



Subject card

Subject name and code		Basics of Nanotechnology, PG_00049373						
Field of study		Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies		October 2022	Academic year of realisation of subject			2022/2023		
Education level		second-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		1	Language of instruction			Polish		
Semester of study		1	ECTS credits			3.0		
Learning profile		general academic profile	Assessment form			assessment		
Conducting unit		Instytut Nanotechnologii i Inżynierii Materiałowej -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)		Subject supervisor		dr inż. Marta Prześniak-Welenc				
		Teachers		dr hab. inż. Jakub Karczewski dr inż. Marta Prześniak-Welenc				
Lesson types and methods of instruction		Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
		Number of study hours	30.0	0.0	15.0	0.0	0.0	45
		E-learning hours included: 0.0						
		Podstawy Nanotechnologii - Moodle ID: 27082 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27082						
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	3.0		27.0		75
Subject objectives		The aim of the course is to gain knowledge of the basics of nanotechnology.						
Learning outcomes		Course outcome	Subject outcome		Method of verification			
		[K7_U06] can analyse the operation of components, circuits and systems related to the field of study; measure their parameters; examine technical specifications; interpret obtained results and draw conclusions	Ability to use the tools necessary to evaluate the parameters and characteristics of materials. The ability to interpret the results and draw correct conclusions.		[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task			
		[K7_W08] Knows and understands, to an increased extent, the fundamental dilemmas of modern civilisation, the main development trends of scientific disciplines relevant to the field of education.	Knowledge of the impact of nanotechnology on the problems of modern civilization related to the scope of biomedical engineering.		[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation			
Subject contents		<p>What is nanotechnology. Elements of solid state physics: crystalline structure of solids, bonds, phonons, band structure. Physical phenomena in nanostructures, quantum wells. Methods of nanosized materials preparations: thin films, nanorods, quantum dots, nanopowders. Electrical, magnetic, optical and mechanical properties of nanosized materials. Photonic structures. Methods of nano-materials examination (AFM, STM and nanoindentation). Physical properties of nanotubes and graphene. Nanotechnology applications: quantum Hall effect, tunneling effect, ballistic charge transport, absorption and emission of radiation, lasers, Coulomb blockade, photonic structures, nanomagnetism. 5. Physical properties of nanotubes. 6. Elements of nanoelectronics.</p>						

Prerequisites and co-requisites	Knowledge of basics of classical and contemporary physics.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Participation in lessons, doing reports	50.0%	33.4%
	Written exam	50.0%	66.6%
Recommended reading	Basic literature	1. Nanotechnologie. Red. Nauk. R.W.Kelsall i in. PWN 2008.2. Wstęp do fizyki ciała stałego. C. Kittel, PWN, 1999	
	Supplementary literature	1. Introduction to nanotechnology. Ch.P.Poole Jr, F.J.Owens. Wiley2003	
	eResources addresses		
Example issues/ example questions/ tasks being completed	1. General concepts related to nanotechnology, production methods and methods of research on nanostructures.2. Physico-chemistry of surfaces.3. Elements of solid state physics: crystal structure of a solid, bonds, models of electrons in a crystal, electron state density, band structure.4. Quantum wells. 5. Physical phenomena in nanostructures: ballistic transport of carriers, quantum Hall effect, tunneling, Coulomb blockade, the Aharonov-Bohm effect, absorption and emission of radiation, lasers. 6. Specific heat in a crystal, thermal properties of nanostructures.7. Photonic structures and their application. 8. Nanomagnetism: magnetic properties of materials, spin-orbit coupling, GMR, TMR, valvesspin, Hall spin effect, Kondo effect.9. Physical properties of nanotubes and graphene.		
Work placement	Not applicable		