



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	October 2024	Academic year of realisation of subject			2024/2025		
Education level	second-cycle studies	Subject group			Optional subject group Specialty 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			assessment		
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 the design of biomedical devices and technologies						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W10] knows and understands, to an increased extent, the basic processes occurring in the life cycle of equipment, objects and technical systems, as well as methods of supporting processes and functions, specific to the field of study	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		
	[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	The student has the knowledge and skills to deepen knowledge of scientific and technical progress in the field of the use of electrochemical methods in biomedical applications. He is a conscious participant in this progress .			[SK2] Assessment of progress of work [SK1] Assessment of group work skills		
[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	The student is able to perform tasks and solve problems related to the use of electrochemical methods in biomedical applications			[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU5] Assessment of ability to present the results of task [SU3] Assessment of ability to use knowledge gained from the subject			

Subject contents	<p>Basics of electrochemistry, electric double layer between metal and electrolyte, semiconductor / electrolyte. Kinetics of electrode processes. Electrocatalysis. Fundamentals of measurement methods: voltammetry, chronoamperometry, electrochemical impedance spectroscopy. The use of electrochemical methods in sensor design in biomedical applications. Biocompatibility of conductive materials, metals, electroactive polymers, electrode nanometers. Methods of producing electrode systems with active biomaterial. Methods of supporting the electrical signal of bio-sensors. Electrode activity of metalloproteins.</p> <p>Batteries and batteries for powering in biomedical devices.</p>		
Prerequisites and co-requisites	basic knowledge in physical chemistry		
Assessment methods and criteria	Subject passing criteria		Passing threshold
	Laboratories - reports		100.0%
	lecture course - written exam		51.0%
	project		100.0%
Recommended reading	Basic literature		<p>Modern Aspect of Electrochemistry No 54, Application of electrochemistry in Medicine, ed. Mordechay Schesisnge , Springer 2013</p> <p>A. Kisza Elektrodyka, WNT 2002</p> <p>Lecture course pdf files link as an example: https://enauczanie.pg.edu.pl/moodle/course/view.php?id=25496</p>
	Supplementary literature		Current articles
	eResources addresses		Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	<p>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 operation of an impedometric sensor identifying analyte components on the basis of the interaction of supramolecular chemistry. The influence of the presence of metallic implants on the formation of unwanted links within the patient's body. Explain the influence of the magnetic field on the electroactivity of selected metalloproteins.</p>		
Work placement	Not applicable		

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