



Subject card

Subject name and code	Physics of materials, PG_00052027						
Field of study	Nanotechnology						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2022/2023		
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						
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_U02	The student has theoretical and practical skills in laboratory work	[SU1] Assessment of task fulfilment
	K7_W03	The student has a general knowledge of current trends and the latest discoveries in physics, chemistry, technology and applications of nanostructures.	[SW1] Assessment of factual knowledge
	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_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_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_W01	The student has extensive and well-ordered knowledge of materials science.	[SW1] Assessment of factual knowledge
Subject contents	<p>Introduction: phases of matter; solid, liquid, and gas; main groups of materials; crystalline and amorphous materials.</p> <p>Fundamentals of crystallography: Bravais lattices and crystal systems; crystal symmetry; Miller indices; reciprocal lattice; primitive and non-primitive unit cells; coordination number; packing fraction; examples of crystals</p> <p>Defects: intrinsic and extrinsic defects; defects in ionic crystals; relations between defects and properties of solids.</p> <p>Atom vibrations and thermal properties of materials: dispersion relations; conception of phonon; Petit-Dulong, Einstein and Debye models of solids; anharmonic effects.</p> <p>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.</p> <p>Classification of solids: band structures and Fermi Surface; metals, semiconductors and insulators;</p> <p>Properties of semiconductors: intrinsic and extrinsic semiconductors;</p> <p>Transport properties: mechanisms of electron scattering; electrical conductivity and mobility; Superconductivity: main properties of superconductors; phenomenological description of superconducting state.</p>		
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	<p>The Basics of Crystallography and Diffraction, Ch. Hammond, Oxford University Press</p> <p>Materials Science J.W. Morris, Jr, www.mse.berkeley.edu/groups/morris/MSE205/.../defects.pdf</p> <p>Fundamentals of Solid State Engineering, link.springer.com/content/pdf/10.1007/0-306-47567-7_7.pdf</p> <p>N.W. Ashcroft and N.D. Mermin, Solid State Physics,</p> <p>Principles of the Theory of Solids, J.M. Ziman,</p> <p>The Physics of Semiconductors</p> <p>An Introduction Including Nanophysics and Applications, Marius Grundmann, Springer link</p> <p>Introduction to Superconductivity</p> <p>Edited by:A.C. Rose-Innes</p>
	eResources addresses	<p>Podstawowe</p> <p>https://enauzanie.pg.edu.pl/moodle/course/view.php?id=26871 - E-nauczanie course with a usefull materials for learning.</p> <p>Adresy na platformie eNauzanie:</p>
Example issues/ example questions/ tasks being completed	<p>prymitive and non-prymitive unit cell</p> <p>Miller indices</p> <p>effective mass</p> <p>mechanisms of electron scattering</p>	
Work placement	Not applicable	