



## Subject card

Subject name and code	Experimental methods in plasmonics and metallic thin films, PG_00071211						
Field of study	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			Polish		
Semester of study	1	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			exam		
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	30.0	0.0	0.0	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	1.0		79.0		125
Subject objectives	Overview of selected experimental methods used in nanotechnology in the field of synthesis and research properties. Acquisition of practical skills in planning and conducting an experiment aimed at the fabrication and characterization of selected properties of nanomaterials. Familiarization with the practical aspects of operating advanced instrumentation used in nanotechnology.						

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 has systematic knowledge of the physical and chemical foundations of nanotechnology, in particular thin films and metallic plasmonic nanostructures	[SW1] Assessment of factual knowledge
	[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 analyze simple scientific and technical problems based on existing knowledge, using analytical and experimental methods, like spectroscopic methods XPS or UV-Vis	[SU1] Assessment of task fulfillment [SU5] Assessment of ability to present the results of task [SU2] Assessment of ability to analyse information
	[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 has knowledge of the construction and operation of physical instruments, measuring and research equipment, as well as of conducting a physical experiment and critically analyzing its results.	[SU1] Assessment of task fulfillment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
[K7_K01] is able to cooperate and work effectively in a group, assuming different roles depending on changing needs. Adheres to the principles of professional ethics and demonstrates creativity and entrepreneurship. Is capable of self-assessment as well as constructive evaluation of the work of others.	The student demonstrates the ability to work constructively in a team. They are familiar with and apply ethical principles in scientific activity and professional practice. They possess the ability to critically assess the outcomes of their own work.	[SK1] Assessment of group work skills [SK3] Assessment of ability to organize work [SK2] Assessment of progress of work [SK5] Assessment of ability to solve problems that arise in practice	
Subject contents	<p>Course content – lecture</p> <p>Measurements methods:</p> <ul style="list-style-type: none"> <li>microscopic methods (SEM, SPM, optical microscopy),</li> <li>structural and chemical analysis methods (XPS, EDS, mass spectroscopy),</li> <li>spectroscopic methods with especially optical spectroscopy,</li> </ul> <p>Manufacturing methods:</p> <ul style="list-style-type: none"> <li>Physical methods (evaporation, magnetron sputtering),</li> <li>Chemical methods (CVD, ALD, sol-gel),</li> <li>Epitaxy</li> </ul> <p>Properties of selected types nanostructures:</p> <ul style="list-style-type: none"> <li>Plasmon resonance in metallic nanostructures,</li> <li>Thermal stability of thin films,</li> <li>Formation of nanoalloys.</li> </ul> <p>Course content – laboratory</p> <ul style="list-style-type: none"> <li>Design of an experiment involving the fabrication of metallic nanostructures.</li> <li>Development of a synthesis technology.</li> <li>Fabrication of nanostructures and characterization of their properties using SEM, AFM, XPS, and UV-Vis spectroscopy.</li> </ul>		
Prerequisites and co-requisites	Basic knowledge of thermodynamics and surface physicochemistry.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Examination of the lecture (test)	51.0%	50.0%
	laboratory assessment (lab report)	51.0%	50.0%

Recommended reading	Basic literature	<p>Nanostructures and Nanomaterials. Synthesis, Properties and Applications. Imperial College Press. Guozhong Gao. 2004.</p> <p>Introduction to Nanotechnology. Ch. P. Poole Jr., F. J. Owens. Wiley. 2003.</p> <p>Thin Films / edited by Alicia Esther Ares, 2021   London, England : IntechOpen</p>
	Supplementary literature	<p>Nanoelectronics and Information Technology. Adv. Electronic Materials and Novel Devices. Reiner Waser (Ed.) Wiley-VCH. 2003.</p> <p>Surface Plasmon Resonance for Biosensing, Fantoni, Alessandro, 2022 Basel MDPI - Multidisciplinary Digital Publishing Institute.</p>
	eResources addresses	
Example issues/ example questions/ tasks being completed	<p>Methods of synthesis of metallic and oxide thin films.</p> <p>Formation plasmonic nanostructures.</p> <p>Methods of test properties of plasmonic platforms.</p> <p>Thermal stability of the thin films.</p>	
Practical activities within the subject	Not applicable	

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