

Identification	Subject	Polymer Synthesis, 4 ECTs	
	Department	Chemistry and Chemical Engineering	
	Program (Undergraduate, Graduate)	Graduate	
	Term	Fall 2026	
	Instructor	Aynura Rzayeva (PhD)	
	Email:	arzayeva@khazar.org	
	Classroom/hours		
Prerequisites	Polymer Science and Composites, Polymer Science		
Language	English		
Compulsory/Elective	Compulsory		
Textbooks and course materials	Main textbooks: 1. Principles of Polymerization - George Odian, 4 th Edition, 2004 2. Polymer Synthesis -Wang & Junjie, 2021 3. Polymer Synthesis: Theory and Practice – Braun et al., 5 th Edition, 2013		
Course description	This course provides an advanced study of polymer synthesis, focusing on the mechanisms, kinetics, thermodynamics, and molecular-weight control of polymerization reactions. It covers step-growth, free-radical, coordination, ionic, and ring-opening polymerization, as well as copolymerization, branching, crosslinking, and advanced macromolecular architectures. The course emphasizes the relationship between polymerization conditions, molecular structure, and the characteristics of the resulting polymers.		
Course objectives	The course aims to develop students’ ability to select and evaluate appropriate synthetic approaches to prepare polymers with desired molecular characteristics. It seeks to strengthen their capacity to analyze polymerization reactions, predict the effects of reaction parameters, perform relevant calculations, compare different synthesis routes, and solve problems related to polymer formation and molecular design. The course emphasizes developing critical thinking and problem-solving skills for advanced polymer synthesis.		
Learning Outcomes	Upon successful completion of the course, students will be able to: • Explain and differentiate major polymer synthesis mechanisms and strategies. • Analyze the kinetics and thermodynamics of polymerization reactions. • Evaluate the influence of reaction conditions on polymerization behavior and polymer characteristics. • Apply molecular-weight and conversion relationships to polymer synthesis problems. • Select appropriate polymerization methods for different monomers and desired polymer structures. • Analyze and predict copolymer composition, branching, crosslinking, and network formation. • Compare synthetic approaches for producing linear, branched, crosslinked, and advanced polymer architectures. • Solve quantitative and conceptual problems related to polymer synthesis and reaction control. • Critically evaluate polymer synthesis routes based on chemical principles and targeted molecular characteristics.		
Teaching methods	Case analysis		X
	Group discussion		X
	Lecture		X
	Simulation		X
Evaluation Criteria	Methods	Date/deadlines	Percentage (%)

	Midterm Exam	November	30
	Quizzes	Each month	10
	Practical Assignments	Each class	10
	Activity	Each class	5
	Attendance	Each class	5
	Final Exam	January	40
	Total		100
Class Policy	Course Organization Course topics will be presented through lectures, visual materials, scientific literature, problem-solving activities, discussions, and, where appropriate, practical examples from contemporary science and industry. Students' understanding may be assessed through quizzes, oral or written questions, assignments, presentations, laboratory work, and examinations, as specified in the course syllabus. Students are expected to participate actively and come to class prepared. Questions and scientific discussion are encouraged. Attendance and Punctuality Regular attendance is expected. Students who miss classes for legitimate reasons should follow the relevant faculty/university procedures. Students who exceed the permitted absence limit may not be eligible to take the examination. Students arriving more than 10 minutes late may be recorded as absent but may normally join the class if this does not disrupt the lesson or create a laboratory safety concern. Respect and Classroom Conduct Students and the instructor are expected to maintain a respectful and professional learning environment. Scientific questions, different interpretations, and respectful disagreement are welcome. Disruptive behavior, unauthorized conversations, disrespect toward others, and activities unrelated to the class are not acceptable. Mobile phones should be kept silent and should not be used for unrelated activities during class. Laptops and tablets may be used when they support legitimate academic activities, including calculations, scientific literature searches, data analysis, note-taking, or instructor-approved exercises. Students will not be penalized or ridiculed for asking questions, giving an incorrect answer, or making an honest academic mistake. Practical Assignments Practical assignments may include laboratory work, case studies, process calculations, data analysis, or biotechnology-related problem-solving tasks. Assessment will be based on scientific understanding, correct application of methods, interpretation of results, and quality of submitted work. Activity Activity is assessed through active participation in class discussions, problem-solving exercises, case analyses, group activities, and responses to course-related questions throughout the semester. Laboratory Work and Safety The course includes two laboratory sessions designed to reinforce theoretical concepts through practical work. Students must follow all laboratory safety requirements, including wearing laboratory coats (bring their own laboratory coats) and other required PPE, handling chemicals or biological materials safely, operating equipment correctly, and disposing of waste appropriately. Laboratory work must be documented systematically and honestly. Records should include, where applicable, the principle/objective, procedure, results, calculations, discussion, and conclusions.		

	Unexpected or unsuccessful experimental results should be reported and interpreted scientifically. Fabrication or deliberate modification of experimental data is prohibited. A student who disregards safety instructions or creates a safety risk may not be allowed to continue the laboratory activity. Quizzes, Assignments and Examinations Assessment requirements, criteria, and major deadlines will be communicated in advance and applied consistently. Students who miss a quiz, presentation, laboratory assessment, or other assessed activity for a legitimate reason should inform the instructor as early as reasonably possible and follow the relevant university procedure. Where permitted, a make-up assessment may be arranged. Examinations and matters concerning examination absence or eligibility are governed by faculty and university regulations. Presentations and Group Work Presentations should demonstrate understanding of the subject, appropriate use of scientific information, and the ability to explain and discuss relevant concepts rather than simply reproduce information. In group activities, every student is expected to contribute meaningfully and remain responsible for their own contribution. Academic Integrity Cheating, plagiarism, unauthorized collaboration, copying another student's work, fabrication or falsification of data, use of unauthorized materials, or presenting another person's work as one's own is unacceptable. Sources must be acknowledged appropriately. Violations of academic or examination rules will be handled according to university regulations. Responsible Use of Artificial Intelligence AI tools may be used for learning activities when permitted by the instructor. Students remain responsible for the accuracy, scientific validity, and integrity of everything they submit and must verify AI-generated information and references. AI must not replace the student's own work in assessments requiring individual performance and must never be used to fabricate data, observations, calculations, results, or references. Unauthorized AI use will be treated as unauthorized academic assistance. Scientific and Professional Relevance Students will be encouraged to connect theoretical knowledge with scientific literature, experimental evidence, laboratory practice, problem-solving, and relevant contemporary scientific or industrial applications. The aim is not only to memorize information but to develop the ability to understand, analyse, apply, and communicate scientific knowledge responsibly. Course Completion Students must meet the attendance, assessment, laboratory, and examination requirements established by the university and the individual course syllabus. Where the institutional passing threshold is 60%, students must achieve at least 60% to complete the course successfully.
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	Date/Day (tentative)	Topics	Textbook/Assignments
1		Introduction to Polymer Synthesis	[1] p. 1-38
2		Molecular Weight Control in Step-Growth Polymerization	[1] p. 40-68
3		Kinetics and Equilibrium of Step-Growth Polymerization	[1] p. 40-79
4		Advanced Step-Growth Polymerization	[1] p. 89-101, 120-174
5		Branching, Crosslinking and Network Formation	[1] p. 101-120
6		Dendrimers and Hyperbranched Polymers	[2] p. 196-219
7		Polymer Modification and Functionalization	[3] p. 323-373
8		Midterm Exam	
9		Free-Radical Polymerization: Mechanism and Kinetics	[1] p. 174-180
10		Molecular Weight Control in Radical Polymerization	[1] p. 198-239; 263-280
11		Radical Polymerization Processes	[1] p. 234-260; 289-292
12		Radical Copolymerization	[1] p. 280-300; 350-369
13		Coordination and Stereoregular Polymerization	[1] p. 464-533
14		Anionic and Cationic Polymerization	[1] p. 619-713
15		Ring-Opening Polymerization	[1] p. 372-449
		Final Exam	