GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00037573						
Field of study	Green Technologies						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2026/2027		
Education level	first-cycle studies		Subject group		Obligatory subject group in the field of study		
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		English		
Semester of study	3		ECTS credits		3.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Biotechnology and Microbiology -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Christian Jungnickel				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	0.0	45.0	0.0	45
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours	Self-study	SUM	
	Number of study hours	45		2.0	28.0	75	
Subject objectives	The aim of the course is to provide students with an understanding of computer-aided design in chemistry and environmental technology, integrating technical drawing, process simulation, and digital data analysis. Students will learn to construct and interpret engineering schematics in AutoCAD, to build and run basic flowsheet models in ChemCAD, and to analyze process outputs in Excel. In addition, they will gain a first introduction to R programming supported by large language models (LLMs), using AI assistance to generate and adapt simple scripts for visualization and data handling. Emphasis is placed on applying these digital methods to sustainable development and pollution prevention, enabling students to evaluate chemical processes not only from a technical perspective but also in terms of their environmental and economic impacts						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W04] is aware of the importance of environmental protection and has a basic knowledge of chemical and biological threats to the environment, with particular emphasis on anthropogenic factors, has a basic knowledge of knowledge of the principles of sustainable development as well as national and European environmental management conditions.	The student understands how computer-aided design and chemical process simulations can be used to assess and minimize the environmental impact of technologies. The student can identify potential sources of pollution in chemical processes, apply CAD tools to analyze material and energy balances, and relate the results to the principles of sustainable development and the relevant national and European conditions of environmental management.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K6_W07] has knowledge of basic terminology and principles of intellectual property protection necessary for proper interpretation and application in practice	The student knows the basic terminology related to computer-aided design and can identify the principles of intellectual property protection in relation to technical documentation, process schematics, and computer simulation results. The student understands the importance of copyright and licensing when using engineering software and when producing educational and project materials.	[SW1] Assessment of factual knowledge
[K6_U04] capable of formulating and solving design tasks in the field of environmental technology to recognize their non-technical aspects, including environmental, economic and legal. Is capable of applying the principles of occupational health and safety. Is able to make initial assessment of engineering solutions and actions	The student understands the basic principles of modeling and simulating chemical processes and can apply CAD tools (AutoCAD, ChemCAD, Excel, R) to solve a simple design task. The student can assess the implications of technical solutions in environmental and economic contexts and present results in graphical and tabular form, while adhering to occupational health and safety principles.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information

Subject contents

Course content – project
Basic principles of computer-aided design in chemical engineering and environmental technology. Introduction to AutoCAD 2D drawings, process and technological diagrams, Sankey diagrams. Fundamentals of ChemCAD building flowsheets, defining streams, selecting unit operations, analyzing stoichiometric reactions and simple separation processes. Exporting and processing process data in Excel mass and energy balances, basic charts and data interpretation. Introduction to the R environment and the use of large language models (LLMs) to assist in generating simple R scripts for data visualization and automation of calculations. Application of computer methods to assess processes in terms of pollution, emissions, and sustainable development principles.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Final test	50.0%	100.0%

Recommended reading

Basic literature	Martín, M. (2014). *Introduction to Software for Chemical Engineers*. CRC Press. Shih, R. (2021). *AutoCAD 2022 Tutorial: First Level 2D Fundamentals*. SDC Publications. Kabacoff, R. (2022). *R in Action: Data Analysis and Graphics with R*. 3rd Edition. Manning.
Supplementary literature	Khan, I. U. (2011). *CHEMCAD as a Tool When Teaching Chemical Engineering*. Lambert Academic Publishing. Field, A., Miles, J., & Field, Z. (2012). *Discovering Statistics Using R*. SAGE Publications. Winston, W. L. (2016). *Microsoft Excel Data Analysis and Business Modeling*. Microsoft Press.

	eResources addresses	
Example issues/ example questions/ tasks being completed	Methanol can be oxidized with air to produce formaldehyde in a stoichiometric reactor at 1 bar. The air is preheated to 100 °C, and methanol is fed at 25 °C. Assume 80% conversion in the presence of a silver catalyst. In ChemCAD, build a flowsheet including a preheater, reactor, and separator, then simulate the reaction. Export the mass balance data to a CSV file and calculate in Excel the amount of formaldehyde produced [mol/h]. In R, generate a plot of process yield versus air temperature in the range 80-150 °C, using data from several simulation runs.	
Practical activites within the subject	Not applicable	

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