



## Subject card

Subject name and code	, PG_00070391						
Field of study	Materials Engineering						
Date of commencement of studies	October 2023	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	3	Language of instruction			Polish		
Semester of study	6	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Leszek Wicikowski					
	Teachers	dr inż. Leszek Wicikowski					
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	0.0	30
	E-learning hours included: 0.0						
	eNauczanie source addresses: Moodle ID: 5561 Czujniki <a href="https://enauzanie.pg.edu.pl/2025/course/view.php?id=5561">https://enauzanie.pg.edu.pl/2025/course/view.php?id=5561</a>						
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 basic types of physicochemical sensors. Particular emphasis will be placed on gas sensors, water pollution sensors, temperature, humidity, pressure, and strain sensors. As part of the course, students will prepare a project involving a selected type of sensor, a system for monitoring a selected object or process.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U06] Can integrate obtained information, interpret it and draw conclusions, as well as formulate and justify opinions.	Based on the available literature on physicochemical sensors, the student is able to prepare a set of sensors necessary to monitor the assumed processes, interpret the results and modify the assumptions made at the beginning	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task
	[K6_W06] Knows selected methods, techniques, tools and materials used in solving simple engineering problems within the scope of materials engineering.	The student can utilize the necessary tools in a project. They can use programs that are helpful in engineering practice. They can utilize manufacturer data regarding the sensors they intend to use.	[SW3] Assessment of knowledge contained in written work and projects
	[K6_W04] Knows selected aspects of construction and operation of scientific equipment in materials engineering.	The student understands the operating principles of physicochemical sensors. They can describe the physical phenomena underlying their operation	[SW1] Assessment of factual knowledge
	[K6_U11] Is able to notice non-technical aspects when forming and solving project tasks, including environmental, economic and legal aspects. Applies the rules of occupational health and safety.	The student understands the importance of sensors in environmental monitoring, can assess their significance in modern medicine and threat monitoring, understands the ethical issues surrounding their use, and can assess the economic aspects of their use.	[SU3] Assessment of ability to use knowledge gained from the subject
Subject contents	<p>Course content – lecture Static and dynamic properties of sensors. Physical basis of sensor operation. Basic sensor classes. Gas sensors, mechanical sensors, accelerometers, strain gauges, electrochemical sensors, gas sensors, biosensors, temperature, humidity, and pressure sensors.</p> <p>Course content – project Development and selection of a set of sensors to monitor a specific process, preparation of a specific type of sensor, measurement of its parameters</p>		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	project report	50.0%	50.0%
	Passing the lecture	50.0%	50.0%
Recommended reading	Basic literature	Chemical Sensors and Biosensors: Fundamentals and Applications	
		Principles of Chemical Sensors, Jiri Janata, Springer 2009	
	Supplementary literature	Articles in Sensors And Actuators	
	eResources addresses	Supplementary <a href="https://www.sciencedirect.com/journal/sensors-and-actuators-a-physical">https://www.sciencedirect.com/journal/sensors-and-actuators-a-physical</a> - a magazine containing articles related to the subject matter	

<p>Example issues/ example questions/ tasks being completed</p>	<p>Design and Characterization of a Resistive Gas Sensor (MOX)  <b>PROJECT OBJECTIVE:</b>  The project objective is to design, fabricate, and characterize a resistive gas sensor based on nanostructured metal oxide (MOX). The project includes: material selection, technology design, microstructure characterization, electrical measurements, and analysis of sensing parameters.  <b>PROJECT SCOPE (BASIC VERSION)</b>  Target gas selection (NH<sub>3</sub>, NO<sub>2</sub>, CO, ethanol, acetone).  Literature analysis (minimum 10 scientific publications).  Active material selection (ZnO, SnO<sub>2</sub>, TiO<sub>2</sub>) and justification.  Process design (deposition method, heat treatment parameters).  Sensor sample fabrication.  Microstructure characterization (SEM/XRD if available).  Electrical measurements <math>R=f(T)</math>.  Sensor tests (sensitivity, response time, selectivity).  Data analysis and literature comparison.  Engineering section (reducing operating temperature, power reduction, prototype cost).  Detailed literature analysis (min. 15 publications).  Theoretical sensor design (technical diagram).  Mathematical model of the <math>R=f(\text{concentration})</math> relationship based on literature data.  Analysis of the effect of grain size and porosity on sensitivity.  Energy simulation (estimating power consumption).  Feasibility study and cost analysis.  <b>SIMPLIFIED VERSION (WITHOUT LABORATORIES) FINAL REPORT STRUCTURE</b>  1. Theoretical introduction. 2. Literature review.  Materials and technological design.  Research methodology.  Results.  Discussion.  Conclusions.  Technical and economic analysis.  Bibliography.</p>
<p>Practical activities within the subject</p>	<p>Not applicable</p>

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