



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 2022	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	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		prof. dr hab. Anna Lisowska-Oleksiak				
Lesson type and method 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						
Metody elektrochemiczne w zastosowaniach biomedycznych - Moodle ID: 25496 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=25496							
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. Achieving the goal possible through familiarization with the basics of electrochemistry, electrochemical methods and examples of their use						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[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 role of the person conducting the measurement as a conscious technical condition of the device, the limitations of the selected method, the need to maintain reproducible conditions for electrochemical measurements			[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge	
	[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: n - developing the achievements of the profession, n- observing and developing rules of professional ethics and acting to comply to these rules		is aware of the essence of progress in the ways of using the methods of one field and implementing it in another, understands interdisciplinarity as the basis of progress, is ready to take creative actions when necessary and when new challenges emerge.			[SK2] Assessment of progress of work [SK1] Assessment of group work skills [SK5] Assessment of ability to solve problems that arise in practice	
	[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 solve problems based on the acquired knowledge and skills in the field of electrochemistry			[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information	

Subject contents	Fundamentals of electrochemistry, metal / electrolyte double layer, electrolyte semiconductor interface, membrane / electrolyte interface. Kinetics electrode processes. Electrocatalysis. Fundamentals of measurement methods: voltammetry, chronoamperometry, electrochemical impedance spectroscopy. Use of methods electrochemical in the design of sensors in biomedical applications. Biocompatibility conductive materials, metals, electroactive polymers, electrode nanometers. Methods production of electrode systems with active biomaterial. Signal enhancement methods electrical bio-sensors. Electrode activity of metalloproteins. Accumulators and batteries to power 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
	lecture	51.0%	60.0%
	laboratory	100.0%	20.0%
	project	100.0%	20.0%
Recommended reading	Basic literature	<p>1. Modern Aspect of Electrochemistry No 54, Application of electrochemistry in Medicine, ed. Mordechay Schesisnger, Springer 2013.</p> <p>2. Instrukcje do ćwiczeń laboratoryjnych oraz materiały do wykładu dostępne 5.10.2021 : https://enauczenie.pg.edu.pl/moodle/course/view.php?id=18857</p> <p>3. A. Kizza Elektrodyka, WNT 2002</p> <p>4. A. Kizza, Jonika, WNT 2002</p>	
	Supplementary literature	<p>Aktualne publikacje rejestrowane JCR</p> <p>Shan Wang et al, A non enzymatic photoelectrochemical glucose sensor based on BiVO₄ 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>	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<ul style="list-style-type: none"> • Describe the principle of operation of the ion pump using electroactive polymers Present a schematic of the structure of an enzymatic and non-enzymatic glucose sensor • Describe the principle of the impedometric sensor that identifies the analyte components on the basis of interactions of supramolecular chemistry. • describe the influence of the presence of metallic implants on the formation of unwanted galvanic cells within the patient's body. • Explain the influence of the magnetic field on the electroactivity of selected metallo-proteins 		
Work placement	Not applicable		