GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Chemical sensors and biosensors, PG_00062752		
Field of study	Technologies for Industry 5.0		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
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	2	Language of instruction	Polish
Semester of study	4	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Electrochemistry and Surface Physical Chemistry -> Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	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 familiarize students with the mechanisms of operation of chemical sensors and biosensors, with particular emphasis on electrochemical detection processes, materials used in modern sensors and sensor construction.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U02] identifies and solves problems related to signal processing and transmission, integrates measurement and control systems, manages electronic systems in the context of intelligent production processes	The student is able to propose a diagnostic tool for a specific chemical compound, describe the detection mechanism, describe the components of the sensor and understand their operating principles.	[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
[K6_W03] demonstrates knowledge on materials used in industrial technologies, their structure and fabrication, knows the principles of conducting research, analyzing it and creating technical documentation	The student has knowledge of materials used for chemical sensors, catalytic properties, modification methods, knows the methods of manufacturing sensor components	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge

Subject contents

1. Physicochemical, biochemical and technological foundations of sensors and biosensors
2. Detection mechanisms for different types of sensors
3. Molecular recognition tools: optical, electrochemical, resistive, other
4. Aspects of nanotechnology: catalytic properties, surface modification and functionalization
5. Materials used in sensors: polymers, semiconductors, metals and oxides, biocompatibility
6. Substrate manufacturing technologies: micro and nanofabrication
7. Signal processing and analysis: electronics and measurement systems, calibration, interference and noise
8. Selected applications of sensors in Industry 5.0
9. Integration with IoT systems
10. Advanced technologies and development trends, flow systems, multi-electrode arrays, etc.

Prerequisites and co-requisites

Basic knowledge of inorganic physics and chemistry, as well as surface physicochemistry.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
exam	60.0%	50.0%
laboratories	60.0%	50.0%

Recommended reading

Basic literature	Chemical Sensors and Biosensors by Rene Lalauze, Wiley

	Supplementary literature	JCR artiles
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	Describe the operating principle of an electrochemical chemical sensor. What are its main applications and what factors affect its accuracy and sensitivity? What are the differences between enzymatic biosensors and antibody-based biosensors? Give examples of their applications and discuss the advantages and disadvantages of each type of biosensor. How can IoT technology be used to improve the efficiency and functionality of chemical sensors and biosensors in the context of Industry 5.0?	
Work placement	Not applicable	

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