

Subject card

Subject name and code	Monographic lecture - Advanced electrochemical methods, PG_00082431						
Field of study	Chemistry						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2026/2027		
Education level	Master's studies		Subject group		Obligatory subject group in the field of study Optional subject group		
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		3.0		
Learning profile	academic		Assessment form		credit		
Conducting unit	Department of Analytical Chemistry -> Faculty of Chemistry -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr Iwona Dąbkowska				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	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	30		5.0		40.0	75
Subject objectives	familiarization with the development and application of electrochemical methods,familiarization with the theoretical foundations and measurement principles of electroanalytical methods,introduction to the methodology of modification and imaging of various surfaces using electrochemical and optical methods and combined methods,presentation of the application of electroanalytical methods to solve complex analytical problems,developing the ability to search for applications of electroanalytical methods in the scientific literature						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[CHEMMU2_K01] Knows the limitations of her/his own knowledge; understands the need for further education and can inspire other people to do so.		- self-assesses their current knowledge - determines the challenges facing chemical sciences		[SK1] oral statement/conversation/discussion [SK4] test/exam - oral or written		
	[CHEMMU2_W01] Uses knowledge of spectroscopic methods of chemical compound analysis.		- can, based on acquired knowledge, propose solutions to chemistry problems, taking into account the economic aspect, using advanced measurement and analytical techniques		[SW4] test/exam - oral or written [SW1] oral statement/conversation/discussion		
	[CHEMMU2_W11] Demonstrates general knowledge about the current trends in the development of chemistry as a science and the latest discoveries in this field.		- explains complex physicochemical processes for a given research method - combines the possibilities of applying analytical chemistry in other fields of science		[SW4] test/exam - oral or written [SW1] oral statement/conversation/discussion		
	[CHEMMU2_W05] Has extended knowledge in the field of the specialisation studied.		- lists and describes modern measurement methods - combines economic conditions with individual research methods		[SW4] test/exam - oral or written		

Subject contents	Theoretical concepts of electroanalytical methods: phenomena at the phase boundary, description of the diffusion of substances to the electrode surface, reversibility of the electrode process, Fick's law, Cottrell's law, modeling of the electrode process, double layer capacitance, kinetics of the electrode reaction, mechanisms of electrode processes. Electrochemical measurements in aqueous, mixed and non-aqueous environments. Voltammetric methods: chronoamperometry, cyclic and normal pulse voltammetry. Electrochemical impedance spectroscopy. Voltametric stripping. Surface modification: Langmuir-Blodgett layers, self-organizing layers on metallic surfaces (SAM). Techniques used to characterize monolayers: Raman, confocal and SERS spectroscopy. Spectroelectrochemical measurements. Application of the atomic force microscope (AFM). Principles of flow analysis. Automation and computerization of analytical methods.		
Prerequisites and co-requisites	completed "instrumental analysis" course		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	test/exam	51.0%	100.0%
Recommended reading	Basic literature	1. A. J. Bard, L. R. Faulkner - Electrochemical methods, Wiley 2. F. Scholz Electroanalytical methods, Guide to Experiments and Applications, Springer 3. C. Z. Zoski - Handbook of electrochemistry Elsevier 4. Z. Galus Elektrochemiczne metody wyznaczania stałych fizykochemicznych, PWN, Warszawa 5. A. Kiszka Elektrochemia cz. I i II, WNT, Warszawa	
	Supplementary literature	1. W. Szczepaniak Metody instrumentalne w analizie chemicznej, PWN, Warszawa	
	eResources addresses		
Example issues/ example questions/ tasks being completed	Electrochemical measurements in aqueous, mixed and non-aqueous environments. Voltammetric methods: chronoamperometry, cyclic and normal pulse voltammetry. Electrochemical impedance spectroscopy. Voltametric stripping.		
Work placement	Not applicable		

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