



Subject card

Subject name and code	Technical applications of superconductors, PG_00070261						
Field of study	ZASTOSOWANIA TECHNICZNE NADPRZEWODNIKÓW						
Date of commencement of studies	February 2025		Academic year of realisation of subject		2025/2026		
Education level	second-cycle studies		Subject group				
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		3.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Partment of Metrology and Information Systems -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Maciej Łuszczek				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	15.0	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		5.0		25.0	75
Subject objectives	The aim of the course is to introduce students to the physical foundations of superconductivity and to modern engineering solutions that employ superconducting materials. Students will learn the operating principles of devices and systems based on superconductors, their limitations, technological requirements, and emerging development trends.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_U03] is able to obtain information from literature, databases and other sources, also in English, draw conclusions, formulate and fully justify opinions. substantiate opinions; is able to identify directions for further learning and implement the process of self-education		The student is able to search, and critically evaluate information from scientific literature, databases and other sources, including English-language ones.		[SU2] Ocena umiejętności analizy informacji		
	[K7_W101] is able to make an in-depth identification of key objects and phenomena related to the field of study, as well as theories that describe them and applicable analytical and design methods		The student has in-depth knowledge of the physics of superconductivity and modern superconducting materials, and understands the principles of operation of devices and systems using superconductors.		[SW1] Ocena wiedzy faktograficznej		
	[K7_K101] acknowledges the importance of knowledge related to the field of study in solving cognitive and practical problems, critically assessing the information obtained		The student is able to creatively analyze solutions using superconductors, using knowledge from various fields of science and technology.		[SK5] Ocena umiejętności rozwiązywania problemów występujących w praktyce		

Subject contents	Course content – lecture Superconductivity phenomenon. Superconducting materials. Basic properties of superconductors. Theory of superconductivity. Type I and Type II superconductors. Critical currents. Josephson effect. Superconductor levitation. High-temperature superconductors. Quantum Interference Device (SQUID). Superconductor fabrication technologies. Course content – seminar Superconducting wires and transmission lines. Superconducting motors and generators. Superconducting Magnetic Energy Storage (SMES). Superconducting Fault Current Limiters (SFCL). Superconducting electromagnets. Superconductors in medical diagnostics (MRI) and in particle accelerators. Magnetic-levitation transportation systems. Superconductors in metrology. Superconducting bolometers. Voltage standards based on the Josephson junction. Superconducting passive microwave components. Review of the latest publications on superconducting applications.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Presentation	50.0%	50.0%
	Test	50.0%	50.0%
Recommended reading	Basic literature	1. Jan Stankowski, Borysław Czyżak, "Nadprzewodnictwo", Wydawnictwo Naukowo-Techniczne, 1999 2. Michel Cyrot, Davor Pavuna, "Wstęp do nadprzewodnictwa: nadprzewodniki wysokotemperaturowe", Wydawnictwo Naukowe PWN, 1996 3. Jacek Sosnowski, "Nadprzewodnictwo i zastosowania", Wydawnictwo Książkowe Instytutu Elektrotechniki, 2008	
	Supplementary literature	1. Jacek Sosnowski, "Materiały nadprzewodnikowe: modelowanie własności i zastosowania", Wydawnictwo Książkowe Inst. Elektrotechniki, 2008 2. Tadeusz Janowski, Henryka Danuta Stryczewska, Andrzej Wac-Włodarczyk, "Technologie nadprzewodnikowe i plazmowe w energetyce", Lubelskie Towarzystwo Naukowe, 2009 3. Andrzej Szewczyk, Andrzej Wiśniewski, Roman Puźniak, Henryk Szymczak, "Magnetyzm i nadprzewodnictwo", Wydawnictwo Naukowe PWN, 2013	
	eResources addresses		
Example issues/ example questions/ tasks being completed	1. What is the critical temperature of a superconductor? 2. List the main differences between Type I and Type II superconductors. 3. What is the Josephson effect?		
Practical activities within the subject	Not applicable		

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