GDAŃSK UNIVERSITY OF TECHNOLOGY

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

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">besic knowledge in physical chemistry</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>sprawozdania</td><td>100.0%</td><td>20.0%</td></tr>
<tr><td>opracowanie - projekt urzadznia</td><td>100.0%</td><td>20.0%</td></tr>
<tr><td>egzamin</td><td>51.0%</td><td>60.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">Modern Aspect of Electrochemistry No 54, Application of electrochemistry in Medicine,ed. Mordechay Schesisnger , Springer 2013

A. Kisza Elektrodyka, WNT 2002

A. Kisza , Jonika, WNT 2002</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">JCR articles

Shan Wang et al, A non enzymatic photoelectrochemical glucose sensor based on $BiVO_4$ electrode under visible light, Sensors and Actuators B:Chemical 291 2019 34-41.

Xiaohong Chen et al, Stretchable and Flexible Buckypaper-Based Lactate Biofuel Cell for Wearable Electronics, Adv. Func. Mat. 2019.

Ghorbani M. et al, Flexible freestanding sandwich type ZnO/rGO/ZnO electrode for wereable supercapacitors Applied Surface Science 419 (2017) 277-285.

Whitmann M, Ultramicroelectrodes for medical applications

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</td></tr>
<tr><td>eResources addresses</td><td colspan="2">Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">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 impidometric 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</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
</table>

Document generated electronically. Does not require a seal or signature.