Identification	**Subject**	CHE 412 Chemical Process Design and Optimization 6 ECTS	
	Department	Chemistry and Chemical Engineering	
	Program	Undergraduate	
	Term	Fall 2023	
	Instructor	Valida Aliyeva	
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	Classroom/hours	101 N/13.40-15.10 114 O/ 13.40-15.10	
	Office hours		
Prerequisites			
Language	English		
Compulsory/Elective	Compulsory		
Required textbooks and course materials	Optimization of Chemical Processes - Edgar Himmelblau and Lasdon 2nd edition, Engineering, January 2001 Optimization Methods and Applications-A.-Ravindan-K.-M.-Ragsdell-G.-V.-Reklaitis-Edisi-2-2006, Engineering-Optimization-Theory-and-Practice-Singiresu-S.-Rao-Edisi-4-2009		
Teaching methods	**Lecture**		**X**
	Group discussion		**X**
	Practical tasks		**X**
Evaluation	**Methods**	**Date/deadlines**	**Percentage (%)**
	Parcipitation	Every week	10
	Quiz	Week 3, 10, 13	15
	Midterm Exam	Week 7	20
	Team Project	Week 3-15	15
	Final Exam		40
	Total		100
Course outline	Chemical process design and optimization describes the process of developing and enhancing the manufacturing procedures for chemicals and related goods. The development of a safe, affordable process that can generate high-quality products at a high yield is the final objective of chemical process design and optimization. Additionally, optimization entails assessing and enhancing a current process for making it more productive, economical, and ecologically responsible. There are various phases to designing a chemical process, involving conceptual design, development of the process, detailed planning, building, and operation. The objective function's formulation, linear and nonlinear programming, and the procedures of separation and distillation are the key topics		

	covered in the course.
Course objectives	▪ Learn the concepts and abilities required to create thorough process flow diagrams (PFDs) and early process designs for chemical processes. ▪ Learn numerous stochastic and deterministic optimization methods to raise the effectiveness and productivity of chemical processes. ▪ Recognize the significance of safety and environmental factors, especially hazard analysis, risk assessment, and adherence to regulations, in the design and optimization of chemical processes. ▪ Learn the skill of modeling chemical processes mathematically and using it to forecast behavior and spot optimization opportunities. ▪ Study cost estimation, profitability analysis, and sensitivity analysis to do economic evaluations of chemical processes. ▪ Analyze case studies from the real world and industry examples to apply course concepts to real-world issues, developing critical thinking and problem-solving abilities.
Learning outcomes	By the end of this topic, a successful student ought to be able to: ▪ Use chemical engineering principles when designing chemical processes, keeping process flow diagrams, equipment selection, and process safety in mind. ▪ Enhance the productivity, output, and economic viability of chemical processes. ▪ To determine the financial viability of a particular process, conduct economic evaluations of chemical processes, including cost estimation, profitability analysis, and sensitivity analysis. ▪ Examining actual case studies and industrial illustrations for applying what was learnt in class to real-world issues.
Policy	▪ **Parcipitation** 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. ▪ **Quiz** Quizzes are a useful tool for gauging students' understanding of the key ideas and concepts underlying the design and optimization of chemical processes. They give teachers information about how well their pupils have understood the material being covered in class. ▪ **Team Project** Designing and optimizing chemical processes frequently entails challenging, multidisciplinary projects that reflect actual engineering situations. Students have the chance to apply their academic knowledge to real-world issues through team projects, which helps them comprehend how ideas are used in the workplace. ▪ **Withdrawal (pass/fail)** The School of Science and Engineering grading guidelines are carefully adhered to throughout this course. In order to pass, a student must typically 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 (zero) without any further consideration. ▪ **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 absolutely forbidden. ▪ **Ethics** In class, students shouldn't be late. During class, all electronic devices must be put away and turned off.

	Tentative Schedule (Can be changed)	
Weeks	**Topics**	**Chapters (Optimization of Chemical Processes)**
1	Introduction to the optimization	1.1, 1.2, 1.3, 1.4, 1.5, 1.6
2	Developing models for optimization	2.1, 2.2, 2.3
3	Optimization problem formulation	2.4, 2.5, 2.6
4	Basic Concepts of optimization	4.1, 4.2, 4.3,4.4,4.5
5	Optimization of unconstrained functions: one-dimensional search	5.1, 5.2,5.3,5.4,
6	Unconstrained multivariable optimization	6.1, 6.2, 6.3, 6.4
7	**Mid Exam**	
8	Linear programming and applications	7.2, 7.3, 7.4,
9	Linear programming and applications	7.5, 7.6, 7.8
10	Nonlinear programming with constraints	8.1, 8.2, 8.3, 8.4,
11	Nonlinear programming with constraints	8.5, 8.6, 8.7, 8.8
12	Separation processes	12.1, 12.2, 12.3, 12.4
13	Chemical reactor design and operation	14.1, 14.2
14	Software practice for improving knowledge	Practical work
15	Software practice for improving knowledge	Practical work
Final Exam		