



Subject card

Subject name and code	Experimental nanotechnology, PG_00071205						
Field of study	Nanotechnology, Nanotechnology						
Date of commencement of studies	February 2027	Academic year of realisation of subject			2026/2027		
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			English		
Semester of study	1	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Division of Nanomaterials Physics -> 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	dr hab. inż. Marcin Łapiński					
	Teachers	dr hab. inż. Marcin Łapiński					
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	45.0	0.0	0.0	60
	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	60	2.0		63.0		125
Subject objectives	Teaching of selected experimental methods used in nanotechnology. Especially in the field of synthesis and study of the properties of nanostructures. In particular, methods for producing and testing the properties of metallic nanostructures and nanoalloys will be teaching. Acquisition by students of practical skills in planning and carrying out an experiment aimed at the fabrication and characterization of nanostructures. Familiarization with advanced scientific research equipment used in the fabrication and investigation of nanomaterials.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W04] has theoretical and practical knowledge of physical and chemical experimental methods in nanotechnology and understands the principles of their application in processes occurring throughout the life cycle of technical systems	The student is able to describe chemical and physical methods of manufacturing of nanomaterials, eg. thermal evaporation, magnetron sputtering, CVD, ALD, zol-gel...	[SW1] Assessment of factual knowledge
	[K7_U02] has advanced skills in the design of nanomaterials and in conducting laboratory work related to the fabrication and characterization of nanostructures	The student is able to operate advanced equipment used for the fabrication of nanostructures. Is able to select and apply an appropriate research method for the analysis of nanostructures.	[SU2] Assessment of ability to analyse information [SU5] Assessment of ability to present the results of task
	[K7_U04] is able to formulate hypotheses, plan and conduct experimental research, critically analyze results, verify hypotheses, draw conclusions, and formulate well-founded opinions within nanotechnology and related physical and natural sciences. Recognizes economic and non-technical aspects of the activities performed	The student is able to plan and safely carry out an experiment, taking into account environmental and economic costs	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information
	[K7_W06] has extended knowledge of scientific laboratory work methodology, supported by experience in laboratory practice. Knows occupational health and safety regulations to an extent enabling independent work at a research or measurement workstation	The student is able to plan and safely carry out experiment involving the manufacturing of metallic nanostructures. Can predict the risks associated with working with nanostructures.	[SW1] Assessment of factual knowledge
Subject contents	<p>Course content – lecture</p> <p>Methods for the characterization of nanomaterials, in particular:</p> <ul style="list-style-type: none"> structural and chemical composition analysis methods, such as XPS, EDS, and mass spectrometry, spectroscopic methods, with particular emphasis on the UV-Vis technique, <p>Methods for the fabrication of nanomaterials:</p> <ul style="list-style-type: none"> physical methods (PVD): vacuum evaporation, magnetron sputtering, chemical methods (solgel, CVD, ALD), epitaxy, semiconductor doping for modern electronics, 3 and 2 nm process <p>Issues related to fabrication and practical applications of selected types of nanomaterials:</p> <ul style="list-style-type: none"> metallic nanostructures and related phenomena, plasmon resonance, stability of thin films, formation of nanoalloys, practical applications of metallic nanostructures. <p>Course content – laboratory</p> <ul style="list-style-type: none"> Deposition of thin films using physical methods, Disintegration of thin metallic films, Fabrication of nanoalloys and nanocomposites and investigation of their properties. 		
Prerequisites and co-requisites	Basic knowledge of the physics of materials and thermodynamics.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	lecture - test	51.0%	66.67%
	laboratory - lab report	51.0%	33.33%
Recommended reading	Basic literature	<p>Micro-Nano Surface Functionalization of Materials and Thin Films for Optical Applications Escobar-Galindo, et al, 2021 Basel, Switzerland MDPI - Multidisciplinary Digital Publishing Institute</p> <p>Surface Plasmon Resonance for Biosensing, Fantoni, Alessandro Fantoni, Alessandro, 2022 Basel MDPI - Multidisciplinary Digital Publishing Institute</p>	

	Supplementary literature	Introduction to Nanotechnology. Ch. P. Poole Jr., F. J. Owens. Wiley. 2003. Surface plasmon resonance based sensors / volume editor: Jiri Homola ; with contributions by J. Dostalek ... [et al.]. Homola, Jiri. 2006 Berlin ; New York : Springer
	eResources addresses	
Example issues/ example questions/ tasks being completed	Synthesis methods of thin metallic and oxides films. Thermal stability of the thin films. Measurements methods of the properties of metallic nanostructures.	
Practical activities within the subject	Not applicable	

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