GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00065848		
Field of study	Materials Engineering		
Date of commencement of studies	October 2025	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	2	Language of instruction	Polish
Semester of study	3	ECTS credits	1.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	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. Michał Winiarski	
	Teachers	dr inż. Michał Winiarski	

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

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	1.0	9.0	25

Subject objectives

"The aim of the course is to familiarize the student with the phenomenon of superconductivity, superconducting materials, and their applications in technology, especially in energy and quantum computers.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W01] Has extended knowledge of the fields of science and scientific disciplines relevant to materials engineering, and their historical development and importance for the progress of exact and natural sciences, knowledge of the world and evolution of humanity.	The student is able to list and describe the applications of superconductors and give examples of superconducting materials.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects

Subject contents

Course content – lecture

- Introduction: Metallic state, interelectron interactions, emergent states
- History of superconductor discovery
- Experimental description of superconductivity

A review of superconducting materials:

- Metals and alloys
- Intermetallic compounds
- Copper superconductors
- Magnesium diboride and other covalent superconductors
- Iron superconductors
- Exotic superconductors

Applications of superconductors

- On the micro and nano scale
- On the macro scale
- Application of machine learning and artificial intelligence in the search for superconductors

Summary

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">Course in Materials Physics or Solid State Physics.</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Final written test</td><td>50.0%</td><td>80.0%</td></tr>
<tr><td>Written assignment</td><td>50.0%</td><td>20.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">1.
Ch Poole i in., Handbook of Superconductivity. Academic Press, 2000.</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">1.
D.I. Khomskii, Basic Aspects of the Quantum Theory of Solids. Cambridge Univ. Press, 2010</td></tr>
<tr><td>eResources addresses</td><td colspan="2">Basic
https://www.ascg.msm.cam.ac.uk/lectures/ - Video lectures on superconductivity - University of Cambridge</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">• List two selected superconducting materials used in technology and describe their applications.
• Describe a selected application of superconductors in the generation, transmission, and/or storage of energy.
• What common feature is shared by the crystal structures of all copper-based high-temperature superconductors?</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="3">Not applicable</td></tr>
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