

Identification	Subject	Polymer Materials and Technology	
	Department	Chemistry and Chemical Engineering	
	Program	Graduate	
	Term	Fall 2026	
	Instructor	Ismayil Safarli	
	E-mail	ismayil.safarli@outlook.com	
	Phone	NA	
	Classroom/hours		
	Office hours	NA	
Prerequisites	NA		
Language	English		
Compulsory/Elective			
Required textbooks and course materials	[1] Pethrick RA. Polymer Science and Technology: for Engineers and Scientists. Dunbeath, Scotland: Whittles Publishing; 2010. [2] Young RJ, Lovell PA. Introduction to Polymers. 3rd edition. Boca Raton, FL: CRC Press, an imprint of Taylor and Francis; 2011. [3] Carraher CE. Introduction to polymer chemistry. 4th ed. Boca Raton: CRC press, Taylor & Francis group; 2017. [4] Xue J, Wu T, Dai Y, Xia Y. Electrospinning and Electrospun Nanofibers: Methods, Materials, and Applications. Chem Rev 2019;119:5298–415. https://doi.org/10.1021/acs.chemrev.8b00593. [5] Machado AV, Covas JA, Bounor-Legare V, Cassagnau P. Reactive polymer processing and design of stable micro- and nanostructures. Advances in Polymer Processing, Elsevier; 2009, p. 579–621. https://doi.org/10.1533/9781845696429.4.579. [6] Tsao C-W. Polymer Microfluidics: Simple, Low-Cost Fabrication Process Bridging Academic Lab Research to Commercialized Production. Micromachines 2016;7:225. https://doi.org/10.3390/mi7120225. [7] Ligon SC, Liska R, Stampfl J, Gurr M, Mülhaupt R. Polymers for 3D Printing and Customized Additive Manufacturing. Chem Rev 2017;117:10212–90. https://doi.org/10.1021/acs.chemrev.7b00074.		
Website of course	This course is taught online.		
Teaching methods	Lecture	X	
	Group discussion	X	
	Practical tasks	X	
Evaluation	Methods	Date/deadlines	Percentage (%)
	Quizz		10
	Midterm Exam		30
	Presentation/Group work		20
	Final Exam		40
	Total		100
Course outline	The course of Polymer Materials and Technology covers fundamentals of polymer materials, their chemistry, fabrication, and applications. Several topics such as polymerization reactions, polymer structure and properties, their characterization as well as conventional and novel polymer processing methods will be covered.		

Course objectives	The objective of this course is to provide students with a comprehensive understanding of the fundamental principles and established knowledge of polymer science, including the structure, synthesis, properties, characterization, and behavior of polymeric materials. The course aims to develop students' understanding of the relationship between polymer structure, molecular architecture, processing conditions, and final material properties. Particular attention will be given to the main mechanisms of polymerization, different classes of polymers, molecular weight and its distribution, thermal and mechanical behavior, and methods used for polymer characterization. In addition, the course introduces modern and emerging approaches to the fabrication, modification, and functionalization of polymeric materials. Students will become familiar with advanced polymer systems such as composites, nanocomposites, functional polymers, smart materials, biodegradable polymers, and environmentally friendly polymeric materials. The course will also examine the application of polymers in areas such as energy, medicine, environmental protection, coatings, packaging, electronics, and other industrial technologies. Through these topics, students will develop the ability to evaluate polymeric materials, understand their advantages and limitations, and select appropriate polymer systems for specific scientific and technological applications.
Learning outcomes	• Recognize the principles and concepts of polymer science. • Understand different copolymer types and polymer architectures (branching, crosslinking, networks). • Distinguish amorphous and crystalline states, and determine T_g and T_m. • Calculate molecular weight parameters (M_n, M_w, PDI) to assess chain length distribution and polymer sample homogeneity. • Understand step-growth and chain-growth polymerization mechanisms. • Interpret and understand the characterization of common properties of polymers. • Recognize conventional and novel polymer processing methods. • Understand the role of additives in polymer formulation.
Policy	• Participation For a variety of reasons, participation in a classroom context is essential. It is essential to the learning process, promotes teamwork, and aids in the general success of both the individual students and the class as a whole. • Presentation/Group work Students frequently must explain difficult chemical ideas to their classmates when they work in groups or make presentations. As they must break it down into simpler terms and respond to inquiries from their classmates, teaching others can help students get a deeper knowledge of the content. • Midterm and Final exams The Midterm and Final exams are conducted to assess students' knowledge by relating the topics that to be covered by the exam time and are evaluated with a total score of 30 (midterm) and 40 (final), respectively. • Withdrawal (pass/fail) The School Science and Engineering grading guidelines are carefully adhered to throughout this course. To pass, a student must receive a mark of at least 60%. If the student fails, the course. • Cheating/plagiarism

	Any form of plagiarism or cheating on a test, quiz, or project will result in the cancellation of the assignment. In this scenario, the student will receive a score of zero without any further consideration. • Illness Student with an illness may miss a presentation. This might be because the student needs to go to the hospital, recover at home, or attend regular medical appointments. In this case, the student must inform the instructor in advance about the illness and must present a document from their doctor. After considering the situation, the instructor may set a new date for the project presentation. Only one opportunity will be given to the student. The students who don't inform the instructor in advance will not be given a chance to give a presentation. • Professional behavior guidelines During class hours, students are expected to conduct themselves in a way that fosters a positive academic and professional atmosphere. Discussions without permission and unethical conduct are forbidden. • Ethics In class, students must not be late. During class, mobile phones must be put away and turned off.
Use of Artificial Intelligence Tools	The use of Generative Artificial Intelligence (GAI) tools within this course is permitted solely for educational, research, and individual learning purposes and must remain consistent with the University's principles of academic integrity. GAI tools may be used as supplementary resources to support learning and research; however, all submitted work must reflect the student's own understanding, critical thinking, and academic contribution. Any use of GAI must be appropriately disclosed in the relevant assignment, project, presentation, or other academic material. Students are fully responsible for evaluating and verifying the accuracy, reliability, and appropriateness of all AI-generated content included in their work.

Tentative Schedule		
Week	Topics	Reference
1	Introduction to Polymer Science (history, definition, nomenclature, basic chemistry and types, applications)	p. 1 – 5 [1] ; p. 1 – 9, 137 – 140 [2] ; p. 1 – 17 [3].
2	Polymer structure and classification: Thermoplastics, Thermosets, Elastomers; Crystallization in polymers, Mn, Mw, DPI	p. 9 – 19, 65 – 68 [1] ; p.10 – 14, 383 – 392, 399 – 421, 435 – 444 [2] ; p. 27 – 50 [3].
3	Polymerization reactions I: Step- and chain- growth	p. 7 [1] ; p. 21 – 56 [2] ; p. 159 – 169, 207 – 240, 245 – 260, [3].
4	Polymerization reactions II: ROP, novel methods	p. 8 [1] ; p. 98 – 118, 169 – 188 [2] ;
5	Properties of polymer materials and their characterization I: Mechanical, Thermal	p. 21 – 40, 57 – 60, 83, [1] ; p. 469 – 477, 487 [2] ; p. 407 – 410, 421 – 433 [3].

6	Properties of polymer materials and their characterization II: Electrical, Optical, Chemical	p. 347 – 363, 374, 623 - 630 [2] ; p. 410 – 416 [3].
7	Midterm Exam	
8	Conventional methods of polymer processing I: Molding, Extrusion	p. 103 – 131, [1] ; p. 495 – 505 [3].
9	Conventional methods of polymer processing II: Fiber spinning, Thermoset processing	p. 134 – 136, [1] ; p. 485 – 488 [3].
10	Novel approaches in polymer processing	[4–7]
11	Polymer additives & formulation I	p. 99 – 102 [1] ; p. 433 – 453 [3].
12	Polymer additives & formulation II	
13	Polymer composites	p. 147 – 171 [1]; p. 591 – 622 [2]
14	Sustainable Polymers	p. 17 – 23, 527 – 533 [3].
15	Polymer Recycling / Group presentation	p. 349 – 354 [1].
Final Exam		