GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00070390		
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	6	ECTS credits	1.0
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 inż. Kamil Kolincio	
	Teachers	dr inż. Kamil Kolincio	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	0.0	0.0	15

E-learning hours included: 0.0

eNauczanie source addresses:

Moodle ID: 3171 Materiały spintroniczne
https://enauczanie.pg.edu.pl/2025/course/view.php?id=3171

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	15	2.0	8.0	25

Subject objectives

The aim of the course is to make students familiar with the basics of spintronics, a rapidly developing field of electronics that utilizes not only the electrons charge but also their spin.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U03] Can critically analyze and evaluate the functioning – particularly in the context of materials engineering –existing technical solutions, particularly equipment, objects, systems, processes.	Understanding technical processes and solutions that enable the evaluation of individual components, not only the whole effect	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject
[K6_W08] Has fundamental knowledge of the development trends in the fields of science and scientific disciplines relevant to materials engineering.	Possession of detailed knowledge in the field of spintronics and related branches of materials science	[SW1] Assessment of factual knowledge
[K6_U06] Can integrate obtained information, interpret it and draw conclusions, as well as formulate and justify opinions.	The ability to gather, evaluate, and analyze information and draw conclusions independently	[SU2] Assessment of ability to analyse information

<table>
<tr><td>Subject contents</td><td>Course content – lecture
The aim of the course is to discuss and familiarize students with the fastest growing branch of electronics - spintronics. The course includes a brief but necessary theoretical introduction discussing magnetic ordering and interactions in a way that facilitates a good understanding of the other topics covered in the course. The core of the course is a discussion of both currently used spintronic materials and devices, along with the physical phenomena used in them, as well as the latest and exotic trends in the development of this field, including quantum computers and spin textures such as skyrmions, hedgehogs, and spin bubbles. In particular, the course covers:

Methods of manufacturing and exploting of spintronic materials

Spintronic devices: memories, hard drives, spin transistors, spin valves

Magnetoelectric and magnetothermoelectric effects

Energy conversion using magnetothermoelectric effects

Spin textures: magnetic hedgehogs, skyrmions, spin bubbles

The structure and principle of operation of a quantum computer</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basic knowledge of crystallography, magnetism, and electronics is essential. Suggested prerequisites: Krystalografia, Fizyka Materiałów, Elektrotechnika i Elektronika or equivlalent</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></td><td>50.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>Magnetism and Magnetic Materials, J.M.D. Coey, Cambridge University Press, 2010

Handbook of Spintronics, edited by Yongbing Xu, David D. Awschalom, Junsaku Nitta, springer 2016

Spintronics, edited by przez: Tomasz Dietl, David Awschalom, Maria Kaminska, Hideo Ohno, Elsevier 2008</td></tr><tr><td>Supplementary literature</td><td>Dilute ferromagnetic semiconductors: Physics and spintronic structures, Tomasz Dietl and Hideo Ohno Rev. Mod. Phys. 86, 187 (2008)

- sicntific papers from peer-reviewed journals, in Englishism an</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Sample exam question: discuss the mechanism of giant magnetoresistance and its application</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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