MSE 450: Polymer Science & Engineering

Instructor: Prof. Qian Chen

Instructor Email: qchen20@illinois.edu;
Website: https://canvas.illinois.edu/courses/44193

Textbook:

There is no required textbook for this course, but a suggested reference is:

Essentials of Polymer Science and Engineering – Paul C. Painter and Michael M. Coleman, DEStech Publications, 2009; on reserve at Grainger Library.

Assignments:

There will be homework most weeks over the course of the semester. Late HW receives 1/2 credit. Graduate students taking the class for 4 credit hours will write a term paper, due on **April 21st, 2024**.

Attendance:

We will use a webform to record in-lecture attendance. You are permitted to have up to four unexcused absences during the semester.

Exams: There will be two in-class exams and one final.

Tentative Exam Dates: February 21, March 20, **Final date:** TBA

Grading: 3 credit hours:

Exam 1 (20%) + Exam 2 (20%) + Final (40%) + Homework (15%) + Attendance (5%)

4 credit hours:

Exam 1 (20%) + Exam 2 (20%) + Final (35%) + Homework (10%) + Term paper (10%) + Attendance (5%)

Teaching Assistants (TA):

Brandon Jeong, email: bj21@illinois.edu

Office hours:

TA (Brandon Jeong): Time: Tuesdays 4:00-5:00 PM; Location: MSE 305

Topics

1. Introduction

What is a polymer? Chain architecture, chemical makeup, physical states. What are typical behavior patterns? viscous liquids, elastomers, fibers, semi-crystalline, liquid crystalline, glassy, conducting.

2. Synthesis and processing

Basic concepts: polymerization methods based on functional units; chains, gels, network, extent of reaction.

Different polymerization methods

3. Mechanical properties

Viscoelastic behaviors: elastic modulus, shear moduli,

Rouse, reptation, T dependence, time-temperature superposition; crazing.

4. Single polymer molecules

Conformations: random walk chain, good solvents.

Molecular weight: Mn, Mw, how to measure molecular weights

5. Characterization methods

Light scattering, fluorescence correlation spectroscopy

6. Thermodynamics of polymers

Mix, Flory-Huggins equation, Phase diagram

7. Applications

How to engineer thermodynamics

Biomaterials; electronic polymers; conducting polymers; biodegradability

Policy on conflicts or emergencies:

(1) For time conflicts with other events (e.g. another scheduled exam), or an official UIUC activity (e.g. varsity athletics, band concert),
Regarding HW, please email official documentation (or scanned version) about the conflict at least **two weeks** before the homework due date. The HW due date will be extended.
Regarding the exam, please email official documentation (or scanned version) about the conflict at least **three weeks** before our exam date. A make-up exam will be scheduled.

(2) If you will not be able to make it to the exam or submit HW on time due to serious illness or other emergent personal crisis (e.g. car accident) that are not described in (1), you must send emails to the TA (bj21@illinois.edu) and the instructor (qchen20@illinois.edu) at the earliest possible opportunity, and submit a statement (or scanned version) from the professionals that are authorized to evaluate your situations (e.g. doctors, police). The statement needs to clearly explain that you are not physically capable of attending the exam or submitting HW on time. The HW due date will be extended for HW, and a make-up exam will be scheduled.

ADDITIONAL NOTES

I. Homework Submission Instructions

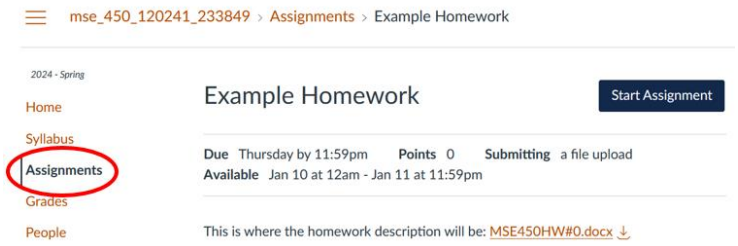
Homework will be given and submitted via canvas system.

Note:

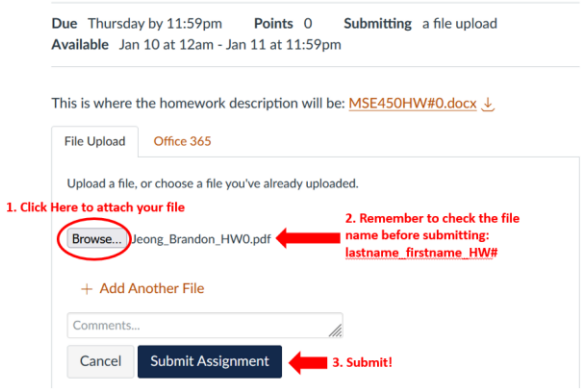
1. **Multiple attempts** are allowed for submission but **only the last attempt will be graded**.
2. Both pdf and word document are acceptable, but typed answer is preferred. If you decide to write your homework, it is suggested to write it electronically using a tablet. If you decide to scan your homework, **make sure your scanned document is readable** to avoid losing points.

Submission steps:

- Click on the assignments tab on the left and navigate to the homework you want to submit.



- Click "Start Assignment"
- Upload homework following the **naming convention: lastname_firstname_HW# (e.g., Smith_John_HW1).**
- Click submit!



II. Term Paper Instruction

- A term paper will be required for the graduate students taking four credit hours **due on 11 pm CST, April 21st, 2024. This is a hard deadline.**
- The term paper will be submitted to Canvas after a plagiarism check offered by Canvas.
- The term paper will be a review of a topic in polymer science. The review will need to be at least 5 pages, **single spaced** with only text, Times New Roman 12 pt font, justified text alignment. You may add figures to your review and go beyond 5 pages, but the text alone needs to cover 5 pages. There is an upper limit of 8 pages total for the review.