



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 2027	Academic year of realisation of subject			2026/2027		
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	1	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 -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Anna Lisowska-Oleksiak					
	Teachers	prof. dr hab. Anna Lisowska-Oleksiak dr hab. Mariusz Szkoda dr hab. inż. Konrad Trzciński					
Lesson types	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_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_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	understands in-depth the physical chemistry of charge transfer processes in biochemical systems, methods of studying the mechanisms of electrochemical processes	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	[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 knowledge of electrochemical methods and their application possibilities in solving biomedical problems	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment
Subject contents	<p>Course content – lecture 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	Percentage of the final grade
	lecture course - written exam	51.0%	60.0%
	Laboratories - reports	100.0%	40.0%
Recommended reading	Basic literature	Modern Aspect of Electrochemistry No 54, Application of electrochemistry in Medicine, ed. Mordechay Schesinger, Springer 2013	
		A. Kizza Elektrodyka, WNT 2002	
	Supplementary literature	Current articles	
	eResources addresses		
Example issues/ example questions/ tasks being completed	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 impedimetric 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.		
Practical activities within the subject	Not applicable		