



## Subject card

Subject name and code	ANALYTICAL CHEMISTRY, PG_00053081						
Field of study	Chemistry						
Date of commencement of studies	October 2021	Academic year of realisation of subject			2022/2023		
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			8.0		
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. Piotr Konieczka					
	Teachers	prof. dr hab. inż. Piotr Konieczka prof. dr hab. inż. Bożena Zabiegała dr inż. Weronika Hewelt-Belka dr hab. inż. Mariusz Marć dr inż. Paweł Kubica dr inż. Małgorzata Rutkowska dr inż. Bartłomiej Cieślík					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	0.0	60.0	0.0	15.0	120
	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	120	10.0	70.0	200		
Subject objectives	The role, place and task analysis, the analytical process, analytical signal; collection and preparation of samples for analysis; analytical methods (methods of primary and absolute, indirect methods); theoretical base and a description of the selected analytical methods (gravimetry, volumetric acid-base titration, precipitation titration, redox titration, complexometry; electroanalysis; spectroscopic techniques, chromatographic techniques and related analytical methods validation parameters-characterization;						
Learning outcomes	Course outcome	Subject outcome		Method of verification			
	[K6_K03] understands the importance of group and team activities in which members adopt various roles	Understand the importance of group's activities		[SK2] Assessment of progress of work			
	K6_U07	Can make accurate and precise measurement in the analytical laboratory		[SU1] Assessment of task fulfilment			
	K6_W03	Has a basic knowledge of trends in the area of theoretical chemistry		[SW3] Assessment of knowledge contained in written work and projects			
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 H2SO4 content by titration technique; determination of CH3COOH content; the determination of Cl- 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; adjustment titre of KMnO4; statistical treatment of analytical results; spectroscopic techniques; gas 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
	seminary	60.0%	20.0%
	laboratory	60.0%	25.0%
	exam	60.0%	55.0%
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. Wesolowski, K. Szefer, D. Zimna, Zbiór zadań z analizy chemicznej, WNT, Warszawa, 2002.	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. Provide characteristics and conclusions regarding the acid-base/precipitation/complexometric/redoxymetry titration curve.</li> <li>2. Describe Warder's method determination NaOH and Na<sub>2</sub>CO<sub>3</sub>.</li> <li>3. Specify the characteristics and requirements of the base substance.</li> <li>4. Characterize titration types: direct, indirect, and reverse.</li> <li>5. Fajans indicators principle and application.</li> <li>6. The composition and explain the roles of the individual components of the Reinhardt-Zimmermann mixture (manganometric determination of iron ions).</li> <li>7. Characteristics of the precipitate in the weighing analysis.</li> <li>8. What are the optimal precipitate conditions in weight analysis?</li> <li>9. What are the causes of over voltage in electrogravimetry?</li> <li>10. What affects the representativeness of the sample at the sampling stage?</li> <li>11. Specify the differences (apparatus, range of applications, measurement beings) between atomic absorption spectroscopy techniques with flame atomization and flame photometry.</li> <li>12. What are the components of the basic chromatographic system?</li> <li>13. Range of elementary analysis applications in analytical chemistry.</li> <li>14. List the calibration techniques and describe one of them.</li> <li>15. List the electroanalytical techniques used in analytical chemistry and characterize one of them.</li> </ol>		
Work placement	Not applicable		