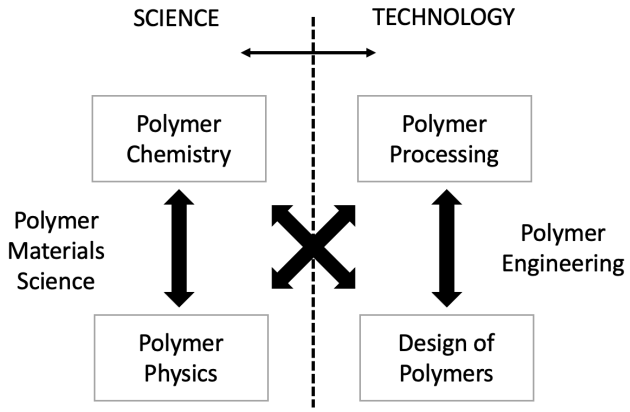
This course is designed to provide an introductory understanding and appreciation of polymers and polymer-based composites from the "Chemical and Biological Engineering" perspective. The basics of polymer structure, physics and chemistry will be outlined. Furthermore, the structures and properties of these materials will be presented, and how we measure their properties will be discussed. The interrelationship between processing, structure, and properties will specifically be reinforced with respect to the requirements of typical polymer and polymer-based composite applications.



Adapted from Torres FG. International Journal of Mechanical Engineering Education. 2002;30(2):155-164. doi:10.7227/IJMEE.30.2.6

You will be continually asked to practice thinking like a polymer engineer. Technical communication is also of utmost importance and you will be given tips/tricks and extensive feedback to improve the effectiveness of your communication skills. Learning will be evaluated based on **presentations** (in groups), **assignments**, online **quizzes** and in class tests **tests**.

Quick Facts: Where? When?

This course will be taught in Winter of 2021.

Meet Your Instructors

INSTRUCTOR | Dr. Johan Foster

NSERC Canfor Industrial Research Chair in Advanced Bioproducts
Chemical and Biological Engineering
Office: CHBE 421, 2360 East Mall

E: johan.foster@ubc.ca

Johan's short bio: Born in BC, spent 3 years in the Netherlands, 5 years in Switzerland, 5.5 years in Virginia. Just back to BC in time for COVID-19. Like: skiing, biking, hiking, travel (or I used to…).

For more research and group information see:

https://foster.chbe.ubc.ca

INSTRUCTOR | Dr. Orlando Rojas

Canada Excellence Research Chair (CERC) and Director of the Bioproducts Institute, Chemical and Biological Engineering, Chemistry and Wood Science.

Office: CHBE Rm. 259, 2360 East Mall

E: orlando.rojas@ubc.ca

Orlando's short bio: Born in Venezuela, spent 20 years in the Spain (Barcelona), USA (Alabama in NC), Sweden (Stockholm) and Finland (Helsinki). Like: Hiking, swimming (water polo)

For more info about his research and group information see:

https://rojas.chbe.ubc.ca/

There is currently no TA for this course

*We try to respond to emails as quickly as possible. If you need to email us, please put "**CHBE 478**" in the **Subject Line** and use your UBC email account.*

Technology-Enhanced Learning

Throughout this course, we will be using various technologies to help us communicate, assess your learning, and keep organized. They are all accessible via a central platform: *Canvas*.

Canvas canvas.ubc.ca Keep organized here. Log in regularly and frequently for lecture notes, assignments, announcements, your grades, calendar, discussion thread, **and links and instructions for all other resources**. Rather than emailing questions to me, I encourage you to post your questions here.

Learning Goals

Where Are We Going?

By mastering the content of this course, students will be able to

- Develop a basic understanding and appreciation of polymers and polymer-based composites
- Analyze and evaluate polymers in both solid and melt state
- Speak the language of polymer materials
- Recognize the key variables, which determine and control the performance of polymers in significant applications such as packaging, and transportation.
- Understand the relationship between processing, structure and rheological properties
- Become familiar with the terminology, literature, and current research thrusts of the polymer community.

What Resources Do You Need?

Recommended Resources

No Textbook Required for Course!

Suggested reference books:

- Principles of Polymer Processing, 2nd ed. Z. Tadmor and C. G. Gogos, Wiley, NY (2006).
- Polymer Processing: Principles and Design, D. G. Baird and D. I. Collias, Wiley, NY (2014). Available on-line via UBC Libraries.
- Other readings will be assigned as necessary

How Will We Know If We Have Met Our Goals? (Very Tentative)

Evaluation

- 15% Project
- 30% Midterm Exams
- 20% In-class Quizzes
- 35% Final Exam

Project/Report – Students must complete a report on a topic of interest related to polymer processing, but not explicitly covered in the course content already. The students must confirm the topic prior to starting to write in earnest. The report is a maximum of 10 pages long, double spaced, 12 pt Times new roman, 8.5 x 11 page with 1-inch margins. This should be done in the style of a Macromolecules (the journal) perspective paper, and references should be in that format.

The midterm, final exams and quizzes will assess the ability to apply learned concepts.

Test formats will be discussed in the first 2 weeks of class.

Assignments may be done individually or in groups of 2-3 students. You may work with a different partner for different assignments. Assignments will be posted on Canvas. **Assignments should be submitted to Canvas by their due date**.

Extension/Late Policy

- Assignments will be **due at the start of class on the specified day** (via Canvas).
- Assignments submitted within 24 hours of deadline will have 10% deducted.
- Assignments submitted within 48 hours of deadline will have 25% deducted.
- **No marks will be given for assignments handed in after the 48 hour grace period.**

UBC's grading policies are outlines here: http://www.calendar.ubc.ca/vancouver/?tree=3,42,96,0

Tips for Success

Making Choices to Learn

You should be spending approximately **2-3 hours out of class for every 1 hour in class**, this time should be spent on assigned readings, webinars, searching & reading the scientific literature, reviewing notes, working on assignments and presentations, etc.

WHAT CAN YOU DO *IN CLASS*?

- ~~**Take**~~ **Make notes** about what's being discussed. Avoid just copying exactly what you see on the slides; you'll have access to lecture slides. *Learn with the intention to teach*.
- **Keep focused**. For example, avoid bringing a computer (or sitting behind someone else's) if it will be a distraction for you. Smartphones must be turned off and no texting/messaging during class. Get adequate sleep and nutrition. Be present!
- **Actively participate in demonstrations and discussions; thoughtfully answer questions**. The point of all of these is to help you think about the material so you can master it and make it meaningful for yourself.
- In-class activities will require completion of assigned readings or preparation of materials in advance. You should come to class prepared to actively contribute to the activity/discussion.

Expectations and Course Policies

What We Expect from You

ATTEND CLASS Please come to every class prepared to actively participate in your learning. Bring a pen and some paper (in addition to a laptop, if you choose to bring one). *If you must miss class* you are responsible for obtaining missed notes and important announcements.

PARTICIPATE Success in this class depends upon your active participation. You should also feel free to **ask questions** (lots of them!).

TREAT OTHERS RESPECTFULLY You are expected to treat all your classmates, instructors, and yourself with respect at all times, both in and out of the classroom, face-to-face and in writing (e.g., on email). This includes arriving to class on time and minimizing distractions for other students.

ACT ETHICALLY You are responsible for your own learning. Cheating of any kind will **not** be tolerated, including copying other's work. See the syllabus section on *Ethical Conduct* for more information.

WRITE ALL TESTS. Presence at tests is expected. In most cases, if you miss a *test* you will receive a zero. There will be *no* make-up tests. **Exceptions:** In documented cases of varsity athletic commitments (as per UBC policy), severe illness or other extenuating circumstance verified by UBC Academic Advising as warranting Concession, or a conflict with a major religious holiday, obtain appropriate official documentation. *If approved, the worth of the missed test will be distributed amongst the other presentations/assignments*.

SHARE CONSTRUCTIVE FEEDBACK I invite you to share your ideas and suggestions with me, particularly about things I am able to change. I am open to working together to make this course a positive experience for all of us. I will solicit formative feedback throughout the term.

What You Can Expect from Me

BE AVAILABLE I am here to help you to succeed. Visiting me in person is typically more effective than email for clearing up questions. If office hours do not work for you (Wednesdays 9 am), please email me **3** time and day **options** to make an appointment. I am flexible regarding deadlines and will do my best to make this course work for you, however, discussions must be had *significantly* prior to assignment due dates.

POST MATERIALS AND GRADES ONLINE PowerPoint slides, handouts, and other teaching materials will be available *before* class on Canvas. Information written on boards/document camera during class will not necessarily be posted online. Grades will be posted on Canvas, **10 days after the due date, at the latest**.

ARRANGE FOR AND PROVIDE FEEDBACK Your peers will be an important source of feedback throughout this course. In addition, we will attempt to provide you with feedback on learning appraisals as promptly and as with as much detail as possible. Peer evaluations will accompany collaborative presentation projects and make up a small percentage of your grade.

ACT RESPECTFULLY & ETHICALLY At all times, I aim to treat each of you with respect, and to make all course decisions with the highest standard of ethics in mind. If you feel you are being treated unfairly or disrespected by me or a classmate, I invite you to talk to us so we can sort out the issue together. To be clear: such a discussion would not impact your grade.

CONSIDER RE-GRADE REQUESTS If you feel very strongly that any test or assignment question was graded unfairly, please email me with a subject line: "**CHBE 478 Re-Grade Request"** and include a clear explanation of your concern and your assignment/exam. You must do so within **1 week** of the date grades were made available on Canvas. Re-grading may result in an increase or decrease. That re-grade is final.

Ethical Conduct

The academic enterprise is founded on **honesty**, **civility**, and **integrity**. As members of this enterprise, all of us are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means **submitting only original work and acknowledging all sources of information or ideas, and attributing them to others** as required. This also means we should not cheat, copy, or mislead others about what is our work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore severe consequences arise, and harsh sanctions are imposed. **Incidences of plagiarism or cheating [will] result in a mark of zero on the assignment or exam and more serious consequences may apply**. **They will also be reported to the Dean's office**. Careful records are kept in order to monitor and prevent recurrences.

For details on pertinent University policies and procedures, please see Chapter 5 in the UBC Calendar.

From http://vpacademic.ubc.ca/integrity/ubc-regulation-on-plagiarism/:

CHEATING This includes but is not limited to dishonest or attempted dishonest conduct at tests or examinations.

PLAGIARISM This includes but is not limited to the presentation or submission of the work of another person, without citation or credits, as the student's own work.

IRON PIN Some of you may also be an Iron Pin Founder or Supporter.[1] It is anticipated that you will uphold the UBC Engineering Code of Ethics. For the full code, please see http://ubcengineers.ca/eus/traditions/ironpin/

P. ENG You may also wish to become a **Professional Engineer** in the future. Therefore, you should also remember Principle 7 of APEGBC's Code of Ethics, which reads:

> "Members and licensees shall act at all times with fairness, courtesy and **good faith** to their associates, employers, employees and clients… They shall uphold the values of **truth**, **honesty** and **trustworthiness** … In keeping with these basic tenets, members and licensees shall: conduct themselves with fairness, courtesy and good faith towards clients, colleagues and others [and] **give credit where it is due**…"[2]
>
> The Code of Ethics Guidelines further explains "Whenever possible, members should **acknowledge contributions of others** for work with which the member is associated and name those who were individually responsible for designs, inventions, writings or other accomplishments."[3]

Visit the Learning Commons' guide to academic integrity UBC offers an online guide to preventing unintentional plagiarism and organizing your writing. Visit http://learningcommons.ubc.ca/resource-guides/avoiding-plagiarism/

Why is Academic Misconduct Treated So Harshly?
Some people don't feel like cheating on a test or taking a sentence or two from someone else's paper without citing it is a big deal. Here's a bit of insight into why we care so much. In the academic community – a community of which you are now a part – **we deal in ideas**. That's our currency, our way of advancing knowledge. By representing others' ideas in an honest way, we are (1) respecting the rules of this academic community, and (2) showcasing how our own novel ideas are distinct from but relate to their ideas. ***Welcome to the academic community. You are expected to act honestly and ethically, just like the rest of us.***

1. UBC Engineering Undergraduate Society. http://ubcengineers.ca/eus/traditions/ironpin/ Retrieved Jan 2/2015.
2. Association of Professional Engineers and Geoscientists of British Columbia. Appendix C – Code of Ethics Guidelines. http://www.apeg.bc.ca/enforcement/documents/codeofethicsguidelines.pdf Retrieved Dec 6/2012.
3. Association of Professional Engineers and Geoscientists of British Columbia. Appendix C- Code of Ethics Guidelines. http://www.apeg.bc.ca/enforcement/documents/codeofethicsguidelines.pdf Retrieved Dec 6/2012.

Course Outline (roughly)

As this course will be 100% online. Guest lectures will be recorded, but associated canvas quizzes are required to be completed.

Unit 1 – Basic Definitions & Concepts / Molecular Weight Determination

Unit 2 – Polymer chemistry and solution rheology

Unit 3 – Solid state (amorphous and crystalline): Polymer characterization techniques (mechanical properties)

Unit 4 – Melt state: Understand polymer dynamics (rheological properties)

Unit 5 – Polymer processing via die forming (extrusion)

Unit 6 – Mixing (thermodynamics of polymer blends), injection molding and thermoforming

Unit 7 – Polymer processing and membranes

Unit 8 – Processing of polymer fibers

Unit 9 – Use and processing of adhesives

Unit 10 – Polymer recycling and sustainability

Resources to Consider

YOUR SUCCESS IS IMPORTANT TO US. Reach out and ask for help if you need it. University students often encounter setbacks from time to time. It is completely normal. It is understandable that these can impact academic performance.

If you run into difficulties and need assistance, I encourage you to contact me by email, during my office hours, before or after class, or by dropping into my office (FSC 4036).
I will do my best to support your success during the term:

- This includes identifying concerns I may have about your academic progress or wellbeing through Early Alert.
- With Early Alert, faculty members can connect you with advisors who offer support and assistance to help students get back on track to success.
- Only specialized UBC advisors would be able to access any concerns I may identify.
- Early Alert does not affect your academic record.

For more information, visit earlyalert.ubc.ca

TAKE CARE OF YOURSELF. For information about addressing mental or physical health concerns, including **counseling services** and more, visit https://students.ubc.ca/health

SCHOLARSHIPS & BURSARIES UBC and its donors provide a range of financial support options to reward your academic and extracurricular achievements and meet your financial needs. Visit: https://students.ubc.ca/enrolment/finances/awards-scholarships-bursaries

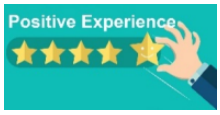
COLLEGE SUCCESS STRATEGIES By S. L. Nist-Olejnik & J. P. Holschuh (2012, 4th edition). This book offers countless tips and strategies. It is primarily geared toward new university students, but there is a ton of useful information in there for upper years as well, from any discipline.

TIME MANAGEMENT Search online for productivity and project management tools and apps (e.g., https://trello.com, https://www.rescuetime.com, https://todoist.com). Give yourself enough time for assignements with http://assignmentcalculator.library.ubc.ca, and master many other aspects of academic life: http://learningcommons.ubc.ca/student-toolkits/ **http://www.learncheme.com/student-resources/how-to-study-resources**

LEARNING COMMONS is UBC's online hub for study and research support. This interactive website provides you with a wealth of academic resources, from **tutoring** and **workshops** to study groups and online technology tools. It also offers plenty of information on a variety of academic topics, and links to nearly all of the academic resources offered at UBC. *Make the Learning Commons your first stop for all things academic!* http://learningcommons.ubc.ca

PHYSICAL OR LEARNING DISABILITIES UBC is committed to equal opportunity in education for all students and so are we! If you have a documented disability that affects your learning in the classroom or your performance on tests or exams, please **contact Access & Diversity** in Brock Hall 1203, 1874 East Mall, Contact: 604.822.5844, www.students.ubc.ca/access.

Let's work together to make this course a positive experience for all of us.



Land Acknowledgement
UBC's Point Grey Campus is located on the traditional, ancestral, and unceded territory of the xʷməθkʷəy̓əm (Musqueam) people. The land it is situated on, has always been a place of learning for the Musqueam people, who for millennia have passed on their culture, history, and traditions from one generation to the next on this site.