GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00058864		
Field of study	Nanotechnology		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
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	2	Language of instruction	English
Semester of study	3	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Michał Winiarski	
	Teachers	dr inż. Michał Winiarski	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	30.0	0.0	0.0	0.0	60

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	60	5.0	60.0	125

Subject objectives

The aim of the class is to introduce students to the topic of analysis of electronic structure of solids and nanostructures.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_U01	Student can perform electronic structure calculations of solids and nanostructures	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
K7_W02	Student has a deepened knowledge of electronic structure calculational methods	[SW1] Assessment of factual knowledge
K7_W04	Student understands the possibilities of relating the results of experimental and calculational methods of electronic structure analysis	[SW1] Assessment of factual knowledge

Subject contents

1. Electronic structure of atoms, Atomic models

2. Chemical bonding theories: valence bond theory & molecular orbital theory

3. Methods of ab initio calculations: Hartree-Fock and related methods, density functional theory

4. Tight binding model

5. Analysis of results of electronic structure calculations

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="2">Course in modern physics</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>mid-term test</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>final test</td><td>50.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>(1)Hoffmann, R. How Chemistry and Physics Meet in the Solid State. Angewandte Chemie International Edition in English 1987, 26 (9), 846878. https://doi.org/10.1002/anie.198708461.(2)Marzari, N.; Ferretti, A.; Wolverton, C. Electronic-Structure Methods for Materials Design. Nat. Mater. 2021, 20 (6), 736749. https://doi.org/10.1038/s41563-021-01013-3.</td></tr>
<tr><td>Supplementary literature</td><td>(1)Dronskowski, R. Chemical Bonding: From Plane Waves via Atomic Orbitals; De Gruyter, 2023.</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">Describe briefly the basic ideas of the density functional theory

Draw schematically the band structure of a 1D hydren atom chain</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
</table>

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