MSE/CHEM/CHBE 6752 Polymer Characterization Fall 2022

Week	Date	Topic	Comment
1	8/23	Course Introduction	
	8/24	**Lab Introduction/homework**	
	8/25	WAXD/SAXS	**Last day to drop w/o W (Aug 27)**
2	8/30	WAXD/SAXS	
	8/31	**Lab tour – Xray /homework**	
	9/1	WAXD/SAXS	
3	9/6	Static and Dynamic Light scattering	
	9/7	**Lab – Light Scattering**	
	9/8	Neutron scattering	
4	9/13	Advanced GPC (MALDI, TREF), Viscosity	
	9/14	**Lab – GPC, Viscosity**	
	9/15	Transport Methods: DLS, Sedimentation	
5	9/20	Solution NMR	
	9/21	**Lab – Solution NMR**	
	9/22	Solution NMR	
6	9/27	Solid State NMR	
	9/28	**Lab – Solid State NMR**	
	9/29	Optical Microscopy; polarized, fluorescence, confocal	
7	10/4	Optical microscopy; polarized, fluorescence, confocal	
	10/5	**Lab – Optical Microscopy**	
	10/6	**Part 1 Exam**	
8	10/11	Feedback on part I	**End Part I**
	10/12	**Lab overview and Introduction to Part 2** Property predictions & simulations	**Begin Part 2**
	10/13	Mechanical properties 1 – Fundamentals; Static testing & impact, fatigue	
9	10/18	**Fall Recess**	
	10/19	**Mechanical lab/homework 1**	
	10/20	Mechanical properties 2 – viscoelastic behavior, dynamic	
10	10/25	UV, IR and Raman spectroscopies 1	
	10/26	**Spectroscopy lab/homework 2**	**Quiz 1**
	10/27	UV, IR and Raman spectroscopies 2	**Last Day to Withdraw, 10/30**
11	11/1	Thermal Analysis 1: DSC, TGA, TMA, DMA, and SThM	
	11/2	**Thermal lab/homework 3**	
	11/3	Thermal Analysis 2: DSC, TGA, TMA, DMA, and SThM	
12	11/8	Scanning Probe Microscopy (SPM) 1: general principles	
	11/9	**SPM lab 1**	**Quiz 2**
	11/10	SPM 2: main modes and critical results: STM, AFM	
13	11/15	SPM 3: Imaging modes: FFM, NSOM, QNM, KFPM, EFM	
	11/16	**SPM lab 2**	**Quiz 3**
	11/17	Electron microscopies 1: TEM, HRTEM, STEM, SEM	
14	11/22	Electron microscopies 2: SEM, ESEM, EDS, EDX	
	11/23	**No Classes/Institute open**	
	11/24	**Thanksgiving**	
15	11/29	Surfaces 1: XPS, ellipsometry, contact angle, tribology	
	11/30	**SEM lab/homework 4**	**Quiz 4**
	12/1	Surfaces 2: XPS, ellipsometry, contact angle, tribology	
16	12/6	Summary, feedback on part 2	**Final Instructional Day**
	8/12, 8-10.50 am	**Exam, Part 2**	

MSE/CHEM/CHBE 6752 Polymer Characterization Fall 2022

Syllabus

Professors:	Prof. Vladimir Tsukruk	Office: MoSE 3100M
	vladimir@mse.gatech.edu	Office Hours: by appointment
		Office Phone: 404-894-6081
	Satish Kumar	Office: MRDC 4512
	Satish.kumar@mse.gatech.edu	Office Hours: by appointment
		Cell Phone: 678-371-2760
TA:	Ms. Daria Bukharina	Office: MoSE 4243
	bukharinad@gatech.edu	Office phone: 404-385-3100

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, and techniques for bulk and molecular characterization of structure as well as 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 PM	Guggenheim Aerospace 244 or as announced
	W 3:30—6:15 PM	Howey Physics S204 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.*

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 given a score of 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. Learn to determine polymer macro and micro structure, as well as properties.
3. Identify which structure and properties are to be analyzed to evaluate the polymer.

4. Determine which techniques are most appropriate to determine the property of interest.
5. Understand how to prepare the sample and collect the data.
6. Understand the fundamental basis of the measurement technique.
7. 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/