MSE/CHEM/CHBE 6752 Polymer Characterization, Fall 2020

Week	Date	Topic	Comment
1	8/18	Course Intro + Macromolecular Parameters	M_w, M_n, A_2, R_g, R_h, a_p, η, $[\eta]$ d_f
	8/19	**Reading Assignment**	
	8/20	Overview of things to come	M_w, M_n, A_2, R_g, R_h, a_p, η, $[\eta]$ d_f
2	8/25	Dimensions, Models of chains, Self-Avoiding Walk, Persistence Lengths	Random walks & Analogies
	8/26	**More papers to read**	
	8/27	Continuation of Chain Dimensions	
3	9/1	Polymer Solvent Interactions, $[\eta]$ isn't η	
	9/2		
	9/3	$[\eta]$ isn't η – Continuation	
4	9/08	Scattering – Way of thinking about scattering – Blue sky, osmotic pressure, Van't Hoff Law	
	9/09		
	9/10	Scattering – Continued – (Static Scattering)	
5	9/15	Scattering – Continued – (Static Scattering)	
	9/16		
	9/17	Scattering (Dynamic, and Differential Dynamic Microscopy –DDM)	
6	9/22	Scattering (Dynamic, and Differential Dynamic Microscopy –DDM)	
	9/23		
	9/24	Polarization and Polarized Light Microscopy	
7	9/29	Optical Crystallography	Conoscopy
	9/30		
	10/1	Optical Microscopy: Confocal/FPR/FCS/SuperResolution	
8	10/6	Viscometric Methods (Melts and Solutions)	
	10/7		
	10/8	Viscometric Methods - Continued	
9	10/13	Exam 1	**End of Part 1**
	10/14	**Part 2 overview and introduction**	**Begin Part 2**
	10/15	Property predictions and computation	
10	10/20	Mechanical properties: Static testing & impact	
	10/21	**Mechanical lab demo/homework**	Katarina, HW1
	10/22	Mechanical properties – viscoelastic behavior	**Last Day to Withdraw**
11	10/27	UV, IR and Raman spectroscopies and microscopies	
	10/28	**Spectroscopy lab demo/homework**	Katarina, HW2
	10/29	UV, IR and Raman spectroscopies and microscopies	
12	11/3	Thermal Analysis: DSC, TGA, TMA, DMA, and SThM	
	11/4	**Thermal lab demo/homework**	Katarina, HW3
	11/5	Thermal Analysis: DSC, TGA, TMA, DMA, and SThM	
13	11/10	Scanning Probe Microscopy (SPM): general principles	
	11/11	**SPM demo/homework**	Katarina/Michelle, HW4
	11/12	SPM: main modes and critical results STM, AFM, FFM, NSOM	
14	11/17	Electron microscopies: TEM, SEM, ESEM, EDS SPM	
	11/18	**SEM demo/homework**	Katarina, HW5
	11/19	Surface-sensitive methods: XPS, ellipsometry, contact angle	**Final instruction day**
15	11/24	**Overview, Q&A**	
	11/25-30	Exam preparation	**Thanksgiving holiday**
	Part 2 Exam, Dec 4-8, TBD	**Take Home exam on lab data analysis**	**Katarina**

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Syllabus

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Description:
This course is an advanced sequence of topics dealing with polymer characterization, and in particular practical aspects of data collection and analysis with lab demonstration for most of techniques in live/on-line. Topics to be covered include property predictions, as well as techniques for bulk and molecular characterization of polymer properties and microstructures with a range of common experimental techniques. While there is no formal pre-requisite, students should have a basic knowledge of polymer science, including such concepts as polydispersity, radius of gyration, virial coefficients, glass transitions, and viscoelasticity.

Requisite Knowledge: MSE 6751 or MSE 4775 or permission of instructor.

Class Time:	T/Th 9:30—10:45 am	Clough Room 423, on-line
	W 3:00—5:45 pm	on-line labs

Electronic Delivery: Canvas

Textbook: *There is no standard text book (yet) which covers all the topics in this course. Therefore, notes will be provided as well as suggested bibliography as appropriate for the various topics.* Lodge & Hiemenz is a good choice for a first textbook.

Grading: 25% Writing Assignments, 25% Part 1 Exam, 25% Part 2 Exam, 25% lab assignments (for Part 2)

Course Expectations:

- Most of assignments will come in the form of homeworks, many of them integrated with lab activities and lab data analysis
- Both exams will be open books and home take exams. Any changes will be indicated.
- We rely on various facilities across campus for lab training and/or familiarity, mostly done on-line and with pre-recorded lab demonstrations
- Occasional live meetings and lab tours might be available if we will pass current stage of life quickly, but probably not
- All assignments need to be completed in the time stated. Any late submissions (except where proper reasons are given) will be marked but score 0.

Course Outcomes:

At the end of the course you will be able to:

1. Make predictions about critical polymer properties, often without calculator or internet access.
2. Identify which properties are to be analyzed to evaluate the polymer.
3. Determine which techniques are most appropriate to determine the property of interest.
4. Understand how to prepare the sample and collect the data.
5. Understand the fundamental basis of the measurement technique.
6. Analyze the experimental data and determine/calculate the relevant properties.