GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Analytics in environmental protection, PG_00060777		
Field of study	Chemical Technology		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2027/2028
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

eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=3657

Moodle ID: 3657 Analityka w ochronie środowiska Wykład 2026
https://enauczanie.pg.edu.pl/2025/course/view.php?id=3657

Additional information:

Link to the Environmental Analytics Laboratory website

https://enauczanie.pg.edu.pl/2025/course/view.php?id=4170

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 independently plan the learning process and acquire, analyse and interpret information from various sources, also in English.	Is able to independently plan their own learning process and search for, analyze, and interpret information from various sources, including in English, and is able to verify the information found.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
[K6_U03] Uses chemical knowledge to design compounds, perform physicochemical and analytical measurements, and obtain appropriate sources of information.	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] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information
[K6_W02] Possesses the chemical knowledge necessary to synthesize, analyze and evaluate the properties of compounds and processes used in chemical technology.	Knows the methods of chemical analysis used in assessing the quality of environmental components. Understands the importance of analytical chemistry in evaluating the impact of technological processes on the environment.	[SW1] Assessment of factual knowledge
[K6_K04] Understands the non-technical aspects of the work of a chemical engineer, including the impact on the environment, and is aware of professionalism, professional ethics and respect for diversity.	The student is aware of the engineer's responsibility for the environment and human health and is prepared to continuously improve their knowledge in the fields of ecology and technology.	[SK3] Assessment of ability to organize work [SK1] Assessment of group work skills [SK4] Assessment of communication skills, including language correctness

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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