



Subject card

Subject name and code	Characterization of nanostructures, PG_00069772						
Field of study	Charakteryzacja nanostruktur						
Date of commencement of studies	February 2025		Academic year of realisation of subject		2025/2026		
Education level	second-cycle studies		Subject group		Specialty 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	2		ECTS credits		10.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Wojciech Sadowski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	0.0	30.0	30.0	0.0	105
	E-learning hours included: 0.0						
	Additional information: Zajęcia wykładowe, laboratoryjne i projektowe prowadzone w Instytucie Wysokich Ciśnień PAN w Warszawie, dr hab. Grzegorz Muziol						
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	105		15.0		130.0	250
Subject objectives	The aim of the course is to familiarize students with modern techniques for the characterization of nanostructures.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_W05] has enhanced knowledge of mathematical, numerical, simulation, classical and quantum methods, applied in modeling nanostructures.		The student has in-depth knowledge of mathematical, numerical and simulation, classical and quantum methods used in modeling nanostructures.		[SW1] Ocena wiedzy faktograficznej		
	[K7_W06] Has extended knowledge on the methodology of physics laboratory work, supported with experience in laboratory work. Knows the rules of occupational health and safety to a degree sufficient for independent work at a research and measuring position.		The student has extended knowledge of the methodology of work in a physics laboratory, supported by experience in laboratory work..		[SW1] Ocena wiedzy faktograficznej		
	[K7_W07] has extended knowledge concerning potential negative biological and ecological effects resulting from using nanostructures and relevant safety rules.		The student has expanded knowledge regarding the potential negative biological and ecological effects related to the use of nanostructures and the relevant safety rules.		[SW1] Ocena wiedzy faktograficznej		
	[K7_U03] has enhanced abilities of using advanced specialist software packages		The student has in-depth skills in using advanced specialist software packages.		[SU1] Ocena realizacji zadania		
	[K7_U02] has enhanced abilities in laboratory work.		The student has in-depth skills in laboratory work.		[SU4] Ocena umiejętności korzystania z metod i narzędzi		

Subject contents	Course content – lecture Interaction of electromagnetic radiation with matter. Microscopic methods (optical, electron microscopy, SEM and TEM) Tunnel and atomic force microscopy STM,AFM. Spectroscopy.		
	Course content – laboratory Laboratory with three microscopic techniques:		
	SEM electron microscopy,		
	AFM atomic force microscopy,		
	STM tunneling microscopy		
	Course content – project Design:		
	deposition using MBE molecular beam epitaxy of thin GaN and InGaN layers and testing their optical properties.		
Prerequisites and co-requisites	Passed all 1st and 2nd semester subjects in the fields of Technical Physics, Nanotechnology or Materials Engineering at the Faculty of FTiMS		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Project execution	100.0%	10.0%
	Performing and passing laboratory exercises	100.0%	60.0%
	Written assessment of the lecture content	60.0%	30.0%
Recommended reading	Basic literature	Concise Encyklopedia of Materials Characterization. Ed. R.W. Cahn. Perrgamon Press, 1993.	
	Supplementary literature	Concise Encyklopedia of Materials Characterization. Ed. R.W. Cahn. Perrgamon Press, 1993. Encyklopedia of materials characterization. Surfaces, Interfaces, Thin Films. Ed. C.Richard Brundle et al. 1992.	
	eResources addresses		
Example issues/ example questions/ tasks being completed	Interaction of electromagnetic radiation with matter. Microscopic methods (optical, electron microscopy, SEM and TEM) Tunnel and atomic force microscopy STM,AFM. Spectroscopy.		
Practical activites within the subject	Not applicable		

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