GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Analytical Chemistry I, PG_00068285		
Field of study	Biomedical Engineering		
Date of commencement of studies	October 2025	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	2	Language of instruction	Polish
Semester of study	4	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Chemistry and Technology of Functional Materials -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Ewa Wagner-Wysiecka	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	15.0	0.0	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	50.0	100

Subject objectives

The aim of the course is to familiarize students with the issues of modern analytical chemistry and analytical problem-solving methodology.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W52] Knows and understands, to an advanced extent, selected aspects of chemistry and biochemistry, constituting general knowledge related to the field of study	The student has knowledge of the procedures related to the basic methods of quantitative analysis. Is able to carry out basic determinations, collect and correctly analyze the results obtained. Is able to determine the areas of application of chemical analytical methods in biomedical engineering.	[SW1] Assessment of factual knowledge
[K6_U12] can analyze the operation of components, circuits and systems related to the field of study, as well as measure their parameters and examine technical specifications, and plan and conduct experiments related to the field of study, including computer simulations and measurements, and interpret obtained results and draw conclusions	The student explains the chemical basics, describes the types of apparatus used in a given analytical method and explains the principle of its operation. Student defines an analytical problem. I plan to conduct an experiment and collect data. Justifies the use of quality assurance systems. Explains the basic issues related to the problems of environmental and process analytics. Understands the essence of the use of modern analytical methods in biomedical engineering.	[SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment

Subject contents	Course content – lecture **Lecture**: Definition and role analytical chemistry. The basic terms. The division, choice and elaboration of the analytical method. Statistical methods in analytical chemistry. The types of the samples, sampling, separation and preconcentration methods. Trace analysis. Methods for gases determination. Classical analysis. Titrimetric methods: acid-base titration, complexometry, redoxymetry, precipitation titration. Spectroscopic methods of analysis: UV-Vis, IR, luminescence, emission, atomic absorption, spectroscopies, turbidimetry, naphelometry, magnetic resonance spectroscopy, mas spectrometry, X-ray spectroscopy. Thermoanalytical methods. Electroanalytical methods: potentiometry, electrogravimetry, coulometry, polarography, voltamperometry, conductometry. Chromatographic methods: GC, HPLC. Kinetic methods of analysis. Miniaturization in analytical chemistry. Elements of environmental analysis. Elements of process analytical chemistry. Quality assurance systems. **Exercises**: Statistical analysis of data. Solutions. Units for expressing concentrations and calculating concentrations. Acid-base reactions. Buffers. Acid-base titration, titration curves, titration error. Complexometry: complex stability constants. Complexometric titration. Reactions of precipitation of solids. Precipitation titration. Redox reactions. Equilibria in redox systems. Redox titration. Gas laws. Analysis of gases. The analysis of the composed material. Evaluation of the reliability of the result.
Prerequisites and co-requisites	Basic knowledge of chemistry sufficient to follow the content of the Analytical Chemistry course.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Calculation exercises – two written tests	51.0%	100.0%

Recommended reading

Basic literature	1.J. Minczewski, Z. Marczenko Chemia analityczna t.1 i t.2 . PWN, W-wa, 2008 2. W. Szczepaniak Metody instrumentalne w analizie chemicznej. PWN, W-wa, 2012 3. D. Kealey, P.J. Haines Krótkie wykłady. Chemia analityczna. PWN, W-wa, 2015; 4. T. Lipiec, Z. Szmal Chemia analityczna z elementami analizy instrumentalnej. PZWL, W-wa,1997 5. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch Podstawy chemii analitycznej. PWN, W-wa, 2006 6. A. Cygański, B. Ptaszyński, J. Krystek Obliczenia w chemii analitycznej . WNT, W-wa, 2000 7. A. Cygański Chemiczne metody analizy ilościowej. WNT, W-wa, 2017 8. Ćwiczenia rachunkowe z chemii analitycznej. Praca zbiorowa pod redakcją Z. Galusa, PWN, W-wa, 2013
Supplementary literature	1. Miniaturyzacja w chemii analitycznej praca zbiorowa pod red. Z. Brzózki. Oficyna Wydawnicza Politechniki Warszawskiej , W-wa 2005 2. A. Cygański Metody spektroskopowe w chemii analitycznej. WNT, W-wa, 2017 3. A. Cygański Podstawy metod elektroanalitycznych. WNT, W-wa, 1999 4. A. Hulanicki Reakcje kwasów i zasad w chemii analitycznej. PWN, W-wa, 2016.
eResources addresses	

Example issues/ example questions/ tasks being completed	1. What is volumetric analysis, what is the analytical signal? Explain the terms: titrant, titrant titer, titration, basic substance, end point of titration, equivalence point, titration curve, titration: direct, indirect, reverse titration. 2. Electrogravimetry as an analytical technique on the borderline between classical and instrumental methods: principles of measurement, examples of application. 3. What is the basis of quantitative analysis byUV-Vis spectroscopy? (Lambert-Beer's law, deviations from this law, the law of additivity of absorption). Give an example of determinations using UV-Vis spectroscopy. 4. Division of chromatographic methods by type of mobile phase similarities and differences. 5. Principles of XRF method determinations and area of application. 6. Ion-selective electrodes: division, principle of operation, characteristics, areas of application. 7. Explain the terms Good Manufacturing Practice (GMP), Good Laboratory Practice (GLP) - discuss their meaning and indicate the areas where these principles are implemented. 8. A 0.5 g sample of an alloy was dissolved and diluted to 250 ml. To titrate the total content of Cu and Zn in 50 ml of the solution, 47.25 ml of 0.01011 mol/dm³ EDTA solution was used. To titrate Zn alone, after masking Cu, 32.50 ml of 0.01011 mol/dm³ EDTA solution was used. Calculate the percentage content of Cu and Zn in the alloy.
Practical activites within the subject	Not applicable

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