



## Subject card

Subject name and code	Analytical Chemistry, PG_00053525						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
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	5		ECTS credits		6.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Chemistry and Technology of Functional Materials -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Ewa Wagner-Wysiecka				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	30.0	0.0	0.0	75
	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	75		15.0		60.0	150
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.		[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		
	[K6_U51] can conduct laboratory work connected with chemistry and biochemistry, specific to biomedical engineering		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. The student measures using selected equipment. Analyzes the obtained data and assesses the reliability of the obtained result. 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.		[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment		

Subject contents	Lecture: Definition and role analytical chemistry. The basic terms in analytical chemistry. The division of the analytical methods. The choice of analytical method. The elaboration of the new analytical method. Statistical methods in analytical chemistry. The types of the samples and sampling methods. Separation and preconcentration methods. Trace analysis. Methods for gases determination. Classical analysis: gravimetric and volumetric methods. 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: gas chromatography, high performance liquid chromatography. Electrophoresis. Kinetic methods of analysis. Miniaturization in analytical chemistry. Elements of environmental analysis. Elements of process analytical chemistry. Quality assurance systems. Tutorial: 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 results. Laboratory: Safety in laboratory. Calibration, standards preparation, sampling. Volumetric analysis – precipitation titration. Gravimetric analysis. UV-Vis spectroscopy. Spectrofluorimetry IR spectroscopy. High performance chromatography. Potentiometry. Optimizing in analytical chemistry.		
Prerequisites and co-requisites	Matters realized during the subject "Chemistry"		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Test: material covering problems disscused during excercises	51.0%	30.0%
	Written exam	51.0%	40.0%
	Lab problems tests, correctly done excercises, repors	51.0%	30.0%
Recommended reading	Basic literature	1. J. Minczewski, Z. Marczenko „Chemia analityczna” t.1 i t.2 . PWN, W-wa, 2007 2. W. Szczepaniak „Metody instrumentalne w analizie chemicznej”. PWN, W-wa, 2007 3. D. Kealey, P.J. Haines „Chemia analityczna”. PWN, W-wa, 2005; 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, 1999 8. „Ćwiczenia rachunkowe z chemii analitycznej”. Praca zbiorowa pod redakcją Z. Galusa, PWN, W-wa, 1993	
	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, 2002 3. A. Cygański „ Podstawy metod elektroanalitycznych”. WNT, W-wa, 1999 4. A. Hulanicki „Reakcje kwasów i zasad w chemii analitycznej”. PWN, W-wa, 1992.	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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