GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Modelling of Technological Processes - Team Project, PG_00045476		
Field of study	Chemical Technology		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2024/2025
Education level	second-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	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Process Engineering and Chemical Technology -> Faculty of Chemistry		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Andrzej Rogala	
	Teachers	dr inż. Andrzej Rogala dr inż. Izabela Frąckiewicz	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	30.0	0.0	45

E-learning hours included: 0.0

Additional information:
The lectures are conducted remotely, providing both basic and practical knowledge. During the lectures, there is interaction with the students to engage them and encourage real-time analysis of the material being presented. Practical sessions are carried out using computer tools in predetermined subgroups of 3-4 students. In project-based classes, students are taught the basics of preparing simulation models, both based on the lecture and through continuous interaction with the instructor. They then proceed to solve tasks set by the instructor in groups. The instructor remains actively involved, offering guidance and steering students toward correct solutions, or, if necessary, demonstrating the solution with detailed explanations.

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	5.0	25.0	75

Subject objectives

The aim of the course is to acquire basic knowledge in the field of modeling of technological processes and the ability to use it to build and optimize mathematical models with the use of statistical and chemical process simulation programs.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_W01	The student possesses the necessary knowledge to select reactors in simulation models of process installations based on design and experimental data. The student understands the preparation of mathematical models and knows how to develop models based on design and experimental data.	[SW3] Assessment of knowledge contained in written work and projects
K7_K04	The student is able to supervise the group's work during the preparation of the technological process model. The student is able to work in a group under the supervision of another person and actively participate in the implementation of the assigned tasks. The student can organize work adequately to the time allocated for the task.	[SK3] Assessment of ability to organize work [SK4] Assessment of communication skills, including language correctness [SK1] Assessment of group work skills
K7_U03	Student can create and optimize model of technological process. Basing on chemical conception student can prepare basics for modeled process project. Basing on previous knowledge student can optimize model of technological instalation. Student can use software like ChemCad, Statistica and programming language C# for design and optimization of technological process.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools

Subject contents

Lecture:

- Review of basic knowledge in chemical technology and process design: technological principles in relation to modeling, preparation of process design, the design-research-model process from laboratory to technological installation, terminology.
- Introduction to modeling, definitions and terminology, classification of models, mathematical and physical models, elements of statistics in modeling, experiment planning and model building, optimization of mathematical models.
- Simulations and optimization of technological processes, introduction to the ChemCAD environment, basic simulation parameters, thermodynamic and kinetic models in the ChemCAD program, principles for preparing simulations.
- Basics of programming using AI tools, implementation of a mathematical model into a computer program, foundations for preparing a program to optimize a mathematical model.

Project:

- Preparation of the basics for a technological project: chemical reactions, process conduction methods, physicochemical properties of reagents, and information on equipment necessary for the selected process, conceptual project scheme, preparation of a model technological process using the ChemCAD program, conducting simulations and optimizing process parameters.
- Preparation and optimization of a process model using an advanced statistical program.
- Preparation of a technological process model in the form of a computer program using AI

Prerequisites and co-requisites	Knowledge of the fundamentals of chemical and process engineering. Good knowledge of the Fundamentals of Chemical Technology. Good knowledge of Process Design. Good knowledge of technical and industrial equipment. Basic knowledge of inorganic, organic, and physical chemistry.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Grade from the project	60.0%	65.0%
Grade from passing the lecture	60.0%	35.0%

Recommended reading

Basic literature	Bretsznajder, S., Kawecki, W., Leyko, J., & Marcinkowski, R. (1973). Podstawy ogólne technologii chemicznej. WNT Warszawa.Bortel, E., & Koneczny, H. (1992). Zarys technologii chemicznej. Wydaw. Naukowe PWN.Synoradzki, L., & Wisialski, J. (2006). Projektowanie procesów technologicznych. Od laboratorium do instalacji przemysłowej, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa.Chmielewski, T. (2013). Projektowanie procesów technologicznych-Spawalnictwo. Oficyna Wydawnicza Politechniki Warszawskiej.Mazerski, J. (2009). Chemometria praktyczna. Malamut, Warszawa.Bequette, B. W., & Bequette, W. B. (1998). Process dynamics: modeling, analysis, and simulation.Ogunnaike, B. A., & Ray, W. H. (1994). Process dynamics, modeling, and control (Vol. 1). New York: Oxford University Press.Matulewski J. (2018), VISUAL STUDIO 2017. TWORZENIE APLIKACJI WINDOWS W JĘZYKU C#
Supplementary literature	Beebe, K. R., Pell, R. J., & Seasholtz, M. B. (1998). *Chemometrics: a practical guide* (Vol. 4). New York: Wiley. Morgan, E. D. (1995). *Chemometrics: experimental design* (Vol. 41). John Wiley & Son Ltd.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed

1. Prepare a process model for the production of dimethyl ether using ChemCAD. Include calculations related to pipelines, heat exchange, and propose at least one recycle loop for unreacted substrates.
2. Based on the obtained mathematical equations and boundary conditions, which are elements of the mathematical model describing process X, prepare a model in the form of a simple computer program using AI tools.
3. Based on the dataset obtained for process X, dependent on temperature, pH, pressure, and ionic strength, propose a mathematical model equation using a statistical software program.

Work placement

Not applicable

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