



Subject card

Subject name and code	, PG_00064669						
Field of study	Recycling and Energy Recovery						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2025/2026		
Education level	first-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish		
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 -> Wydział Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Jacek Gębicki				
	Teachers		dr hab. inż. Jacek Gębicki				
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_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.	[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
	[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.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task [SU3] Assessment of ability to use knowledge gained from the subject
	[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.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation
	[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.	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation
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 inorganic and organic chemistry.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	lecture - test	60.0%	40.0%
	project - 2 projects	100.0%	25.0%
	exercises - 2 tests	60.0%	25.0%
	seminar - 2 presentations	100.0%	10.0%
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		

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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