GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00069396		
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	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	3	Language of instruction	Polish
Semester of study	5	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Magnetic Properties of Materials -> 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	15.0	0.0	0.0	0.0	15.0	30

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	30	2.0	18.0	50

Subject objectives

The aim of the course is a practical introduction to magnetic materials science, with particular emphasis on bulk ferromagnetic materials. Practical aspects of the use of materials of this type and the possibilities of modifying their parameters, especially the hysteresis loop, will be presented. Magnetic nanomaterials in spintronic and medical applications will also be discussed.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W04] Knows selected aspects of construction and operation of scientific equipment in materials engineering.	The student is able to describe the principle of operation of devices and systems for measuring the magnetic properties of materials.	[SW1] Assessment of factual knowledge
[K6_K01] Understands the need to improve professional and personal competencies; is conscious of own limitations and knows when to turn to experts, properly establishes priorities helping to accomplish tasks defined by oneself or others.	The student is aware of the pace of changes in the knowledge about magnetic materials, especially nanomaterials. He understands that in the field of materials science, it is impossible to be a good engineer without updating his knowledge.	[SK5] Assessment of ability to solve problems that arise in practice
[K6_W06] Knows selected methods, techniques, tools and materials used in solving simple engineering problems within the scope of materials engineering.	The student is able to analyze and design simple magnetic circuits, i.e. closed and near-closed circuits in which a magnetic flux circulates (electromagnets, fragments of electrical machines). He knows and understands the differences between theoretical equations describing spatially extended electromagnetic fields and real systems in which demagnetization plays one of the key roles.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[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 is able to acquire and organize pieces of technical information from the Internet, determining the degree of data credibility, and then present it both in the context of the progress of science and engineering practice.	[SU5] Assessment of ability to present the results of task [SU1] Assessment of task fulfilment

<table>
<tr><td>Subject contents</td><td>Magnetism of matter , diamagnetics , paramagnetics , ferromagnetics . Magnetic hysteresis . Soft and magnetic hard materials . Applications of magnetic materials - permanent magnets and electromagnets . Magnetic Data Recording - Hard Drives and MRAM Memories Superparamagnetism and the use of magnetic nanoparticles . Magnetism in medical applications .</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>activity during the lectures</td><td>0.0%</td><td>20.0%</td></tr>
<tr><td>Oral presentation</td><td>50.0%</td><td>80.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>J.M.D Coley, Magnetism and Magnetic Materials</td></tr>
<tr><td>Supplementary literature</td><td>David Jiiles, Introduction to Magnetism and Magnetic Materials</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>What is the difference between the material for electromagnet cores and the material for a permanent magnet?
What is the effect of temperature on ferromagnetic materials ?
Explain how the data is atored with the help of a hard drive.
How does MRAM work ?
Give examples of applications of magnetic materials in medicine .</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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