ChE 4X03/6X03 Polymer Processing

Course Outline – Winter 2026

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In case of conflicts, the latest version of this document posted on the course's A2L page prevails.

TEACHING STAFF

Role	Name	E-mail	Office Hours*
Instructor	Li Xi	xili@mcmaster.ca	by appointment
TA	Hoda Oyarhoseini	oyarhosh@mcmaster.ca	–

*Subject to change with prior notice on A2L.

SCHEDULE

Day(s)	Time*	Calendar Designation	Our Designation
Tuesdays	14:30–16:20	C01	Class Meetings
Thursdays	14:30–15:20		

*Per university policy, venues for class sessions cannot be listed in the course outline. Check your Mosaic account.

TEXTBOOK

Required Text

J. Vlachopoulos, *Introduction to Plastics Processing*, available at the Course A2L Shell: Content→Course Materials→eReserves.

Additional References

- J. Vlachopoulos and N. D. Polychronopoulos, *Understanding Rheology and Technology of Polymer Extrusion*, available at the Course A2L Shell: Content→Course Materials→eReserves.
- R. B. Bird, R. C. Armstrong, and O. Hassager, *Dynamics of Polymeric Liquids, Volume 1: Fluid Mechanics*, 2nd Edn., Wiley, 1987.
- T. P. Lodge and P. C. Hiemenz, *Polymer Chemistry*, 3nd Edn., CRC Press, 2020.
- M. Rubinstein and R. H. Colby, *Polymer Physics*, Oxford, 2003.
- R. B. Bird, W. E. Stewart, and E. N. Lightfoot, *Transport Phenomena*, 2nd Edn., Wiley, 2002.

COMMUNICATION

Avenue to Learn (http://avenue.mcmaster.ca/; also referred to as "Avenue" or "A2L") will host the main course webpages, where course materials, documents, assignments, online discussion, important announcements, and other related information will be posted/hosted. The students are expected to check the course A2L page regularly.

McMaster E-mail Account The "@mcmaster.ca" E-mail accounts will also be used for course-related correspondence. The students are expected to check their E-mail accounts regularly. (Note: A2L has its separate *internal E-mail system*, which *will NOT be used or checked*.)

Microsoft Teams (https://teams.microsoft.com/; also referred to as "MS Teams" or just "Teams") will be used for additional class-related communications, including online meetings and direct messages. The students are expected to keep an active Teams account and be able to receive messages there.

COURSE OBJECTIVES

This course will introduce the student to the basic principles of polymer processing, stressing the development of models, which have aided engineers in understanding the fundamental aspect of this field. Efforts will focus on extending transport phenomena to the specific behavior of polymers and acquaint students with the machinery typically of the field of polymer processing.

OUTLINE OF TOPICS*

1. Polymer fundamentals
   - Introduction
   - Polymer properties
2. Polymer melt flows
   - Stress and tensor calculus
   - Viscosity
   - Polymer fluid mechanics
   - Melt flow in extrusion
3. Polymer rheology
   - Stress relaxation
   - Rheological properties
   - Rheological effects on flow and rheometry
   - Rheological effects on the extrudate
4. Polymer production processes
   - Extrusion
   - Product shaping
   - Injection molding

*Subject to change at the instructor's discretion.

ASSESSMENT PROCEDURE

Term Grade Calculation

Term grades are calculated using the following distributions.

Category	Schedule/Due	Scheme	
		ChE 4X03	ChE 6X03
Assignments	as indicated on A2L	20%	15%
Midterm Exam (110 mins)	Feb. 24 (Tuesday) 14:30–16:20	30%	25%
Final Exam (2 hours)	TBD by the Exam Office	50%	40%
Term Report	as indicated on A2L	–	20%

- The instructor reserves the right to change the number and format of each assessment item.
- Assignments and term reports must be submitted electronically to corresponding A2L assignment folders. *Only PDF files are accepted. Submission through unauthorized channels (MS Teams, E-mail, etc.) will be ignored.*
- The term letter grade will be assigned following the Registrar's recommended procedure.
- Grade adjustment may be applied at the instructor's discretion.

Missed Work Policies

- Relief for missed work must be requested through the McMaster Student Absence Form (MSAF) system.
- *The onus is on the student to contact the instructor* for missed work relief after completing the MSAF process.

- Specific grading procedures for missed work with valid MSAF requests are provided below for each assessment category.
- A zero mark will be given for missed work without MSAF.

Assignments

- Assignments will be posted on A2L.
- With a valid MSAF, reasonable extension may be granted.
- Without MSAF, each late submission is subject to a penalty of 1% for every hour late (rounded to the next whole hour).

Midterm Exam

- With a valid MSAF, the weight of the missed exam will be moved to the final exam.

Final Exam

- The coverage will be comprehensive, including contents of the whole course.
- MSAF does not apply to the final exam. Please refer to McMaster's deferred examination policies.

Term Report

- For ChE 6X03 only.
- The format and due date of the term report will be announced on A2L.
- With a valid MSAF, reasonable extension may be granted. However, no extension will be granted beyond the final exam date.

Additional Policies on Assessment

Aids Allowed in Exams

The exams will be closed book with the following aids allowed.

- **Two (midterm)** *or* **three (final exam)** letter-size, double-sided crib sheets. The following requirements must be strictly followed – violations will be considered academic integrity infractions.
  - All crib sheets must be **hand-written** (printed or photocopied copies not allowed);
  - Any **mathematical equations written on the crib sheets must be found in either the lecture slides** (as posted on A2L) **or the required textbook**[*].
  - Solutions to problems, either complete or partial, are NOT allowed on the crib sheets.
  - The crib sheets must be submitted with the exam paper and answer booklet. They cannot be taken out of the exam room.
- any calculator;
- writing/drawing tools;
- timepiece (with no computing or communication functions).

No other books or materials will be allowed. Electronic devices not in the list will be forbidden, including but not limited to computers, tablets, cell phones, smart watches, PDAs, and any other devices with computing or communication capabilities. Any evidence of violation will be treated as a case of academic dishonesty.

[*]Exceptions are allowed for common physical constants.

Use of Generative AI

Generative AI may **only** be used in *the term report* (for ChE 6X03 students only) and it is **permitted only to the extent specified in the report instructions**. Use of AI in other assessment items and/or beyond the allowed limit is **considered academic dishonesty** and will be subject to relevant proceedings.

Collaboration and Academic Integrity

For *assignments*:

- Students are encouraged to discuss with each other, but each student must submit their own work.
- Identical or unreasonably similar answers will be considered an act of plagiarism or improper collaboration.
- Use of AI tools is prohibited.

For *exams*:

- Students will only be allowed to use the aids specified on the exam paper.
- Communication with others, including *but not limited to* other students, either in person or remotely (through telephone, messaging, internet, or any other electronic communication method) is strictly prohibited.

For *term report*:

- The student is allowed to discuss their thoughts with the instructor, TA, and/or other students.
- The report must be conceived and drafted entirely by the student's sole effort.

For all categories of assessment, academic integrity infractions *will be reported to the Academic Integrity Office*, in addition to heavy penalties on the grade.

Grade Challenge

To challenge the grading of an graded item (*other than the final exam*), the following procedure must be followed.

- The request needs to contain a detailed list of the alleged grading errors, with page/line numbers specified (as appropriate) and reasons/justifications provided.
- The student is responsible for submitting a copy of the graded material along with the request.
- The instructor and/or TAs will review the request and may call for meetings with the student if further discussion is needed.
- The instructor reserves the right to deny any re-grading requests submitted beyond a reasonable time window after the graded material is first made available to the student.

The graded *final exam* may be reviewed upon written request *to the instructor* (through @mcmaster.ca E-mail accounts). Its re-grading, if requested, is subject to the following policies.

- It may only be re-graded if there is sufficient evidence of major mistakes in the original grading that have substantially affected the outcome.
- Once started, the final exam will always be graded in its entirety – *the new grade may be lower than the original*.

Partial Credit

- Partial credit may be awarded for incorrect answers at the discretion of the instructor or TAs.
- Accumulation of errors: if an incorrect answer of one step is partially or fully caused by incorrect answer(s) from previous steps, partial credit will only be assigned for correct conceptual understanding/thought process as reflected in the written solution. Note: the instructor/TAs will not check whether the calculation process of the new step itself is correct by attempting to reproduce the answer from the wrong results of previous steps.

THE P.R.O.C.E.S.S.

As some of you may already be aware, the Department of Chemical Engineering has a storied history of education. In addition to teaching and learning, the department is proud of our graduates not only for their academic success, but their more intrinsic traits that make them respected members of the engineering community.

Recently, several high-ranking graduates from the McMaster Chemical Engineering Program employed in various industries (oil/gas, financials, etc.) were interviewed to ask what traits they look for when hiring for engineering positions. Using this information, the department would like to present to you the **PROCESS**: a code of conduct that we hope will guide our students throughout this program and their careers to come.

- Professionalism
- Responsibility
- Ownership
- Curiosity
- Empathy
- Selflessness
- Service

It is up to YOU to interpret these traits and apply them to your time at McMaster and your career as you see fit. These traits will not be assessed for grades but will be strongly encouraged throughout your time at McMaster. We hope that you identify with these character traits and what they mean to you, and that you **trust the process**.

APPROVED ADVISORY STATEMENTS

The following statements are required per McMaster's Undergraduate Course Management Policies.

Academic Integrity

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at https://secretariat.mcmaster.ca/university-policies-proceduresguidelines/.

The following illustrates only three forms of academic dishonesty:

1. plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. improper collaboration in group work.
3. copying or using unauthorized aids in tests and examinations.

Authenticity/Plagiarism Detection

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

Courses with an On-Line Element

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster

e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

Online Proctoring

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

Conduct Expectations

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the Code of Student Rights & Responsibilities (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

Academic Accommodation of Students with Disabilities

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's Academic Accommodation of Students with Disabilities policy.

Requests for Relief for Missed Academic Term Work

In the event of an absence for medical or other reasons, students should review and follow the Policy on Requests for Relief for Missed Academic Term Work.

Academic Accommodation for Religious, Indigenous or Spiritual Observances (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office ***normally within 10 working days*** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

Copyright and Recording

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

Extreme Circumstances

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.