GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Physics of materials, PG_00052027		
Field of study	Nanotechnology		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2023/2024
Education level	second-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	1	Language of instruction	English
Semester of study	1	ECTS credits	8.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Solid State Physics -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Tadeusz Miruszewski	
	Teachers	dr inż. Tadeusz Miruszewski dr inż. Sebastian Wachowski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	30.0	0.0	0.0	90
	E-learning hours included: 0.0						
	Additional information: E-Learning course: https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33132						

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	90	5.0	105.0	200

Subject objectives	Gaining knowledge of the fundamentals of physics of materials

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_W01	The student has extensive and well-ordered knowledge of materials science.	[SW1] Assessment of factual knowledge
K7_K03	The student is able to cooperate and work as part of a group, in a variety of roles. The student can make a meaningful assessment of their performance and the performance of others.	[SK1] Assessment of group work skills
K7_W09	The student has extensive knowledge of English terminology in the field of physics and mathematics, as well as chemistry, computer science, technology	[SW3] Assessment of knowledge contained in written work and projects
K7_W06	The student has extensive knowledge of methodology of working in a physics laboratory, supported by experience in laboratory work. He knows the principles of health and safety to a degree that enables working independently in a research laboratory.	[SW3] Assessment of knowledge contained in written work and projects
K7_W03	The student has a general knowledge of current trends and the latest discoveries in physics, chemistry, technology and and applications of nanostructures.	[SW1] Assessment of factual knowledge
K7_U02	The student has theoretical and practical skills in laboratory work	[SU1] Assessment of task fulfilment

Subject contents

Introduction: phases of matter; solid, liquid, and gas; main groups of materials; crystalline and amorphous materials.

Fundamentals of crystallography: Bravais lattices and crystal systems; crystal symmetry; Miller indices; reciprocal lattice; prymitive and non-prymitive unit cells; coordination numer; packing fraction; examples of crystals

Defects: intrinsic and extrinsic defects; defects in ionic crystals; relations between defects and properties of solids.

Atom vibrations and thermal properties of materials: dispersion relations; conception of phonon; Petit-Doulong, Einstein and Debye models of solids; anharmonic effects.

Electronic properties of materials: free electron model, boundary conditions, density of states; electron in periodic potential, Bloch theorem; nearly free electrons; tightly bound electrons; holes and electrons, effective mass.

Classification of solids: band structures and Fermi Surface; metals, semiconductors and insulators;

Properties of semiconductors: intrinsic and extrinsic semiconductors;

Transport properties: mechanisms of electron scattering; electrical conductivity and mobility; Superconductivity: main properties of superconductors; phenomenological description of superconducting state.

Prerequisites and co-requisites

basics of math

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
test	51.0%	50.0%
obecność, wejściówki, sprawozdania	51.0%	20.0%
obecność, kolokwia	51.0%	30.0%

Recommended reading

Basic literature	Introduction to solid state physics by Charles Kittel

	Supplementary literature	The Basics of Crystallography and Diffraction, Ch. Hammond, Oxford University Press Materials Science J.W. Morris, Jr, www.mse.berkeley.edu/groups/morris/MSE205/.../defects.pdf Fundamentals of Solid State Engineering, link.springer.com/content/pdf/10.1007/0-306-47567-7_7.pdf N.W. Ashcroft and N.D. Mermin, Solid State Physics, Principles of the Theory of Solids, J.M. Ziman, The Physics of Semiconductors An Introduction Including Nanophysics and Applications, Marius Grundmann, Springer link Introduction to Superconductivity Edited by:A.C. Rose-Innes
	eResources addresses	Uzupełniające Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	prymitive and non-prymitive unit cell Miller indices effective mass mechanisms of electron scattering	
Work placement	Not applicable	