MSE/CHEM/CHBE 6752/4141 Polymer Characterization Fall 2021

Week	Date	Topic	Comment
1	8/24	Course Intro + Macromolecular Parameters	M_w, M_n, A_2, R_g, R_h, a_p, η, $[\eta]$ d_f
	8/25	**Lab Tour: SLS/DLS/SMALS/SALS/Viscosity/PT/Scopes**	**OPALL Optics Lab, then Prep Lab**
	8/26	Roots of Polymer Science: $[\eta]$ isn't η	Last day to drop w/o W (Aug 27)
2	8/31	MALDI … understanding distributions	
	9/1	**Viscosity**	**OPALL Prep Lab (MRDC 4348)**
	9/2	Inverse Space 1: Zimm, Guinier, etc.	
3	9/7	Inverse Space 2: SAXS & SANS	**Student Verification Due**
	9/8	**SLS & DLS data gathering**	**OPALL Prep Lab (MRDC 4348)**
	9/9	Chromatography: GPC → GPC/MALS → AF4/MALS	
4	9/14	Advanced GPC (MALDI, TREF)	
	9/15	**GPC data gathering**	**OPALL Optics (MRDC 2503B)**
	9/16	Transport Methods: DLS, Sedimentation	
5	9/21	Transport Methods: PFGNMR	
	9/22	**Particle Tracking**	**OPALL "Little Room" (MRDC 4334)**
	9/23	Transport Methods: PT, DFM, Microviscosity	
6	9/28	Dynamic Methods: NSE and XPCS	
	9/29	**Optical Microscopy: POM/EPI**	**OPALL Optics (MRDC 2503B)**
	9/30	Optical Microscopy: Confocal/FPR/FCS/SuperRes	
7	10/5	New Methods (TBD)	
	10/6	**TBD**	
	10/7	**Part 1 Exam**	**End Part 1**
8	10/12		**Fall Recess**
	10/13	**Lab overview**	**Begin Part 2**
	10/14	**Introduction to Part 2** Property predictions Mechanical properties – Fundamentals	
9	10/19	Static testing & impact, fatigue, friction	
	10/20	**Mechanical lab tour/homework**	
	10/21	Mechanical properties – viscoelastic behavior	
10	10/26	UV, IR and Raman spectroscopies and microscopies	
	10/27	**Spectroscopy lab tour/homework**	**Last Day to Withdraw (10/30)**
	10/28	UV, IR and Raman spectroscopies and microscopies	
11	11/9	Thermal Analysis: DSC, TGA, TMA, DMA, and SThM	
	11/10	**Thermal lab tour/homework**	
	11/11	Thermal Analysis: DSC, TGA, TMA, DMA, and SThM	
12	11/16	Scanning Probe Microscopy (SPM): general principles	
	11/17	**SPM lab tour**	
	11/18	SPM: main modes and critical results	
13	11/23	SPM imaging modes: STM, AFM, FFM, NSOM	
	11/24		**No Classes/Institute open**
	11/25		**Thanksgiving holiday**
14	11/30	**SPM homework**	
	12/1	SPM advanced methods; Electron microscopies: TEM, STEM, SEM	
	12/2	Electron microscopies: SEM, ESEM, EDS	
15	12/7	**SEM lab tour/homework**	
	11/28		
	12/2	Surface-sensitive methods: XPS, ellipsometry, contact angle	
16	12/7		**Final Instructional Day**
	Part 2 Exam To Be Scheduled		

MSE/CHEM/CHBE 6752/4141 Polymer Characterization Fall 2021

Syllabus

Professors:	Prof. Vladimir Tsukruk	Office: MoSE 3100M
	vladimir@mse.gatech.edu	Office Hours: by appointment
		Office Phone: 404-894-6081
	Prof. Paul Russo	Office: MRDC 3508
	paul.russo@mse.gatech.edu	Office Hours: Wednesdays 5 pm or by appointment
		Cell Phone: 225-588-8104 (call any time)
TA:	Ms. Daria Bukharina	Office: MoSE 4243
	bukharinad@gatech.edu	Cell Phone:

Description:
This course is a sequence of advanced topics dealing with polymer characterization, and in particular practical aspects of data collection and analysis. Topics to be covered include property predictions, as well as techniques for bulk and molecular characterization of polymer properties. 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	MRDC 3403 or as announced
	W 3:00—5:45 pm	Clough 423 or Other GT Facilities as announced

Modality: In-class lectures (150 minutes/week) + practical experiences (up to 180 minutes/week). Either lab or lecture may be supplemented by "watch at home" videos or "watch-in-class" videos, but the goal is for dynamic exchange during lecture and hands-on competence in lab, within reason. The times normally used for lecture (T/Th mornings) may be used for lab operations to maximize the educational experience and hands-on activities without crowding.

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: 20% Quizzes, 30% Assignments, 25% Part 1 Exam, 25% Part 2 Exam

Course Expectations:

- Short quizzes will be given in class or on Canvas. In-class quizzes will be generally closed book unless otherwise indicated.
- Some assignments will come in the form of homeworks, perhaps integrated with lab activities.
- Midterm and final exams will be closed book unless otherwise indicated, relevant equations will be supplied. Any changes will be announced at least 5 days before the exam.
- We rely on various facilities across campus for lab training and/or familiarity.
- 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.

Covid-19 considerations

*In lecture environments, we expect simple courtesy and consideration of the feelings of others.
*In lab environments, the hands-on activities and close quarters necessitate special equipment and practices that must be obeyed, according to Georgia Tech policies.

Honor Code

We believe in the Georgia Tech Honor code: https://policies.gatech.edu/academic-affairs/academic-honor-code Students are urged to ask questions about what is permissible when it comes to working together on assignments and what is not, plagiarism, or other issues.

Wellness

We expect another semester in which challenges due to public health factors add to the normal stresses of academic life. We enjoy talking with students, so don't be shy about letting us know if you are feeling stressed. Remember GT's various resources for wellness, too: https://hw.gatech.edu/

Disabilities

We get it! If you qualify for an accommodation, be assured that we are eager to work with you.
https://disabilityservices.gatech.edu/