University of Gdańsk

Subject card

Subject name and code	Elements of Solid State Physics and Crystallography, PG_00182262		
Field of study	Physics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
Education level	Bachelor’s 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	3	Language of instruction	Polish
Semester of study	5	ECTS credits	4.0
Learning profile	academic	Assessment form	credit
Conducting unit	Division of Condensed Matter Spectroscopy -> Institute of Experimental Physics -> Faculty of Mathematics, Physics and Informatics -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Sebastian Mahlik	
	Teachers		

Lesson types						
Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	45.0	0.0	0.0	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	0.0	55.0	100

Subject objectives	The aim of the course is to **provide fundamental knowledge of crystallography and the band structure of solids**, essential for understanding the properties and applications of materials.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[FIZL3_W10] has advanced knowledge of the elementary components of matter and the types of fundamental interactions between them, of the manifestations of these interactions in phenomena occurring on various scales from subatomic to astronomical, knows the time and energy scales associated with these phenomena	The student possesses knowledge of the fundamental concepts of solid state physics and crystallography, including types of chemical bonding in solids, crystallographic systems and Bravais lattices, the unit cell (including the Wigner–Seitz cell), Miller indices, the reciprocal lattice, Bragg's law, the Brillouin zone, packing factor, the free electron gas model, and the concept of the band structure of solids.	[SW1] oral statement/ conversation/discussion [SW3] text preparation/written work
	[FIZL3_W01] has advanced knowledge of physical concepts, principles and theories, understands their historical development and significance not only for physics, but also for other exact and natural sciences and cognition of the world	The student has knowledge of the fundamental concepts of solid state physics and crystallography, including types of chemical bonding in solids, crystallographic systems and Bravais lattices, the unit cell (including the Wigner–Seitz cell), Miller indices, the reciprocal lattice, Bragg's law, the Brillouin zone, the packing factor, the free electron gas model, and the concept of the band structure of solids.	[SW1] oral statement/ conversation/discussion [SW3] text preparation/written work
	[FIZL3_U06] can use the formalism of quantum physics to describe physical phenomena in the microworld	The student is able to apply the formalism of quantum physics to describe phenomena in solids, in particular those related to the electronic band structure, electrical and thermal conductivity, electron–phonon interactions, and the dielectric and magnetic properties of crystalline materials. The student makes use of the fundamental concepts of solid state physics and crystallography, including types of chemical bonding in solids (ionic, covalent, metallic, van der Waals), crystallographic systems and Bravais lattices, the unit cell (including the Wigner–Seitz cell), Miller indices, the reciprocal lattice, Bragg's law, the Brillouin zone, the packing factor, the free electron gas model, and the concept of the band structure of solids.	[SU1] oral statement/conversation/ discussion [SU3] text preparation/written work
	[FIZL3_W08] has advanced knowledge in the field of phenomena and laws of geometric, wave and photometry optics	The student possesses knowledge of the phenomena and laws of geometrical and wave optics relevant to solid state physics and crystallography, in particular those related to diffraction and interference of electromagnetic radiation in crystal lattices, Bragg's law, the construction of the Brillouin zone, and optical methods used to investigate the structure and properties of crystalline materials.	[SW1] oral statement/ conversation/discussion [SW3] text preparation/written work

	<table><tr><th>Course outcome</th><th>Subject outcome</th><th>Method of verification</th></tr><tr><td>[FIZL3_U05] can apply the formalism of classical electrodynamics and Maxwell's equation to describe electric and magnetic fields in vacuum and in material media and in electrical circuits, and to classify material media according to the way they interact with an external electromagnetic field</td><td>The student is able to apply the formalism of classical electrodynamics and Maxwell’s equations to describe the interaction of the electromagnetic field with solids, including the analysis of electrical conductivity, dielectric and magnetic properties, as well as to classify materials according to their response to an external electromagnetic field; the student makes use of the fundamental concepts of solid state physics and crystallography, including types of chemical bonding in solids (ionic, covalent, metallic, van der Waals), crystallographic systems and Bravais lattices, the unit cell (including the Wigner–Seitz cell), Miller indices, the reciprocal lattice, Bragg’s law, the Brillouin zone, the packing factor, the free electron gas model, and the concept of the band structure of solids.</td><td>[SU1] oral statement/conversation/ discussion [SU3] text preparation/written work</td></tr></table>
Subject contents	The student knows the fundamental concepts of solid state physics and crystallography, including types of chemical bonding in solids (ionic, covalent, metallic, van der Waals), crystallographic systems and Bravais lattices, the unit cell (including the WignerSeitz cell), Miller indices, the reciprocal lattice, Braggs law, the Brillouin zone, the packing factor, the free electron gas model, and the concept of the band structure of solids.
Prerequisites and co-requisites	
Assessment methods and criteria	<table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>activity during classes</td><td>0.0%</td><td>10.0%</td></tr><tr><td>tests</td><td>51.0%</td><td>90.0%</td></tr></table>
Recommended reading	<table><tr><td>Basic literature</td><td>C. Kittel, Introduction to Solid State Physics, Wiley. N.W. Ashcroft, N.D. Mermin, Solid State Physics, Holt, Rinehart and Winston.</td></tr><tr><td>Supplementary literature</td><td>not applicable</td></tr><tr><td>eResources addresses</td><td></td></tr></table>
Example issues/ example questions/ tasks being completed	not applicable
Work placement	Not applicable

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