



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 2025		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	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 -> Wydział Politechniki Gdańskiej						
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_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		[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects		
	[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.		[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject		
Subject contents	<div>1. Physicochemical, biochemical and technological foundations of sensors and biosensors</div> <div>2. Detection mechanisms for different types of sensors</div> <div>3. Molecular recognition tools: optical, electrochemical, resistive, other</div> <div>4. Aspects of nanotechnology: catalytic properties, surface modification and functionalization</div> <div>5. Materials used in sensors: polymers, semiconductors, metals and oxides, biocompatibility</div> <div>6. Substrate manufacturing technologies: micro and nanofabrication</div> <div>7. Signal processing and analysis: electronics and measurement systems, calibration, interference and noise</div> <div>8. Selected applications of sensors in Industry 5.0</div> <div>9. Integration with IoT systems</div> <div>10. Advanced technologies and development trends, flow systems, multi-electrode arrays, etc.</div>						
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		
	laboratories		60.0%		50.0%		
	exam		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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