



Subject card

Subject name and code	Introduction to nanotechnology, PG_00061923						
Field of study	Materials Engineering						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2025/2026		
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			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Wojciech Sadowski					
	Teachers	prof. dr hab. inż. Wojciech Sadowski dr hab. inż. Marcin Łapiński					
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	15.0	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		25.0	75
Subject objectives	The aim of the course is to familiarize students with the properties of materials at the transition from the macroscopic to the nano-sized scale, with basic manufacturing techniques, and with the study of their properties and applications.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W08] Has fundamental knowledge of the development trends in the fields of science and scientific disciplines relevant to materials engineering.	The student has in-depth knowledge of development trends in the field of nanomaterials and nanotechnology.	[SW1] Assessment of factual knowledge
	[K6_U06] Can integrate obtained information, interpret it and draw conclusions, as well as formulate and justify opinions.	The student is able to integrate the obtained information on the influence of nano-sizing on the properties of materials and indicate their potential applications.	[SU2] Assessment of ability to analyse information
	[K6_W03] Has knowledge of materials science and can relate the properties of materials with their structure and composition, knows the theoretical description of phenomena occurring in materials subjected to external factors.	The student has knowledge of nanomaterials, allowing the connection of material properties with their structure and composition, and knows the theoretical description of phenomena occurring during the transition from macroscopic to nanoscopic sizes.	[SW1] Assessment of factual knowledge
	[K6_U02] Can operate typical laboratory equipment and analyze material tests	The student knows the basics of operating laboratory equipment - electron microscope SEM, tunneling STM and atomic force microscope AFM and perform analyses related to material research at the nano-size level.	[SU4] Assessment of ability to use methods and tools
	[K6_U09] Has the ability to prepare oral presentations in Polish and in a foreign language, concerning detailed issues, using fundamental theoretical approaches, and diverse sources.	The student has the ability to prepare oral presentations on issues related to nanotechnology in both theoretical and applied aspects.	[SU5] Assessment of ability to present the results of task

Subject contents	<p>Course content – lecture</p> <p>Historical Introduction to Nanotechnology</p> <p>Elements of Solid State Structure (Crystallography, Chemical Bonding, Band Structure)</p> <p>Physical Foundations of Nanotechnology, Nanosize Criteria, Size Effects, 3D, 2D, 1D, and 0D Structures.</p> <p>Nucleation and Crystallization.</p> <p>Methods for Obtaining Nanomaterials: Thin Films and Film Structures, Wires and Quantum Dots, Nanopowders.</p> <p>Electrical, Magnetic, Optical, and Mechanical Properties of Nanosized Solids.</p> <p>Methods for Investigating Nanosized Solids: STM and AFM Microscopy.</p> <p>Fullerenes, Nanotubes, Graphene. 2D Materials.</p> <p>Elements of Superconductivity.</p> <p>Nanotechnology in Applications (Electronics, Various Fields of Technology, Medicine)</p>														
	<p>Course content – laboratory</p> <p>Au-based plasmonic nanosensors:</p> <p>- fabrication,</p> <p>- testing the physico-chemical properties of the nanosensors.</p>														
	<p>Course content – seminar</p> <p>Overview of various applications of nanomaterials and functional nanostructures,</p> <p>e.g. in electronics, optoelectronics, medicine, energy (energy conversion), environmental protection, food industry, architecture, etc.</p>														
	<p>Prerequisites and co-requisites</p> <p>Physics and chemistry course.</p>														
Assessment methods and criteria	<table border="1"> <thead> <tr> <th>Subject passing criteria</th> <th>Passing threshold</th> <th>Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>Passing the lecture content</td> <td>51.0%</td> <td>60.0%</td> </tr> <tr> <td>Passing the seminar, presentation</td> <td>100.0%</td> <td>20.0%</td> </tr> <tr> <td>Passing the laboratory</td> <td>100.0%</td> <td>20.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Passing the lecture content	51.0%	60.0%	Passing the seminar, presentation	100.0%	20.0%	Passing the laboratory	100.0%	20.0%
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Recommended reading	Basic literature	<p>Basic Principles of Nanotechnology. Wesley C. Sanders. 2019 by Taylor & Francis Group, LLC CRC</p> <p>Introduction to Nano Basics to Nanoscience and Nanotechnology. Editors - Amretashis Sengupta Chandan Kumar Sarkar. Springer-Verlag Berlin Heidelberg 2015</p> <p>Introduction to Nanoscience. S.M. LINDSAY. Oxford University Press Inc., New York © S.M. Lindsay 2010.</p>													
	Supplementary literature	<p>History of Nanotechnology. From Pre-Historic to Modern Times. Edited by Madhuri Sharon. 2019 by John Wiley & Sons, Inc.; 2019 Scrivener Publishing LLC</p>													
	eResources addresses														

<p>Example issues/ example questions/ tasks being completed</p>	<p>Fizyczne podstawy nanotechnologii, kryteria wielkości nanorozmiarowych, efekty rozmiarowe, struktury 3D, 2D, 1D, 0D.</p> <p>Metody otrzymywania nanomateriałów: cienkie warstwy i struktury cienkowarstwowe, druty i kropki</p> <p>kwantowa, nanoproszki,</p> <p>Właściwości elektryczne, magnetyczne, optyczne i mechaniczne ciał nanorozmiarowych.</p> <p>Mikroskopia STM, AFM.</p> <p>Fulereny, nanorurki, grafen.</p> <p>Materiały 2D.</p>
<p>Practical activities within the subject</p>	<p>Not applicable</p>

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