



## Subject card

Subject name and code	, PG_00058940						
Field of study	Nanotechnology						
Date of commencement of studies	October 2023		Academic year of realisation of subject		2024/2025		
Education level	first-cycle studies		Subject group		Obligatory subject group in the field of study 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		4.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Maria Gazda				
	Teachers		dr inż. Sebastian Wachowski  Joanna Pośpiech  prof. dr hab. inż. Maria Gazda				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	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	45		5.0		50.0	100
Subject objectives	Gaining knowledge of selected nanomaterials and functional nanostructures, their properties and applications.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K6_U06		Is able to present problems related to the applications of functional nanostructures and nanomaterials.		[SU5] Assessment of ability to present the results of task		
	K6_W06		Has basic knowledge of nanomaterials science and knows how size affects selected properties.		[SW1] Assessment of factual knowledge		
	K6_U09		can produce selected nanomaterials		[SU1] Assessment of task fulfilment		
	K6_U10		Can predict the risks associated with the use of functional nanomaterials		[SU2] Assessment of ability to analyse information		
	K6_W07		Has systematic knowledge of the physical and chemical properties of functional nanomaterials		[SW1] Assessment of factual knowledge		
Subject contents	<b>Lecture</b> Introduction: nanomaterials, nanostructures;Nanomaterials and nanostructures with specific functions resulting from the properties:Electrical (conductors, superconductors, electrides, Coulomb blockade, ballistic conductivity, ionic conductors, dielectrics, ferroelectrics, etc.);Optical (effect of size on optical properties);magnetic (ferro-, antiferro-, dia-, paramagnetics, superparamagnetism);other;Nanomaterials in information recording and energy conversion. <b>Laboratory:</b> The laboratory includes exercises: production and testing of a ceramic superconductor, production and testing of nanoparticles (ZnO, CeO2, etc.), preparation and testing of a nanocrystalline photoelectrochemical cell, testing of hydrophilic and hydrophobic materials. Exercises will be performed in groups of 2-3 people.						
Prerequisites and co-requisites	no						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	written assesment: open questions	52.0%	50.0%
	lab assesment	52.0%	50.0%
Recommended reading	Basic literature	Nanomaterials, D. Vollath	
	Supplementary literature	scientific literature	
	eResources addresses	Adresy na platformie eNauczanie: Nanomaterialy funkcjonalne - Moodle ID: 27780 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=27780">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=27780</a>	
Example issues/ example questions/ tasks being completed	1. How does size affect the elastic properties (e.g. Young's modulus), melting point and heat capacity of materials (with a brief explanation)?2. Write and briefly explain why the electrical conductivity will change (increase or decrease) (Note: this is about conductivity):a. Copper as a result of heating it to a higher temperatureb. Copper as a result of its strong plastic deformationc. Undoped silicon as a result of heating it to a higher temperatured. Doped silicon as a result of heating it to a higher temperature3. What properties should the superconductor have, from which the winding of an electromagnet generating a magnetic field of B = 9 T is made?4. Can a mirror be made in a way other than applying a layer of metal to glass? If so, describe such a mirror.5. List non-magnetic ways of recording information. Describe two of them.		
Work placement	Not applicable		

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