



Subject card

Subject name and code	Nanotechnology, PG_00039822						
Field of study	Materials Engineering, Materials Engineering, Materials Engineering						
Date of commencement of studies	October 2021	Academic year of realisation of subject			2023/2024		
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	3	Language of instruction			Polish		
Semester of study	6	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Division of Nanomaterials Physics -> Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Wojciech Sadowski					
	Teachers	prof. dr hab. inż. Wojciech Sadowski					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	15.0	30
	E-learning hours included: 0.0						
Address on the e-learning platform: https://enauczanie.pg.edu.pl/moodle/course/view.php?id=13039							
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	1.0	19.0	50		
Subject objectives	To familiarize students with the properties of materials at the transition from the macro to nano techniques manufacturing of nanomaterials and their applications.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K6_U06	The ability to integrate information, interpret it, as well as draw conclusions related to the science of materials.			[SU2] Assessment of ability to analyse information		
	K6_K01	Demonstrates the need to improve professional and personal competences; is aware of its own limitations and knows when to turn to experts, is able to find the right source material.			[SK1] Assessment of group work skills [SK5] Assessment of ability to solve problems that arise in practice		
	K6_W03	Has basic knowledge in the field of materials science, nanotechnology and is able to connect the properties of materials with their structure and composition, knows the theoretical description of phenomena occurring in materials.			[SW1] Assessment of factual knowledge		
	K6_U08	The ability to prepare typical written works in Polish and English, appropriate for nanotechnology and materials science, concerning specific issues, using basic theoretical approaches, as well as various sources.			[SU1] Assessment of task fulfilment		

Subject contents	<p>1. Historical Introduction to Nanotechnology</p> <p>2. Elements of solid state.</p> <p>3. The physical basis of nanotechnology and size effects - the structure of a 3D, 2D , 1D , 0D .</p> <p>4. Nucleation and crystallization.</p> <p>5. Methods for the preparation of nanomaterials : thin layer and the thin film structure , quantum wires and dots , nanopowders.</p> <p>6. Methods of examination of the nanomaterials.</p> <p>7. Fullerenes and nanotubes .</p> <p>8. Elements of superconductivity.</p> <p>9. Nanotechnology applications.</p>		
Prerequisites and co-requisites	Physics of materials, Functional materials		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Credit lecture	50.0%	70.0%
	Examination of the seminar	100.0%	30.0%
Recommended reading	Basic literature	<p>Nanostructures and Nanomaterials. Synthesis, Properties and Applications. Imperial College Press. Guozhong Gao. 2004.</p> <p>Introduction to Nanotechnology. Ch.P.Poole Jr., F.J.Owens. Wiley. 2003.</p> <p>Nanoelectronics and Information Technology. Advanced Electronic Materials and Novel Devices. Reiner Waser (Ed.) Wiley-VCH. 2003.</p> <p>Nanomaterials: Synthesis, properties and Applications. Ed. by Edelstein A.S and Commarta R.S. IOP London 1996.</p> <p>F.E. Fujita. Physics of New Materials. Springer 1999.</p>	
	Supplementary literature	<p>Nanomaterials: Synthesis, properties and Applications. Ed. by Edelstein A.S and Commarta R.S. IOP London 1996.</p> <p>F.E. Fujita. Physics of New Materials. Springer 1999.</p>	
	eResources addresses	<p>Adresy na platformie eNauczanie:</p> <p>Nanotechnologia - Moodle ID: 36250</p> <p>https://enauzanie.pg.edu.pl/moodle/course/view.php?id=36250</p>	

<p>Example issues/ example questions/ tasks being completed</p>	<ol style="list-style-type: none"> 1. Elements of the structure of a solid (crystallography, chemical bonds, band stature) 2. Physical basis of nanotechnology and size effects - 3D, 2D, 1D, 0D structures. 3. Fundamentals of the synthesis of nanostructures, nucleation and crystallization. 4. Methods of obtaining nanomaterials: thin layers and thin-layer structures, quantum wires and dots, nanopowders, 5. Electrical, magnetic, optical and mechanical properties of nanostructures. 6. Methods of studying nanomaterials. STM microscopy, AFM. 7. Fullerenes and nanotubes. 8. Nanotechnology in applications
<p>Work placement</p>	<p>Not applicable</p>

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