



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	<ol style="list-style-type: none">1. Physicochemical, biochemical and technological foundations of sensors and biosensors2. Detection mechanisms for different types of sensors3. Molecular recognition tools: optical, electrochemical, resistive, other4. Aspects of nanotechnology: catalytic properties, surface modification and functionalization5. Materials used in sensors: polymers, semiconductors, metals and oxides, biocompatibility6. Substrate manufacturing technologies: micro and nanofabrication7. Signal processing and analysis: electronics and measurement systems, calibration, interference and noise8. Selected applications of sensors in Industry 5.09. Integration with IoT systems10. 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 articles
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	<p>Describe the operating principle of an electrochemical chemical sensor. What are its main applications and what factors affect its accuracy and sensitivity?</p> <p>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.</p> <p>How can IoT technology be used to improve the efficiency and functionality of chemical sensors and biosensors in the context of Industry 5.0?</p>	
Work placement	Not applicable	

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