



Subject card

Subject name and code	, PG_00052094						
Field of study	Nanotechnology						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2024/2025		
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 Polish		
Semester of study	5	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			exam		
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	dr hab. inż. Marcin Łapiński dr inż. Marek Chmielewski dr inż. Marta Prześniak-Welenc 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	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 show the influence of nanostructures on the properties of macroscopic materials, creating construction materials with new functional properties, increased strength, energy-saving and environmentally friendly.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K6_U04	Student is able to plan and conduct experiments, critically analyze their results, draw conclusions and formulate opinions. He has experience in laboratory work in the field of material testing.			[SU2] Assessment of ability to analyse information		
	K6_W06	The student has basic knowledge of materials science and nanomaterials (structure of crystalline and amorphous bodies, crystal bonds, structural defects and their impact on material properties, lattice vibrations and thermal properties of materials, electronic structure, selected transport phenomena).			[SW1] Assessment of factual knowledge		
	K6_U02	Student is able to analyze and solve simple scientific, technical and construction problems based on his knowledge of nanotechnology.			[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject		

Subject contents	<p>Lecture:</p> <p>Properties of nanomaterials. Nanostructures in macroscopic materials Self-organization in the system nano-sized.</p> <p>Nanofibers. Nanoporous materials. Nanocomposite materials</p> <p>Modification of the surface structure.</p> <p>Structural and functional nanostructures - examples.</p> <p>Laboratory:</p> <ol style="list-style-type: none"> 1. Microscopic analysis (SEM, confocal microscopy) of multiphase composite material. 2. Non-destructive flaw detection of nanoferrocomposite material. 3. Research on multiphase materials using thermal analysis. 											
Prerequisites and co-requisites	Introduction to nanotechnology.											
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="456 891 794 920">Subject passing criteria</th> <th data-bbox="799 891 1137 920">Passing threshold</th> <th data-bbox="1142 891 1469 920">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="456 927 794 956">Passing laboratory work</td> <td data-bbox="799 927 1137 956">100.0%</td> <td data-bbox="1142 927 1469 956">30.0%</td> </tr> <tr> <td data-bbox="456 963 794 992">Completion of the lecture content</td> <td data-bbox="799 963 1137 992">50.0%</td> <td data-bbox="1142 963 1469 992">70.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Passing laboratory work	100.0%	30.0%	Completion of the lecture content	50.0%	70.0%
Subject passing criteria	Passing threshold	Percentage of the final grade										
Passing laboratory work	100.0%	30.0%										
Completion of the lecture content	50.0%	70.0%										
Recommended reading	Basic literature	<p>Nanomaterials and Their Applications. Editors Zishan Husain Khan. Springer, 2018</p> <p>Springer Handbook of Nanotechnology. Editors Bharat Bhushan. Springer, 2017</p>										
	Supplementary literature	<p>Nanomaterials and Their Applications. Editors Zishan Husain Khan. Springer, 2018</p> <p>Springer Handbook of Nanotechnology. Editors Bharat Bhushan. Springer, 2017</p>										
	eResources addresses	<p>Adresy na platformie eNauczenie:</p> <p>Nanotechnologie w materiałach konstrukcyjnych - Moodle ID: 40950 https://enauczenie.pg.edu.pl/moodle/course/view.php?id=40950</p>										
Example issues/ example questions/ tasks being completed	<p>Thermal properties of nanomaterials and structures.</p> <p>Optical properties of nanomaterials and structures.</p> <p>Strength properties of nanomaterials and structures.</p> <p>Properties of nanocomposite materials.</p> <p>Methods of designing material properties taking into account nanotechnology and artificial intelligence.</p>											
Work placement	Not applicable											

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