GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Electrochemical Biosensors, PG_00069698		
Field of study	Nanotechnology		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
Education level	first-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	3	Language of instruction	Polish
Semester of study	5	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Division of Electrochemistry and Surface Physical Chemistry -> Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Jacek Ryl	
	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	0.0	0.0	30

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	30	5.0	40.0	75

Subject objectives

The aim of the course is to explore the design methods and ways of using devices for identifying molecular interactions based on biological elements, biosensors, for the development of advanced diagnostic technologies, environmental monitoring and safety improvement.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U10] can forecast and assess potential negative biological and ecological effects of producing nanostructures on an industrial scale and their practical application.	The student is able to predict and assess potential negative biological and ecological effects associated with the use of nanomaterials, as well as the practical role of biosensors in their detection.	[SU2] Assessment of ability to analyse information
[K6_W01] has knowledge of materials science and understands its key role in the progress of civilization	The student has knowledge of materials used in chemical sensors and biosensors and understands their role in the development of modern diagnostic technologies	[SW1] Assessment of factual knowledge
[K6_U05] can design and build a simple measuring device or instrument.	The student is able to design and build a simple sensor system or biosensor element, including the selection of architectural elements, development of a measurement station for detection	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information

Subject contents	Lectures (15 hours): - Fundamental properties of chemical sensors and biosensors - Material technologies in biosensors: lithography, off-set printing, 1D and 2D nanomaterials, metallic and semiconductor materials, electrode arrays - Chemical sensors for bioactive compounds (O2, dopamine, drug, heavy metal sensors) - Examples of catalytic electrochemical biosensors (glucose, cholesterol sensors) - Examples of affinity electrochemical biosensors (protein, DNA, virus sensors) - FET biosensors based on nanomaterials Laboratories (selected topics): - Environmental water diagnostics (heavy metal detection, constant current (CV) methods, stripping) - Environmental water diagnostics (antibiotic detection, constant current (CV) methods, DPV) - Design and annealing of multi-electrode arrays - Electrode array diagnostics - Effects Electrocatalytic activity provided by metal nanoparticles (EIS alternating current methods) - Preparation and functionalization of polysaccharide hydrogel layers - Biosensor diagnostics, determination of detection limits and selectivity using a selected method
Prerequisites and co-requisites	Completed course in basic surface physicochemistry, organic chemistry or biochemistry and basic knowledge of electrochemical tools and nanomaterial fabrication

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
laboratory reports	50.0%	50.0%
test	50.0%	50.0%

Recommended reading	Basic literature	Browne - Elektrochemia, PWN Li, Wu - Biosensors Based on Nanomaterials and Nanodevices, CRC Press
	Supplementary literature	JCR articles
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Discuss the basic relationships in the chemistry of host-guest systems. 2. Discuss the basic problems of diagnostics using electrochemical biosensors. 3. Discuss examples of anti-fouling methods.	
Work placement	Not applicable	

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