



## Subject card

Subject name and code	Industrial analytics , PG_00038543						
Field of study	Chemical Technology						
Date of commencement of studies	February 2023	Academic year of realisation of subject			2022/2023		
Education level	second-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	1	Language of instruction			Polish		
Semester of study	1	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			assessment		
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 dr inż. Tomasz Dymerski dr inż. Małgorzata Rutkowska dr inż. Bartłomiej Cieślik dr inż. Weronika Hewelt-Belka					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	60.0	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	5.0		45.0	125	
Subject objectives	The main goal of studies is to achieve the knowledge and practical experience in the field of: - samples pretreatment;- separation methods with particular regard to chromatographic techniques;- quantitative determination of chosen analytes using elemental analysis and physicochemical methods (spectroscopic and electroanalytical);- calculation of results of quantitative analysis using mathematics methods and its statistical evaluation;- methods validation (reference materials, interlaboratory comparison, sources of errors, estimation of systematic error);- usage of scientific literature.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	K7_U05	Student is able to properly prepare samples for analysis and perform analysis using chromatographic, spectrophotometric and electrochemical techniques; is able to calculate the results of quantitative analyzes using mathematical and graphic methods and interpret them statistically; carry out validation of methods using reference materials, organize and use the results of inter-laboratory tests.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools
	K7_W04	The student is able to solve analytical problems with the use of elemental analysis of organic compounds; can use appropriate separation techniques with particular emphasis on chromatographic techniques	[SW2] Assessment of knowledge contained in presentation
	K7_U10	The student is able to carry out research with the use of selected modern analytical techniques and measuring devices	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
K7_K03	The student is able to interact and work in a group, assuming various roles in it. Is able to properly define the priorities for the implementation of the task set by himself or others	[SK5] Assessment of ability to solve problems that arise in practice	
Subject contents	<p>Specificity of analytical methods based on relative measurements. Characteristics of analytical devices. Types of signals, position and value of signals; problems of noises in the relative methods. Comparison of accuracy and precision of analytical methods.</p> <p>Elemental analysis of organic compounds, use in analytical chemistry. Methods of determination of carbon, hydrogen, halogen, nitrogen and sulphur. Methods of mineralisation; flash ignition and automatic elemental analysers.</p> <p>Spectroscopic methods of analysis. Types of methods and principles. Monochromators, detectors, methods of atomisation and excitation. Matrix influence on analytical effect. Sources of interference and methods of its elimination. Flame emission, steel analysis, atomic absorption spectroscopy, ultraviolet and visible absorption methods principles, apparatus, methods of measurements and choice optimal work conditions. Optimisation by simplex technique.</p> <p>Separation methods with particular regard to chromatographic techniques. Gas chromatography; principles, characteristic of columns, selected detectors, qualitative and quantitative analysis. High performance liquid chromatography (HPLC) column and thin-layer. Mechanism of chromatographic processes, selectivity and efficiency of chromatographic sets, types of phases, chromatographic equipment.</p> <p>Electroanalytical methods, basic physicochemical law. Potentiometry, conductometry, coulometry, ion selective electrodes, chronovoltamperometry: principles, methods of measurements and apparatus.</p> <p>Electron microscopy, theoretical foundations of electron diffraction, application of electron diffraction in metal microanalysis. Neutron activation, theoretical foundations, use in analytics.</p>		
Prerequisites and co-requisites	Passed subjects: Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Physics, Analytical Chemistry. Basic knowledge of analytical chemistry.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture: exams and short tests	60.0%	60.0%
	Laboratory: Tests and reports	60.0%	40.0%

Recommended reading	Basic literature	<p>1 J. Minczewski, Z. Marczenko, Chemia analityczna, tom 3, wyd. 9 i 10, zm., PWN, Warszawa 2005.</p> <p>2 D.A. Skoog, D.M. West, J.F. Holler, S.R.Crouch, Fundamentals of Analytical Chemistry, (VII ed.), Saunders College Publishing, Philadelphia 1996, Podstawy Chemii Analitycznej, t. 1-2, PWN, Warszawa 2006.</p> <p>3 P. Konieczka P., Namieśnik J., Zygmunt B., Bulska E., Świtaj-Zawadka A., Naganowska A., Kremer E., Rompa M., Ocena i kontrola jakości wyników pomiarów analitycznych, WN-T, Warszawa 2007.</p> <p>4 Fizykochemiczne metody kontroli zanieczyszczeń środowiska, [red.] J. Namieśnik i Z. Jamrógiewicz, WN-T, Warszawa 1998.</p> <p>5 A. Cygański, Metody spektroskopowe w chemii analitycznej, WN-T, Warszawa 1993.</p> <p>6 N.S. Połuektow, Analiza metodą fotometrii płomieniowej, WN-T, Warszawa 1969.</p> <p>7 M. Pinta, Absorpcyjna spektrometria atomowa. Zastosowania w chemii analitycznej, PWN, Warszawa 1977.</p> <p>8 Z. Marczenko, Spektrofotometryczne oznaczanie pierwiastków, PWN, Warszawa 1979.</p> <p>9 A. Cygański, Metody elektroanalityczne, WN-T, Warszawa 1995.</p> <p>10 Z. Witkiewicz, Podstawy chromatografii, WN-T, Warszawa 2000.</p> <p>11 Z Witkiewicz, J. Hetper, Chromatografia gazowa, WN-T, Warszawa 2001.</p> <p>12 B. Bobrański, Analiza ilościowa związków organicznych, PWN, Warszawa 1979.</p> <p>13 Chromatografia cieczowa, [red.] M. Kamiński, CEEAM, Gdańsk 2004.</p> <p>14 Spektrometria atomowa, [red.] E. Bulska, K. Pyrzyńska, Malmut, Warszawa 2007.</p>
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	Supplementary literature	<p>1 M. Jarosz, E. Malinowska, Pracownia chemiczna. Analiza instrumentalna, wyd. 2 uzup., WSiP, Warszawa 1999.</p> <p>2 W. Szczepaniak, Metody instrumentalne w analizie chemicznej, PWN, Warszawa 1999.</p> <p>3 K. Danzer, E. Than, D. Moloch, Analityka. Przegląd systematyczny, WN-T, Warszawa 1993.</p> <p>4 J. Czermiński i współautorzy, Metody statystyczne dla chemików, PWN, Warszawa 1986.</p> <p>5 G.W. Ewing, Metody instrumentalne w analizie chemicznej, PWN, Warszawa 1980.</p> <p>6 T.H. Gow, Nowoczesne metody instrumentalne analizy, WN-T, Warszawa 1976.</p> <p>7 H.W. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, Instrumental Methods of Analysis, Wadsworth, Belmont 1981.</p> <p>8 Z. Marczenko, Spektrofotometryczne oznaczanie pierwiastków, PWN, Warszawa 1979.</p> <p>9 A. Cygański, Metody elektroanalizy, WN-T, Warszawa 1995.</p> <p>10 Z. Galus, Teoretyczne podstawy elektroanalizy chemicznej, PWN, Warszawa 1977.</p> <p>11 Metody analitycznej spektrometrii atomowej, [red.] W. Żywnicki, J. Borkowska-Burnecka, E. Bulska, E. Szmyd, Malmut, Warszawa 2010.</p>
	eResources addresses	
Example issues/ example questions/ tasks being completed	Which detector can be used to determine the TOC parameter? List the main division of mineralization methods. Introduce the principle of chromatographic separation, types of capillary columns used in GC, and classification of chromatographic techniques. List and describe the parameters characterizing the detectors used in GC and HPLC. What is the difference between TEM and SEM techniques; What could be measured in the industry with the use of TEM and SEM techniques? Describe the main laws on the basis of which the phenomenon of isotachopheresis occurs. Please describe the necessary condition to provide the ITP analysis. Application of PTR-MS and SIFT-MS techniques.	
Work placement	Not applicable	