GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Analytics in environmental protection, PG_00060777						
Field of study	Analityka w ochronie środowiska						
Date of commencement of studies	October 2024		Academic year of realisation of subject	2026/2027			
Education level	first-cycle studies		Subject group	Optional subject group Subject group related to scientific research in the field of study			
Mode of study	Full-time studies		Mode of delivery	at the university			
Year of study	3		Language of instruction	Polish			
Semester of study	6		ECTS credits	3.0			
Learning profile	general academic profile		Assessment form	exam			
Conducting unit	Department of Analytical Chemistry -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Bożena Zabiegała				
	Teachers						
Lesson types	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 familiarize students with chemical analysis methods used to assess the condition and quality of the environment, as well as to control emissions and waste in the chemical industry. Students learn the practical application of analytical techniques for identifying and determining pollutants in air, water, soil, and waste products, as well as interpreting results in the context of legal and technological requirements.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U01] is able to acquire information from literature, databases and other appropriately selected sources, also in English; is able to integrate information obtained, interpret it and make conclusions, formulate and justify opinions	The student is able to analyze measurement results, process and interpret the obtained data, assessing their uncertainty, reliability, and compliance with applicable environmental protection regulations	[SU4] Ocena umiejętności korzystania z metod i narzędzi [SU5] Ocena umiejętności zaprezentowania wyników realizacji zadania
[K6_W02] has knowledge of inorganic, organic, physical and analytical chemistry useful for obtaining selected groups of compounds, determining their physical and chemical properties allowing for their quantitative and qualitative analysis, making measurements and determining the parameters of chemical reactions, phenomena and processes occurring in chemical technology	The student knows the chemical analysis methods used in assessing the quality of environmental elements. The student knows and understands the importance of analytics in evaluating the impact of technological processes on the environment	[SW1] Ocena wiedzy faktograficznej
[K6_K05] is aware of the social role of a technical university graduate, and in particular understands the need to formulate and communicate to the public, in particular through the mass media, information and opinions on the achievements of technology and other aspects of engineering activity	The student is aware of the importance of analytical reliability in the context of environmental protection and sustainable development. The student is able to work in a laboratory team while adhering to safety rules and good laboratory practices	[SK1] Ocena umiejętności pracy w grupie [SK5] Ocena umiejętności rozwiązywania problemów występujących w praktyce
[K6_U03] is able to apply knowledge of inorganic, organic, physical and analytical chemistry and identify appropriate sources of information to design and synthesize simple chemical compounds, carry out basic physicochemical and analytical measurements	The student is able to prepare samples for analysis and perform measurements using analytical instruments. The student can apply statistical methods to assess the quality of analytical results	[SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu [SU2] Ocena umiejętności analizy informacji

Subject contents

Course content – lecture

The lecture topics cover the role of analytics in environmental protection and sustainable technology. The course discusses environmental monitoring systems operating in Poland and the European Union, as well as the fundamental standards, directives, and legal regulations governing these areas. The scope of the course includes environmental monitoring, bioindication, and environmental risk assessment. The principles of representative sampling of various environmental components are also presented. A separate thematic block is devoted to the analysis of waste and industrial emissions. Methods for analyzing water and wastewater are discussed, particularly with regard to determining biogenic substances, metals, pesticides, and indicators of organic pollution. The section on air covers issues related to the determination of particulate matter, gases, and VOCs, as well as sampling methods. With respect to soils and sediments, topics include the presence of trace elements, metals, and organic compounds, as well as contaminant mobility. The lectures also cover basic chemometric techniques, such as PCA and cluster analysis, along with methods of data visualization and interpretation in the context of technological processes and their associated emissions.

Course content – laboratory

- Determination of heavy metals (Pb, Cu, Zn, Cd) in environmental samples and waste
- Method validation and measurement uncertainty calculation, as well as preparation of an environmental analysis report
- Determination of phenols, PAHs and pharmaceutical residues in the environment using chromatographic techniques
- Analysis of air pollution by volatile organic compounds (VOCs)
- Monitoring atmospheric aerosol and examining the chemical composition of suspended particulate matter
- Method validation and measurement uncertainty calculation, as well as preparation of an environmental analysis report

Prerequisites and co-requisites

The student should:

- be familiar with general concepts in the field of environmental protection (after completing the course *Introduction to Environmental Studies*)**.**
- possess knowledge of general, inorganic, analytical, and physical chemistry,
- know basic industrial processes and their impact on the environment,
- have basic laboratory skills,

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
	60.0%	40.0%
	60.0%	60.0%

Recommended reading

Basic literature

1. Skoog D.A., Holler F.J., Crouch S.R., *Principles of Instrumental Analysis*
2. Kellner, R. et al., *Analytical Chemistry*.

	Supplementary literature	1. WIOŚ and GIOŚ manuals, reference methodologies 2. PN-EN and ISO standards related to the analysis of water, wastewater, soil, and air 3. EU Directives: Water Framework Directive, Air Quality Directive 4. Chemat, Green Analytical Chemistry and Environmental Analysis
	eResources addresses	
Example issues/ example questions/ tasks being completed	• Analysis of air pollution in a selected industrial region • Comparison of methods for determining heavy metals in water and soil • Comparison of VOC determination methods in air possibilities and limitations • Atmospheric aerosol vs. suspended particulate matter • Pharmaceutical residues in the aquatic environment	
Practical activites within the subject	Not applicable	

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