



Subject card

Subject name and code	Magnetic Properties of Materials and Nanomaterials, PG_00069349						
Field of study	Nanotechnology						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2025/2026		
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	2		Language of instruction		Polish		
Semester of study	4		ECTS credits		2.0		
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		dr hab. inż. Leszek Piotrowski				
	Teachers		dr hab. inż. Leszek Piotrowski				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	21.0	0.0	9.0	0.0	0.0	30
	E-learning hours included: 0.0						
	eNauczanie source addresses: Moodle ID: 1115 Właściwości magnetyczne materiałów i nanomateriałów 2025/26 https://enauzanie.pg.edu.pl/2025/course/view.php?id=1115						
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		3.0		17.0	50
Subject objectives	The aim of the course is to introduce the practical aspects of magnetism of materials . Volumetric materials with a classical division into diamagnets , paramagnetics and ferromagnets will be discussed . The second part will discuss the magnetism of nanomaterials and the basics of spintronics , with particular emphasis on the practical applications of nanometer sized materials .						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W09] Has knowledge of the structure and operation of scientific instruments, measuring and test equipment and in the field of planning and conducting a physical experiment and critical analysis of its results.		He has knowledge of measurement methods used in the case of thin films and nanoparticles.		[SW1] Assessment of factual knowledge		
	[K6_U04] can plan and conduct experiments, critically analyze their results, draw conclusions and formulate opinions. Has laboratory experience.		The student has a practical ability to measure the basic magnetic properties of bulk materials		[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools		
Subject contents	Lecture content 1 . Basic magnetic quantities 2 . Magnetism in solids , types of magnetic materials (dia - para - and ferromagnetics) 4 . Ferromagnetism , domain structure , coercive mechanisms . Applications of bulk materials permanent magnets , electromagnets . 5 . Magnetism of small particles , monodomain particles (Wohlfarth Stoner model) . 8 Experimental techniques for determining properties magnetic and magnetic . Visualization and analysis of the domain structure . 6 . Thin Layers 7 . Magnetic Recording 8 Nano Magnetic Particles and Superparamagnetism . 9 Applications of magnetic nanoparticles in medicine . Laboratory tasks : 1 . Hysteresis loop measurements 2 . Effect of demagnetization on magnetization of materials 3 . Effect of heat treatment on hysteresis loop parameters						

Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam	50.0%	70.0%
	Lab reports	50.0%	30.0%
Recommended reading	Basic literature	J. Stohr, H.C. Siegmann; Magnetism From Fundamentals to Nanoscale Dynamics; Springer, 2006	
	Supplementary literature	1. Handbook of Spin Transport and Magnetism; Ed. E.Y. Tsymbal, I.Žutić; CRC Press 2012.	
	eResources addresses		
Example issues/ example questions/ tasks being completed	What is the difference between electromagnet core material and permanent magnet material ? What is the effect of temperature on ferromagnetic materials ? What are the causes of magnetocrystalline anisotropy ? Discuss how to write to your hard drive What is spin - orbit coupling ? How does a spin valve work ? Give examples of applications of magnetic materials in medicine .		
Work placement	Not applicable		

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