

Identification	Subject	CHE 412 Chemical Process Design and Optimization, 6 ECTS		
	Department	Chemistry and Chemical Engineering		
	Program	Undergraduate		
	Term	Fall 2026		
	Instructor	Ruslan Hajiyeu		
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	Classroom/hours	TBC		
	Office hours			
Prerequisites				
Language	English			
Compulsory/Elective	Compulsory			
Required textbooks and course materials	- Towler, G. and Sinnott, R., Chemical Engineering Design: Principles, Practice and Economics of Plant and Process Design, 3rd Edition, Butterworth-Heinemann/Elsevier, 2022 [1] - Coker, A. K. and Sotudeh-Gharebagh, R., Chemical Process Engineering: Design, Analysis, Simulation and Integration, and Problem Solving, Volume 1, Scrivener Publishing, 2022 [2]			
Website of course	This course is based on traditional face-to-face classes.			
Teaching methods	Lecture	X		
	Group discussion	X		
	Workshops	X		
Evaluation	Methods	Date/deadlines		Percentage (%)
	Midterm exam	TBC		30
	Quiz	2nd week of each month		10
	Process Design Project	TBC		20
	Final exam	TBC		40
	Total			100
Course outline	This course provides students with a comprehensive understanding of the principles and practices of chemical process design and optimization. Students will learn how to conceptualize, synthesize, and optimize chemical processes with a focus on safety, and economic efficiency. The course will involve researching into several industrial processes and evaluating the conditions to determine the feasibility of the project.			
Course objectives	The course aims to provide students with a practical understanding of Chemical Process Design and Optimization. Students will learn how to develop and interpret Process Flow Diagrams (PFDs) for different chemical production processes and understand the relationships between major process units. The course introduces the principles of material and energy balances and their application to process calculations, equipment design, and process evaluation. Students will also develop skills in preparing equipment specification sheets, including key operating parameters and technical requirements for common process equipment. An important part of the course is the introduction to HAZOP methodology, which helps students identify potential hazards, process deviations, possible causes, consequences, and safety measures. Overall, the course combines process design,			

	calculation, optimization, equipment selection, and safety analysis to help students evaluate and improve the efficiency, reliability, and safety of chemical processes.
Learning outcomes	Here are some common learning outcomes associated with process design courses: • Knowledge of engineering drawings • Ability to prepare heat and material balances for a process • Optimize the unit for higher efficiency • Manage costs to find optimum economics • Perform HAZOP study
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. • Withdrawal (pass/fail) The School Science and Engineering grading guidelines are carefully adhered to throughout this course. To pass, a student must typically receive a mark of at least 60%. • Process Design Project Students will work in groups of 2-3 to develop a complete process design package based on a given Block Flow Diagram (BFD). The project will involve the preparation of a Process Flow Diagram (PFD) and a Process and Instrumentation Diagram (P&ID), as well as the development of detailed mass and energy balances. Students will also perform the preliminary design and sizing of major and auxiliary process equipment using appropriate engineering principles and design assumptions. The main deliverable will be a comprehensive technical report containing key engineering documents, including equipment process datasheets, mass and energy balance tables, equipment lists, line lists, and line sizing calculations, together with all supporting design information. At the end of the project, each group will present their work, discuss their design methodology, and explain the results and engineering decisions that led to the final process design • Activity Students are expected to actively participate in all course related activities, including lectures, case studies, and problem-solving sessions. Active participation is considered an essential part of the learning process, as the course relies on discussion, analysis of practical examples, and the application of theoretical concepts to engineering problems. • 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. • Illness Students with an illness may miss a quiz or presentation. This might be because students need 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 quiz or 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 retake the quiz or 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, side conversations and unethical conduct are absolutely forbidden. • Ethics In class, students must not be late. During class, mobile phones must be put away and turned off.

Tentative Schedule		
Weeks	Topics	Reference books
1	Introduction to Chemical Process Design	[1] Ch. 1, pp. 3–24
2	Process Selection and Conceptual Design	[1] Ch. 1–2, pp. 3–78
3	Process Flow Diagram Development	[1] Ch. 2, pp. 25–78
4	Material Balances	[2] Ch. 1, pp. 1–79
5	Energy Balances and Utilities	[1] Ch. 3, pp. 79–121
6	Process Equipment Design I	[1] Ch. 13–14, pp. 437–495
7	Midterm Exam	
8	Process Equipment Design II	[1] Ch. 15,19, pp. 497–588
9	Process Equipment Design III	[2] Ch. 7, pp. 437–500
10	Process Integration and Energy Optimization	[2] Ch. 9, pp. 947–1091
11	Capital Cost and Operating Cost Estimation	[1] Ch. 7–8, pp. 239–304
12	Economic Evaluation of Process Design	[1] Ch. 9, pp. 305–337
13	Process Optimization	[1] Ch. 12, pp. 413–434
14	Process Safety, HAZOP and Inherently Safer Design	[1] Ch. 10, pp. 339–395
15	Final Exam	