



## Subject card

Subject name and code	Analytical Chemistry , PG_00048460						
Field of study	Chemistry in Construction Engineering						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2023/2024		
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study 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	3	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Analytical Chemistry -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Andrzej Wasik					
	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	4.0		46.0	125	
Subject objectives	To acquaint students with the importance of analytical chemistry. To provide knowledge about the basics of classical analytical chemistry and selected instrumental analysis methods. The acquisition by the students ability to perform calculations for analysis problems. The acquisition of practical knowledge of basic analytical reactions and classical techniques of quantitative analysis.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K6_U08	Student uses properly selected methods and devices that enable the measurement of basic quantities characterizing materials and technological processes.					
	K6_K03	Student solves the most common problems associated with the profession of engineer, correctly identifies and resolves dilemmas associated with the profession of engineer, assesses the risks and is able to assess the effects of her/his activities.			[SK5] Assessment of ability to solve problems that arise in practice		
	K6_W03	Student has established theoretical knowledge in the field of chemistry including analytical chemistry, including the knowledge necessary to describe and understand the phenomena and chemical processes occurring in the construction industry and to measure and characterize these processes.			[SW1] Assessment of factual knowledge		

Subject contents	Lecture: The role and the place and tasks chemical analytical process, signal analytical; the collection and preparation of samples for analysis; the analytical methods (primary methods and absolute, indirect method); bases theoretical selected and a description of the analytical methods (gravimetry, volumetry, titration, redoxometry, complexometry, electroanalytical techniques, spectroscopic techniques ; chromatographic techniques, characteristics of the analytical method- validation parameters. The Seminar: Presentation of analytical result, the uncertainty, significant figures; gravimetric analysis, volumetric techniques, titration curves calculation; bases statistics in chemical metrology. Laboratory: Health and safety rules, the correct weighing, handling of volumetric equipment; adjustment titre NaOH; determination of H <sub>2</sub> SO <sub>4</sub> content by titration technique; determination of CH <sub>3</sub> COOH content; the determination of Cl <sup>-</sup> in the water-precipitation titration; the determination of iron- gravimetric analysis; the determination of Ca and Mg side by side-complexometry; the determination of Cu-redoxometric and electrogravimetric titration; statistical treatment of analytical results; electroanalytical techniques; spectroscopic techniques; gas chromatography; liquid chromatography.		
Prerequisites and co-requisites	Student should have knowledge of the: stoichiometry, chemical reaction equilibrium, reactions and theory of acids and bases, precipitation reaction, solubility product, reaction mechanism, complex formation constant		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Practical exercise	60.0%	35.0%
	Written exam	60.0%	35.0%
	Exercises	60.0%	30.0%
Recommended reading	Basic literature	1. J. Minczewski, Z. Marczenko, Chemia analityczna t.1 Podstawy teoretyczne i analiza ilościowa, PWN, Warszawa 2006. 2. J. Minczewski, Z. Marczenko, Chemia analityczna t. 2, Chemiczne metody analizy ilościowej, PWN, Warszawa 2006. 3. Z. Galus, Ćwiczenia rachunkowe z chemii analitycznej, PWN, Warszawa 2007. 4. A. Cygański, Chemiczne metody analizy ilościowej, WNT, Warszawa 1999. 5. W. Szczepaniak, Metody instrumentalne w analizie chemicznej, PWN, Warszawa 2008. 6. Ocena i kontrola jakości wyników pomiarów analitycznych, praca zbiorowa pod redakcją Piotra Konieczki i Jacka Namieśnika, WNT, Warszawa, 2007.	
	Supplementary literature	1. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Podstawy chemii analitycznej z CD-ROM. T. 1, PWN, Warszawa 2006 2. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Podstawy chemii analitycznej z CD-ROM. T. 2, PWN, Warszawa 2007 3. A. Cygański, Metody spektroskopowe w chemii analitycznej, WNT, Warszawa, 2002. 4. A. Cygański, Chemiczne metody analizy ilościowej, WNT, Warszawa, 2005. 5. Z. Witkiewicz, J. Hepter, Chromatografia gazowa, WNT, Warszawa, 2009. 6. Z. Witkiewicz, Podstawy chromatografii, WNT, Warszawa, 2005. 7. M. Wesółowski, K. Szefer, D. Zimna, Zbiór zadań z analizy chemicznej, WNT, Warszawa, 2002.	
	eResources addresses	Adresy na platformie eNauczanie:	

<p>Example issues/ example questions/ tasks being completed</p>	<ol style="list-style-type: none"> <li>1. Simple conversions within molar and percentage concentrations.</li> <li>2. Sampling for analysis.</li> <li>3. Correct presentation of the analysis result, rounding of numbers.</li> <li>4. Estimating the uncertainty of the analysis result, theoretical and empirical approach.</li> <li>5. Phenomena occurring during precipitation.</li> <li>6. Acid-base titration, titration curves, indicators, pH buffers.</li> <li>7. Argentometry, titration curves, indicators.</li> <li>8. Redoxometry, titration curves, indicators, popular redoxometric methods.</li> <li>9. Complexometry, types and formation of complexes, application of complexometry in analysis.</li> <li>10. Spectroscopic methods.</li> <li>11. Validation of analytical methodologies.</li> <li>12. Introduction to chromatography.</li> <li>13. Selected electroanalytical methods</li> </ol>
<p>Work placement</p>	<p>Not applicable</p>