

Syllabus

CHE 475: Chemical Engineering Fluid Mechanics Spring 2024

CHE 443 provides an introduction to polymer physical properties and characterization, explores the relationship between synthesis techniques and processing techniques, and explores natural and synthetic materials, property optimization and modern applications.

Lectures

MW, 4:00 – 5:50 pm, VHE 217

Instructor

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Office Hours: Tuesdays 11:00 am – noon or by appointment

Text

Polymer Science and Technology by Joel R. Fried, second edition, ISBN 0-13-018168-4

Communication resources

Blackboard will be used for posting information and assignments as well as turning in work.

Grading

Grades will be based on weekly homework assignments, a midterm project, a midterm exam, a final project, and a final concept inventory. The proportions of the final grade determined by each of these elements will be as follows:

Midterm Concept Inventory:	25%
Midterm Group Project:	30%
Final Individual Project:	30%
Final Summary Essay:	15%

Final grades will be calculated as follows: Total points will be added and transformed into percentages; the arithmetic mean of the percentage scores will be determined. If the highest score in the class is ten or more percentage points higher than this mean, the mean score will receive a B, ten percentage points above the mean will receive an A, ten percentage points below the mean will receive a C, twenty percentage points below the mean will receive a D, etc. If the highest score in the class is less than ten percentage points above the mean, the highest score will receive an A, ten percentage points below the highest score will receive a B, ten percentage points below that will receive a C, etc. **All students who complete and submit all homework assignments on time will have their final calculated grades increased by one third of a letter grade.** That is an A- becomes an A, a B+ becomes an A-, etc.

Projects will be undertaken as follows:

Project 1 (Group Project): Processing Techniques

In 3-4 person teams, pick a processing technique and write a paper (~4-5 pages with ~7-8 references) and develop a 30 minute presentation. Examples of potential topics include: 3-D printing, Extrusion, Electrospinning, Injection Molding, Foaming, Interfacial Polymerization, etc. The paper and presentation should explain: a) how the process works, b) which types of polymers can and cannot be processed, c) capabilities, d) characterization for the materials, e) size limitations of the technique.

Topic Due: January 31

Draft Due: February 12, Feedback given on February 16

Final Paper Due: February 28

Presentations: February 28 and March 4

Project 2 (Individual Project): Polymer Applications

Pick a scientific/engineering publication (from 2015 or later) about a polymer application. Prepare a 10-15 minute presentation. Examples of potential subjects include: Optical, Electronic, Mechanical, Sensing, Separations, etc. Presentation should include the figures from the publication and explain: the methodology, the key results, the implications, and limitations.

PDF of the publication due: April 3

Presentations: Last week of April

The midterm concept inventory will be a multiple-choice / short-response exam administered during the standard class period. Scheduled for March 27.

The final essay will consist of summaries (one page each) of two of the individual presentation.

Homework will be assigned biweekly; each homework set will be due two weeks after it is assigned.

Collaboration Policy

Students are encouraged to discuss and work together on homework assignments, but the work each student hands in must be their own. It is not acceptable to merely copy another student's effort; each student must be capable of fully understanding and describing everything they have written in the submitted homework assignment. To ensure that this is the case, it is recommended that when working in a group (group sizes of five or fewer are recommended), students plan their approach to a problem making notes on scratch paper or a blackboard. The work that each student submits, however, should be written independently without referencing these notes. If you have any doubts regarding whether a certain instance of collaboration is acceptable at any point in the semester, ask the instructor for clarification.

Work on the midterm concept inventory, the individual project, and the final essay will be completely independent.

Homework Due Dates

Homework assignments will be available at 4 pm every other Tuesday, and they will be due in the at 6 pm two Tuesdays after. Homework will be posted on Blackboard and can be turned in as a photograph or scan on Blackboard. There will be no homework due on weeks where there are exams or projects due.

Lecture and Reading Schedule

This schedule is subject to change, with notice.

- Week 1: Terminology, nomenclature, and classification; stereochemistry; molecular weight.
Chapter 1
- Week 2: Polymer synthesis I. Step growth and free radical chain reactions.
Sections 2.1-2.2
- Week 3: Polymer Synthesis II. Specialized polymerization reactions; structure determination.
Sections 2.3-2.6
- Week 4: Solution thermodynamics.
Sections 3.1-3.3
- Week 5: Solid state properties.
Chapter 5
- Week 6: Elasticity and viscoelasticity.
Chapter 6
- Week 7: Polymer processing I.
N/A
- Week 8: Project 1 presentations.
N/A
- Week 9: Polymer processing II.
Section 11.1
- Week 10: Polymer rheology and flows.
Sections 11.2-11.4
- Week 11: Review and concept inventory.
N/A
- Week 12: Polymer blends, block copolymers, interpenetrating networks, and hydrogels.
Chapter 7

Week 13: Polymer applications I.

N/A

Week 14: Polymer applications II.

N/A

Week 15: Project 2 presentations.

N/A

Special Dates

Mon. Jan. 5: MLK Day, no class

Wed. Jan. 31: Project 1 topics due

Mon. Feb. 12: Project 1 paper drafts due

Mon. Feb. 19: Presidents' Day, no class

Wed. Feb. 28: Project 1 papers due

Mon. Mar. 11: Spring Recess, no class

Wed. Mar. 13: Spring Recess, no class

Wed. Mar. 27: Midterm concept inventory

Wed. Apr. 3: Publication selection for Project 2 due

Wed. May. 1: Final essays due

Statement on Academic Conduct and Support Systems

Academic Integrity:

The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, compromises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or “recycle” work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see [the student handbook](#) or the [Office of Academic Integrity's website](#), and university policies on [Research and Scholarship Misconduct](#).

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. [The Office of Student Accessibility Services](#) (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

[Counseling and Mental Health](#) - (213) 740-9355 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

[988 Suicide and Crisis Lifeline](#) - 988 for both calls and text messages – 24/7 on call

The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

[Relationship and Sexual Violence Prevention Services \(RSVP\)](#) - (213) 740-9355(WELL) – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

[Office for Equity, Equal Opportunity, and Title IX \(EEO-TIX\)](#) - (213) 740-5086

Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

[Reporting Incidents of Bias or Harassment](#) - (213) 740-5086 or (213) 821-8298

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

[The Office of Student Accessibility Services \(OSAS\)](#) - (213) 740-0776

OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

[USC Campus Support and Intervention](#) - (213) 740-0411

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

[Diversity, Equity and Inclusion](#) - (213) 740-2101

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

[USC Emergency](#) - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

[USC Department of Public Safety](#) - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call

Non-emergency assistance or information.

[Office of the Ombuds](#) - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

[Occupational Therapy Faculty Practice](#) - (323) 442-2850 or otfp@med.usc.edu

Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.