight and its determination</td>
<td>3</td>
</tr>
<tr>
<td>Thermal analysis of polymers</td>
<td>2</td>
</tr>
<tr>
<td>Structure and properties of polymers, crosslinking</td>
<td>3</td>
</tr>
<tr>
<td>Copolymers and self-assembly</td>
<td>5</td>
</tr>
<tr>
<td>Inorganic alkene analogs</td>
<td>2</td>
</tr>
</tbody>
</table>
Required Materials:

**Laboratory Manual:** The Lab Manual and Prelab Notes for Chem 3320 will be available through the UWO bookstore.

**Laboratory Notebook:** Please purchase a Hayden McNeil, Organic Chemistry Spiral Bound 100 page Notebook from the bookstore. An identical notebook from a different (but not concurrent) chemistry laboratory, if only partially used, will be suitable.

**Textbook:** There is no required textbook for Chem 3320.

Reference Materials:

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Edition</th>
<th>Call Number</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic and Physical Chem. of Polymers</td>
<td>Gnanou and Fontanille</td>
<td></td>
<td>QD 381.G55X</td>
<td>2008</td>
</tr>
<tr>
<td>Polymer Chemistry</td>
<td>C. E. Carraher</td>
<td>5th</td>
<td>QD 381.S483</td>
<td>2000</td>
</tr>
<tr>
<td>Principles of Polymer Chemistry</td>
<td>A. Ravve</td>
<td>3rd</td>
<td>QD 381.R38</td>
<td>2000</td>
</tr>
<tr>
<td>Spectroscopy of Polymers</td>
<td>L. Koenig</td>
<td>2nd</td>
<td>QD 139.P6K64</td>
<td>1999</td>
</tr>
<tr>
<td>Polymer Characterization</td>
<td>D. Campbell</td>
<td>2nd</td>
<td>QD 139.P6C35</td>
<td>2000</td>
</tr>
</tbody>
</table>

Laboratory: All in-person laboratory experiments will be held in ChB 080/084 (Monday or Friday from 1:30–5:20). The lab schedule is included below.

The laboratory TA is Justin Lomax. Please contact Justin (jlomax5@uwo.ca) before contacting Prof. Gilroy about laboratory issues to allow us to ensure consistency across the entire course.

The laboratory topics are listed below. **You will be required to submit electronic copies of your lab reports via Gradescope for Chem 3320.**

- **Lab A:** Polystyrene
- **Lab C:** Plexiglass
- **Lab D:** Styrofoam
- **Lab E:** Poly(3-hexylthiophene)
- **Lab F:** Molecular Weight Distributions of Polystyrene/Plexiglass

Read the introductory pages in the Lab Manual – they have been included for a reason. Be on time, there is no provision for making the lab period last longer. Being able to finish the required experiment in the allotted time is part of the challenge and your evaluation.
**Laboratory Schedule:**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 6</td>
<td>A</td>
<td>No Lab</td>
<td>No Lab</td>
<td>C&amp;D</td>
<td>C&amp;D</td>
<td>E</td>
<td>E&amp;F Sub C&amp;D</td>
<td>No Lab</td>
<td>No Lab</td>
</tr>
<tr>
<td>7 - 12</td>
<td>A</td>
<td>No Lab</td>
<td>No Lab</td>
<td>C&amp;D</td>
<td>C&amp;D</td>
<td>E</td>
<td>E&amp;F Sub C&amp;D</td>
<td>No Lab</td>
<td>No Lab</td>
</tr>
</tbody>
</table>
**Laboratory Safety:** This is our number one priority. To help you find the hazards/safety information for reagents that you will be using in the lab, the following online resources will help you:

[http://www.uwo.ca/hr/safety/topics/msds.html](http://www.uwo.ca/hr/safety/topics/msds.html)

**Safety Glasses and Lab Coats:** Safety glasses are required at all times when working in the laboratory. Students who normally wear prescription glasses must wear safety glasses or goggles over their regular glasses. A lab coat, closed toe shoes, and full-length pants are also required when working in the laboratory.

**NOTE:** Contact lenses are generally NOT recommended.

**Notes about Pre/antirequisites:**

**Prerequisite(s):** Either Chemistry 2273A and 2283G or Chemistry 2213A/B, either Chemistry 2214A/B or 2384B or the former 2284B.

**Antirequisite(s):** CBE 4493A/B, the former CBE 3392A/B.

**A Mandatory Notice from the Registrar:** Unless you have either the prerequisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

**Student Absences:**

**Academic Consideration for Student Absences:** Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

(i) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:

- an absence must be no more than 48 hours
- an SRA for a lab report provides an automatic 48 hour extension from the original due date
- an SRA for a lab session excuses that week of the experiment. Either the report will also be excused, or the instructor will provide data and/or materials to allow for multi-week experiments and reports to be completed
- the assessments must be worth no more than 30% of the student’s final grade
- no more than two SRAs may be submitted during the Fall/Winter term
(ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.

(iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered, unless otherwise instructed in the course outline.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.

For the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf

and for the Student Medical Certificate (SMC), see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

**Religious Accommodation:** When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University’s list of recognized religious holidays (updated annually) at https://multiculturalcalendar.com/ecal/index.php?s=c-univwo

**Course Absences due to Daily COVID Screening Questionnaire:** Missed assessments (e.g., presentations, quizzes, tests, midterms, etc.) require formal academic considerations (typically self-reported absences and/or academic counselling). Methods for dealing with missed work and course content are at the discretion of the instructor(s). Students should be aware that some learning outcomes cannot be easily made up and may need to be completed in a subsequent year. Your instructor will provide you with further information as to how this applies within this course. Students who demonstrate a pattern of routinely missing coursework due to self-reported COVID symptoms, and therefore do not demonstrate mastery of the learning outcomes of the course, will not receive credit for the course.

**Accommodation and Accessibility:**
Accommodation Policies: Students with disabilities work with Accessible Education (formerly SSD), which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_disabilities.pdf

Academic Policies:

The website for Registrarial Services is http://www.registrar.uwo.ca.

In accordance with policy, https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf, the centrally administered e-mail account provided to students will be considered the individual’s official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Permitted aids for quizzes, tests and exams: Students will always be allowed to use model kits and basic scientific calculators. Any other information students require will be provided by Dr. Gilroy.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

Support Services:

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: https://www.uwo.ca/sci/counselling/.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at (519) 661-2147 if you have any questions regarding accommodations.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: https://www.uwo.ca/se/digital/.
Learning-skills counsellors at the Student Development Centre (http://www.sdc.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (http://www.health.uwo.ca/mentalhealth) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, https://westernusc.ca/your-services/.

**Masking Guidelines:**

Students will be expected to wear triple layer, non-medical, masks at all times in the classroom as per University policy and public health directives. Students who are unable to wear a mask must seek formal accommodation through Western Accessible Education, and present medical documentation. Students are not permitted to eat or drink while in class to ensure masks stay in place. Students will be able to eat and drink outside of the classroom during scheduled breaks. Students unwilling to wear a mask as stipulated by Western policy and public health directives will be referred to the Dean, and such actions will be considered a violation of the student Code of Conduct.

**Statements Concerning Online Etiquette:**

Some components of this course will involve online interactions. To ensure the best experience for both you and your classmates, please honour the following rules of etiquette:

- “arrive” to class on time.
- use your computer and/or laptop if possible (as opposed to a cell phone or tablet).
- ensure that you are in a private location (if possible) to protect the confidentiality of discussions in the event that a class discussion deals with sensitive or personal material.
- to minimize background noise, mute your microphone for the entire class until you are invited to speak, unless directed otherwise.
- In order to give us optimum bandwidth and web quality, turn off your video camera for the entire class unless you are invited to speak.
- Please be prepared to turn your video camera off at the instructor’s request if the internet connection becomes unstable.
- Unless invited by your instructor, do not share your screen in the meeting.

The course instructor will act as moderator for the class and will deal with any questions from participants (generally via the chat feature). To participate please consider the following:

- If you wish to speak, use the “raise hand” function and wait for the instructor to acknowledge you before beginning your comment or question.
- Please remember to unmute your microphone and turn on your video camera before speaking.
• Self-identify when speaking.
• Please remember to mute your mic and turn off your video camera after speaking (unless directed otherwise).

General considerations of “netiquette”:

• Keep in mind the different cultural and linguistic backgrounds of the students in the course.
• Be courteous toward the instructor, your colleagues, and authors whose work you are discussing.
• Be respectful of the diversity of viewpoints that you will encounter in the class and in your readings. The exchange of diverse ideas and opinions is part of the scholarly environment. “Flaming” is never appropriate.
• Be professional and scholarly in all online postings. Use proper grammar and spelling. Cite the ideas of others appropriately.

Note that disruptive behaviour of any type during online classes, including inappropriate use of the chat function, is unacceptable. Students found guilty of Zoom-bombing a class or of other serious online offenses may be subject to disciplinary measures under the Code of Student Conduct.

Remote Proctoring and Lecturing:

If Remote Proctoring Software is used in this course it is because of UWO OR Provincial-mandated restrictions to in-person teaching. Tests and examinations in this course may be conducted using a remote proctoring service, such as Proctortrack. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide personal information (including some biometric data) and the session will be recorded. More information about this remote proctoring service is available in the Online Proctoring Guidelines at the following link: [https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf](https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf). Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. Information about the technical requirements are available at the following link: [https://www.proctortrack.com/tech-requirements/](https://www.proctortrack.com/tech-requirements/).

Zoom will be used for lectures. Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please provide this information to the instructor.