GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Materials management and recovery technology, PG_00069291		
Field of study	Chemical Technology		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	
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 Chemistry and Technology of Functional Materials -> Faculty of Chemistry -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Andrzej Nowak	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	30.0	0.0	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	5.0	25.0	75

Subject objectives

The aim of the course is to provide students with theoretical and practical knowledge on modern methods of processing, management and recovery of secondary raw materials and waste from various sectors of industry, municipal economy and specialist production branches. During the course, students will become familiar with the technologies of recovery of materials such as plastics, metals, glass, ceramics and composite materials, learning to assess their usefulness and efficiency from a technical and environmental perspective.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U02] carries out experiments using properly selected techniques and apparatus, taking advantage of new developments in technology and related fields	The student is able to select appropriate techniques and equipment when conducting an experiment.	[SU4] Assessment of ability to use methods and tools
[K7_U03] designs innovative technological solutions for obtaining useful goods based on the state of the knowledge in accordance with the latest scientific literature	The student has the ability to design an innovative technological solution	[SU4] Assessment of ability to use methods and tools
[K7_K03] can interact and work in a group, taking on a variety of roles	The student is able to work as a team member and carry out assigned tasks	[SK1] Assessment of group work skills
[K7_W05] recognises the key developments in research, apparatus and technology in technology and related fields	The student has knowledge about the directions of research development and equipment used in the management and recovery of waste from various industries.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents	**Lecture:** 1. Introduction to waste management (waste classification; waste management basics; waste management hierarchy; the concept of secondary raw materials; circular economy) 2. Legal and normative aspects (national and EU regulations on waste management; environmental and technological requirements; certification and documentation of recovery processes) 3. Characteristics of selected waste groups (municipal, industrial, electronic, hazardous waste; methods of their identification and segregation) 4. Technologies for the recovery of metallic materials (mechanical, chemical and electrochemical methods of metal recovery; recycling of steel scrap, non-ferrous metals and strategic metals) 5. Recycling of plastics and composites (recovery and processing of polymers; pyrolysis, depolymerization, chemical and mechanical methods) 6. Recovery of inorganic materials (recycling of glass, ceramics, fly ash, concrete; use of construction and mineral waste as secondary raw materials) 7. Modern recovery and separation technologies (magnetic, electrostatic separation, flotation, optical methods; automatic sorting and intelligent recycling systems) 8. Biorecovery and biological processes in material management (biosorption, bioleaching, bioremediation as elements of material recovery and purification) 9. Environmental and energy aspects of material recovery (life cycle assessment, carbon and energy footprint analysis; impact of recovery processes on the environment) 10. Examples of implementations of material recovery technologies (chemical industry) 11. Development prospects and innovations in material recovery (nanotechnologies, recovery of critical raw materials, use of AI and automation in waste management) **Laboratory:** 1. Sorption capacity testing of soil 2. Copper electroremediation 3. Zinc recovery by hydrometallurgy. 4. Use of sorbents 5. Photochemical decomposition of organic compounds 6. Thermal solidification of waste 7. Electrochemical removal of pollutants
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory	60.0%	50.0%
Lecture	60.0%	50.0%

Recommended reading	Basic literature	1. Gospodarka odpadami niebezpiecznymi pod redakcją Krystyny Mędrzyckiej, Wydział Chemiczny Politechniki Gdańskiej, 1996 2. A. K. Błędzki, R. Jeziórska, J. Kijeński, Odzysk i recykling materiałów polimerowych, Wydawnictwo Naukowe PWN, Warszawa 2021 3. Odpady niebezpieczne. Przepisy i codzienność, Wiktoria Sobczyk,Wydawnictwo AGH, Kraków, 2019 4. C. Hubert, Handbook of Recycling Technology, Syrawood Publishing House, 2019
	Supplementary literature	1. Basic hazardous waste management, William C. Blackman Jr., LewisPublishers, New York, 2001 2. K. Kijeński, Andrzej K. Błędzki, Regina Jeziórska, Odzysk i recykling materiałów polimerowych, PWN, 2011
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Classification and sources of waste generation. 2. Types of packaging used for storing/transporting waste 3. The importance of a closed-loop economy. 4. What are the methods of recovering metals from electronic waste? 5. How is medical waste handled? 6. What are the routes of asbestos absorption into the human body? 7. Recycling plastics.	
Work placement	Not applicable	

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