



Subject card

Subject name and code	Nanotechnology in chemistry and medicine, PG_00049385						
Field of study	Biomedical Engineering, Biomedical Engineering, Biomedical Engineering						
Date of commencement of studies	October 2023	Academic year of realisation of subject				2026/2027	
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	4	Language of instruction				Polish	
Semester of study	7	ECTS credits				2.0	
Learning profile	general academic profile	Assessment form				assessment	
Conducting unit	Department of Biomedical Engineering -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Ewa Wagner-Wysiecka					
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	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		2.0		18.0	50
Subject objectives	The aim of the course is to introduce basic concepts related to nanotechnology. Methods of nanostructures manufacturing, methods of their properties examination and examples of usage in the biomedical sciences will be discussed.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K6_W53] Knows and understands, to an advanced extent, selected aspects of materials science and biomaterials constituting general knowledge related to the field of study		The student knows and understands, at an advanced level, the types of chemical bonds and intermolecular interactions and their impact on the properties of materials, with particular emphasis on nanostructures used in chemistry and medicine.			[SW1] Assessment of factual knowledge	
	[K6_U52] can determine properties of materials and biomaterials used in biomedical engineering		The student is able to relate the type of chemical bonding and methods of nanostructure preparation to their physicochemical properties relevant for applications in biomedical engineering.			[SU2] Assessment of ability to analyse information	
	[K6_U07] can apply methods of process and function support, specific to the field of study		The student is able to identify and describe methods for designing and modifying nanostructures to achieve desired chemical and surface properties relevant for applications in biomedical engineering.			[SU3] Assessment of ability to use knowledge gained from the subject	
Subject contents	Course content – lecture Lecture: Molecules and bonds. Types of bonds and the material properties. Chemical bonds and interactions in nanotechnology (covalent, ionic, metallic, coordinative, hydrogen bridge bonds, van der Waals, dipol-dipol, hydrophobic interactions). Bottom-up and top-down methods. Precursors, building blocks, assembly of building blocks, reaction equilibrium. Nanoparticle size control. Zero-dimensional nanostructures: metallic, semiconducting, ceramic, polymer and carbon nanoparticles. One-dimensional nanostructures: nanorods, nanotubes, nanowires. Two-dimensional nanostructures: monolayers and thin films of metals, ceramics, polymers, carbon and organic compounds. Langmuir-Blodgett technique. Surface modification. Lipophilic and lipophobic materials. Doping of nanostructures. Composite materials, hybrid materials (metal-organic etc.). Examination methods of chemical properties. Examples of nanostructures implementation in chemistry and medicine.						

Prerequisites and co-requisites	Student uses basic chemical terms. Student defines basic terms concerning structure of matter. Student lists types of chemical compounds, organic and inorganic.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written test	50.0%	100.0%
Recommended reading	Basic literature	1. Guazhong Cao. NANOSTRUCTURES& NANOMATERIALS. Synthesis, Properties, and Applications. Imperial College Press, 2004. 2. M. Kohler, W. Fritzsche. Nanotechnology. Wiley-Vch, 2003 3. C.C. Koch. NANOSTRUCTURED MATERIALS. Processing, Properties and Potential Applications. Noyes Publications, 2002. 3. K. Żelechowska. Nanotechnologia w chemii i medycynie. Wydawnictwo PG, Gdańsk 2015	
	Supplementary literature	1. R. W. Keldall i inni. Nanotechnologie. PWN, 2008. 2. H. Dodziuk. Wstęp do chemii supramolekularnej. Wydawnictwo Uniwersytetu Warszawskiego, 2008.	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> List three types of weak interactions that play an important role in the formation of nanostructures. List three specific examples of zero-dimensional nanoparticles and the reactions used for their preparation. List three examples of applications of one-dimensional structures (specify the type of structure and its application). Give two specific examples of the preparation of monomolecular layers (indicate the material of the layer and the type of substrate). Give an example of a reaction used to modify carbon nanotubes. List the methods used to obtain graphene. Indicate the carbon source. 		
Practical activities within the subject	Not applicable		

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