



Subject card

Subject name and code	Physics of materials, PG_00071202						
Field of study	Nanotechnology						
Date of commencement of studies	October 2026	Academic year of realisation of subject				2026/2027	
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				8.0	
Learning profile	general academic profile	Assessment form				exam	
Conducting unit	Department of Solid State Physics -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Tadeusz Miruszewski					
	Teachers						
Lesson types	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						
	eNauczanie source address: <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=42062">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=42062</a>						
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		2.0		108.0	200
Subject objectives	The course aims to introduce students to a range of topics related to materials physics. Lectures, exercises, and laboratories will be held throughout the course, during which students will acquire new knowledge about physical phenomena in materials and develop engineering skills.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K7_K01] is able to cooperate and work effectively in a group, assuming different roles depending on changing needs. Adheres to the principles of professional ethics and demonstrates creativity and entrepreneurship. Is capable of self-assessment as well as constructive evaluation of the work of others.		The student is able to cooperate and work in a laboratory group, assuming various roles. They are able to perform self-assessment and constructively evaluate the work of others in the group.			[SK2] Assessment of progress of work [SK3] Assessment of ability to organize work	
	[K7_U04] is able to formulate hypotheses, plan and conduct experimental research, critically analyze results, verify hypotheses, draw conclusions, and formulate well-founded opinions within nanotechnology and related physical and natural sciences. Recognizes economic and non-technical aspects of the activities performed		Possesses extensive knowledge of the methodology of work in a physics laboratory for the production of ceramic materials, supported by limited laboratory experience. The student understands the principles of occupational health and safety to a degree that allows for independent work at a research or measurement station.			[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools	
[K7_W01] has broadened and well-structured knowledge in the field of materials science, including material fabrication or control of processes accompanying fabrication, with particular emphasis on materials and structures at the nanoscale.		The student has expanded and structured knowledge in the field of materials science.			[SW1] Assessment of factual knowledge		

Subject contents	<p>Course content – lecture 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> <hr/> <p>Course content – exercises Solving of analytical problems set about:</p> <p>-Fundamentals of crystallography</p> <p>-Atom vibrations and thermal properties of materials:</p> <p>-Electronic properties of materials:</p> <p>-Properties of semiconductors: intrinsic and extrinsic semiconductors;</p> <p>-Transport properties:</p> <hr/> <p>Course content – laboratory Synthesis of ceramic functional materials via solid state synthesis and study structural, microstructural and electrical properties.</p>														
Prerequisites and co-requisites	basics of math														
Assessment methods and criteria	<table border="1" data-bbox="448 1585 1477 1731"> <thead> <tr> <th data-bbox="448 1585 794 1630">Subject passing criteria</th> <th data-bbox="794 1585 1139 1630">Passing threshold</th> <th data-bbox="1139 1585 1477 1630">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 1630 794 1664">Lecture exam</td> <td data-bbox="794 1630 1139 1664">51.0%</td> <td data-bbox="1139 1630 1477 1664">50.0%</td> </tr> <tr> <td data-bbox="448 1664 794 1697">Lab report</td> <td data-bbox="794 1664 1139 1697">51.0%</td> <td data-bbox="1139 1664 1477 1697">20.0%</td> </tr> <tr> <td data-bbox="448 1697 794 1731">Colloquium</td> <td data-bbox="794 1697 1139 1731">51.0%</td> <td data-bbox="1139 1697 1477 1731">30.0%</td> </tr> </tbody> </table>	Subject passing criteria	Passing threshold	Percentage of the final grade	Lecture exam	51.0%	50.0%	Lab report	51.0%	20.0%	Colloquium	51.0%	30.0%		
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Lecture exam	51.0%	50.0%													
Lab report	51.0%	20.0%													
Colloquium	51.0%	30.0%													
Recommended reading	Basic literature	Introduction to solid state physics, Charles Kittel, 2005													

	Supplementary literature	<p>The Basics of Crystallography and Diffraction, Ch. Hammond, Oxford University Press</p> <p>Materials Science J.W. Morris, Jr, <a href="http://www.mse.berkeley.edu/groups/morris/MSE205/.../defects.pdf">www.mse.berkeley.edu/groups/morris/MSE205/.../defects.pdf</a></p> <p>Fundamentals of Solid State Engineering, <a href="http://link.springer.com/content/pdf/10.1007/0-306-47567-7_7.pdf">link.springer.com/content/pdf/10.1007/0-306-47567-7_7.pdf</a></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 <a href="#">link</a></p> <p>Introduction to Superconductivity</p> <p>Edited by:A.C. Rose-Innes</p>
	eResources addresses	
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>	
Practical activites within the subject	Not applicable	

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