



Subject card

Subject name and code	Electrochemical methods in biomedical applications, PG_00053378						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	February 2024	Academic year of realisation of subject				2024/2025	
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	2	ECTS credits				3.0	
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		prof. dr hab. Anna Lisowska-Oleksiak				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	15.0	0.0	45
	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	45		3.0		27.0	75
Subject objectives	The aim of the course is to familiarize students with the possibilities of using electrochemical methods in designing biomedical devices and technologies.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_U02] can perform tasks related to the field of study as well as formulate and solve problems applying recent knowledge of physics and other areas of science	Is able to perform tasks related to the field of study concerning electrochemical methods and electrochemistry and is able to use knowledge of electrochemistry in the design of devices and technologies			[SU5] Assessment of ability to present the results of task [SU1] Assessment of task fulfilment		
	[K7_K01] is ready to create and develop models of proper behaviour in the work and life environment; undertake initiatives; critically evaluate actions of their own, teams and organisations they are part of; lead a group and take responsibility for its actions; responsibly perform professional roles taking into account changing social needs, including: - developing the achievements of the profession, - observing and developing rules of professional ethics and acting to comply to these rules	is ready to undertake and develop patterns of proper conduct in the work and life environment having knowledge of electrochemical methods in biomedical applications in undertaking tasks in a team is able to take on leadership roles and be a participant in a group, understands the mechanisms of change resulting from the development of knowledge in the field of electrochemistry and the technical possibilities resulting from it for biomedical applications			[SK1] Assessment of group work skills [SK3] Assessment of ability to organize work [SK5] Assessment of ability to solve problems that arise in practice		
[K7_W06] Knows and understands, to an increased extent, the basic processes taking place in the life cycle of devices, facilities and technical systems.	Knows and understands the basics of electrochemistry and is able to use them in the design of devices and technologies.			[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge			
Subject contents	Basics of electrochemistry, electrical double layer metal/electrolyte, semiconductor electrolyte. Kinetics of electrode processes. Electrocatalysis. Basics of measurement methods: voltammetry, chronoamperometry, electrochemical impedance spectroscopy. Application of electrochemical methods in designing sensors in biomedical applications. Biocompatibility of conducting materials, metals, electroactive polymers, electrode nanomaterials. Methods of manufacturing electrode systems with active biomaterial. Methods of supporting the electrical signal of bio-sensors. Electrode activity of metalloproteins. Batteries and accumulators for power supply in biomedical devices						

Prerequisites and co-requisites	basic knowledge in physical chemistry		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	sprawozdania	100.0%	20.0%
	opracowanie - projekt urzadzenia	100.0%	20.0%
	egzamin	51.0%	60.0%
Recommended reading	Basic literature	<p>Modern Aspect of Electrochemistry No 54, Application of electrochemistry in Medicine, ed. Mordechay Schesisnger, Springer 2013</p> <p>A. Kisza Elektrodyka, WNT 2002</p> <p>A. Kisza, Jonika, WNT 2002</p>	
	Supplementary literature	<p>JCR articles</p> <p>Shan Wang et al, A non enzymatic photoelectrochemical glucose sensor based on BiVO<sub>4</sub> electrode under visible light, Sensors and Actuators B:Chemical 291 2019 34-41.</p> <p>Xiaohong Chen et al, Stretchable and Flexible Buckypaper-Based Lactate Biofuel Cell for Wearable Electronics, Adv. Func. Mat. 2019.</p> <p>Ghorbani M. et al, Flexible freestanding sandwich type ZnO/rGO/ZnO electrode for wereable supercapacitors Applied Surface Science 419 (2017) 277-285.</p> <p>Whitmann M, Ultramicroelectrodes for medical applications</p> <p>Sempiatto J., Wang J., Touch-Based Fingertip Blood-Free Reliable Glucose Monitoring: Personalized Data Processing for Predicting Blood Glucose Concentration, ACS Sensors 6, (2021)1875-1883</p>	
	eResources addresses	Adresy na platformie eNauczenie:	
Example issues/ example questions/ tasks being completed	<p>Discuss the principle of operation of an ion pump using electroactive polymers Present a diagram of the construction of an enzymatic and non-enzymatic glucose sensor Describe the principle of operation of an impedometric sensor identifying analyte components based on the principles of supramolecular chemistry interactions. The influence of the presence of metal implants on the formation of undesirable cells within the patient's body. Explain the influence of a magnetic field on the electroactivity of selected metalloproteins</p>		
Work placement	Not applicable		

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