

## Subject card

Subject name and code	Physics of Materials I, PG_00039806								
Field of study	Materials Engineering	Materials Engineering, Materials Engineering, Materials Engineering							
Date of commencement of studies	October 2022		Academic year of realisation of subject			2022/2023			
Education level	second-cycle studies		Subject group			Obligatory subject group in the field of study 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			Polish			
Semester of study	1		ECTS credits			4.0			
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		prof. dr hab. inż. Barbara Kościelska						
	Teachers		prof. dr hab. inż. Barbara Kościelska						
			dr hab. inż. Natalia Wójcik						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project		Seminar	SUM	
	Number of study hours	30.0	0.0	15.0	0.0		0.0	45	
	E-learning hours included: 0.0								
	Additional information:								
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		50.0		100	
Subject objectives	The main aim is to give the fundamental knowledge in solid state physics and also the interpretation physical properties of materials								
Learning outcomes	Course outcome		Subject outcome			Method of verification			
	K7_W04					[SW1] Assessment of factual knowledge			
	K7_U03					[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject			

Data wydruku: 10.04.2024 15:28 Strona 1 z 2

Cubicat contents							
Subject contents	<ol> <li>A short introduction to atomic and quantum physics.</li> <li>Crystal binding energy. Bonds: ionic, covalent, metallic, molecular. Crystal structure.</li> </ol>						
	3. Thermal properties of solids. Vibrations of atoms in crystals - phonons. Phonon statistics. Density of states. Specific heat: Dulong-Petit law, Einstein and Debye models. Thermal conductivity of solids. Thermal expansion of solids.						
	4. Classical theory of free electrons in metal. Electrical conductivity of metals. Quantum models of electrons in a crystal. Density of electronic states. Crystal band structure. Electronic thermal conductivity and specific heat.						
	5. Semiconductor crystals. Electron statistics - concentration of intrinsic carriers. Fermi level in an intrinsic semiconductor. Conductivity. Doping states. Equation of electrical neutrality of a semiconductor. Fermi level in a doped semiconductor. Ionization energy of the admixture. Conductivity.of doped semiconductors.						
	6. Examples of semiconductor devices.						
	7. Glasses and amorphous materials and their preparation. Short-range ordering, transition from liquid phase to glass phase.						
	Dielectrics. Macroscopic and microscopic description of dielectrics. Polarizat ferroelectrics.						
	Magnetic materials. Microscopic and macroscopic description of magnetic materials. Diamagnetism, paramagnetism, ferromagnetism.						
	10. Superconductivity, properties of the superconducting state, I and II - type of superconductors, Cooperairs, high temperature superconductors. Josephson phenomena.						
Prerequisites and co-requisites	Fundamental knowledge in physics and analytical mathematics						
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade				
	Test concerning laboratory exercises	50.0%	15.0%				
	Written exam	50.0%	70.0%				
	Evaluation of results of laboratory exercises	50.0%	15.0%				
Recommended reading	Basic literature	1. D. Halliday, R. Resnick, J. Walker, Podstawy fizyki t.V, PWN 2003, 2. B.N. Buszmanow, J.A. Chromow, Fizyka Ciała Stałego , Wyd. N-T, 1973 3. Ch. A. Wert, R.M. Thomson, Fizyka CiałaStałego, PWN,1974 4. J. Massalski, Fizyka dla inżynierów Część II Fizyka współczesna, Wyd. N-T, 2009					
	Supplementary literature	No requirements					
	eResources addresses						
Example issues/ example questions/ tasks being completed	Amorphous and crystalline solids. Liquid crystals. Bonding energy in crystals. Types of bonds: Ionically and covalently bonded solids. Metallic and molecular bonding. Thermal properties of solids. Atomic vibrations in crystals. Phonons. Heat capacity, thermal expansion, thermal conductivity of solids. Classical theory of free electrons in metals. Fundamentals of band theory. Quantum model of free electrons in metals. Fermi-Dirac distribution. Density of states. Band theory of electrical conduction in metals. Specific heat capacity of the electrons. Thermal conductivity in metals. Superconductivity. Macroscopic properties of superconductors. Classification of solid in the frame of band theory of solids. Intrinsic and extrinsic semiconductors. Effective mass. The role of doping. Electrical conductivity. Magnetic properties of materials. Lasers						
Work placement	Not applicable						

Data wydruku: 10.04.2024 15:28 Strona 2 z 2