GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00064669		
Field of study	Recycling and Energy Recovery		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
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	Polish not applicable
Semester of study	3	ECTS credits	6.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Process Engineering and Chemical Technology -> Faculty of Chemistry		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jacek Gębicki	
	Teachers	dr hab. inż. Jacek Gębicki dr inż. Izabela Frąckiewicz mgr inż. Przemysław Gnatowski dr hab. inż. Justyna Łuczak dr hab. inż. Justyna Kucińska-Lipka dr inż. Maciej Sienkiewicz	

Lesson types and methods of instruction							
	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	20.0	20.0	0.0	40.0	20.0	100
	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	100	5.0	45.0	150

Subject objectives	The aim of the course is to familiarize students with the basic principles of conducting technological processes, the fundamentals of kinetics and chemical thermodynamics, heat and mass balances, the production of plastics, as well as technologies for the recovery and reuse of waste as raw materials for the chemical industry. It also includes introducing students to the basics of chemical reactor design and life cycle assessment (LCA) of products. The course aims to develop students' computational skills in the areas of mass and heat balance of technological processes, including familiarization with modern technologies for recovering raw materials from production and post-consumer waste

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W02] analyzes engineering and technological issues and problems in the area of raw materials and energy recovery using appropriate and appropriate analytical, numerical and experimental tools and methods	The student assesses and analyzes technological issues related to raw material and energy recovery technologies, such as the potential use of waste plastics/ biomass as material or energy substrates.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K6_W04] demonstrates knowledge and understanding of research methods (information acquisition, simulations, experimental methods) in the field of technologies related to the recovery of raw materials and energy.	The student applies knowledge for the analysis of raw material and energy recovery technological processes.The student presents the acquired knowledge in the form of an oral presentation and computational projects.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K6_U02] solves engineering issues and problems in the area of raw materials and energy recovery through the use of appropriate analytical, numerical and experimental tools and methods.	The student can use computational methods to solve engineering problems such as mass and energy flow balances, chemical reactors, and life cycle analysis of a product to analyze technological processes utilizing waste materials and energy.	[SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information
[K6_U04] formulates research problems and selects appropriate research methods (information acquisition, simulations, experimental methods) in the field of technologies related to the recovery of raw materials and energy in order to solve specific tasks and to report research results.	Student chooses appropriate computational methods for engineering calculations, such as mass balance, heat balance, or life cycle analysis of a product, calculation of reactor's size.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information

Subject contents

Basic concepts related to technological processes, thermodynamics, and chemical kinetics, technological principles, and the principles of green chemistry and engineering. Mass and heat stream balances of unit operations/processes. Fundamentals of chemical reactor design. Technologies for utilizing waste materials and energy as feedstocks for the chemical industry. Basics of Life Cycle Assessment (LCA) as a key evaluation of a product's impact on the environment throughout its entire lifespan, from raw material extraction, through production and use, to its disposal.

Prerequisites and co-requisites

Basic knowledge from inrganic and organic chemistry.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
seminar - 2 presentations	100.0%	10.0%
exercises - 2 tests	60.0%	25.0%
project - 2 projects	100.0%	25.0%
lecture - test	60.0%	40.0%

Recommended reading

Basic literature	• J. Piotrowski, J. Szarawara ,,Podstawy technologii chemicznej", WNT 2010 • M. Wisniewski, K. Alejski, ,,Podstawy technologii chemicznej i reaktorów chemicznych" część 1 i 2, Wydawnictwo Politechniki Poznańskiej, 2017
Supplementary literature	A. Selecki, L. Gradoń, ,,Podstawowe procesy przemysłu chemicznego", Wydawnictwa Naukowo-Technicznej, 1985
eResources addresses	Adresy na platformie eNauczanie: Podstawy technologii chemicznej_wykład - Moodle ID: 40790 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=40790 Podstawy technologii chemicznej_ćwiczenia - Moodle ID: 40791 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=40791 Podstawy technologii chemicznej_seminarium - Moodle ID: 40792 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=40792 Podstawy technologii chemicznej_projekt - Moodle ID: 40793 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=40793

Example issues/ example questions/ tasks being completed	1. List the technological principles. 2. List the principles of green chemistry and engineering. 3. Present the possibilities of recycling mass and heat streams using the example of soda production by the Solvay process and ammonia production by the Haber-Bosch process. 4. Present the possibilities of using waste for the production of synthetic fuels and fertilizers. 5. Present the basic technologies used in the production of consumer goods made from plastics. 6. Present the technologies for the disposal/recycling of selected product groups made from plastics and bioplastics. 7. Present the types of impacts that polymer products have on the natural environment. 8. LCA - assumptions, analysis methods, interpretation of product life cycle results.
Work placement	Not applicable

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