

## SDAŃSK UNIVERSITY 的 OF TECHNOLOGY

## Subject card

Subject name and code	Solid state electronics and nanoelectronics, PG_00037001								
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	2		ECTS credits		2.0				
Learning profile	general academic profile		Assessmer	Assessment form		exam			
Conducting unit	Department of Solid State Physics -> Faculty of Applied Physics and Mathematics								
Name and surname	Subject supervisor		dr inż. Kamil Kolincio						
of lecturer (lecturers)	Teachers		dr inż. Kamil Kolincio						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Projec	:t	Seminar	SUM	
	Number of study hours	30.0	0.0	0.0	0.0 0.0 30			30	
	E-learning hours inclu	uded: 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	30		2.0		18.0		50	
Subject objectives	The aim of the course is to acquire knowledge, skills and competence in the field of solid state electronics and nanoelectronics.								
Learning outcomes Course outcom		come	Subject outcome			Method of verification			
	K7_W02		Posessing the detailed knowledge of the selected field of nanotechnology and related scientific disciplines			[SW1] Assessment of factual knowledge			
	K7_U07		Ability to use the obtained knowledge in other fields of science			[SU1] Assessment of task fulfilment			
	К7_К09		Understanding non-technical aspects and effects of engineering activities.			[SK2] Assessment of progress of work			
K7_W03						[SW1] Assessment of factual knowledge			

2. Physics and properties of solids - a review   2.1. Density of states in 0D, 1D, 2D and 3D materials.   2.2. Band structure of solids: free electron, nearly free electron and tight binding model.   2.3. Energy bands and carrier concentration in thermal equilibrium.   2.4. Electrical and thermal conductors in oblids: carrier transport phenomena.   2.5. Kinetic phenomena in semiconductors.   3. Metal-semiconductor junctions and p-n junctions.   4. Diodes: Schottky diode, p-n diode, MIS, MOS, turnel diode, resonant-tunneling diode.   5. Transistors: bipolar, FET, hot electron HET and THET, single-electron transistor.   6.1. Light emitting diodes   6.2. Semiconductor lesers.   8.3. Quantum-cascade leser.   7. Photodetectors and solar cells.   8. Turnel phenomena in superconductors: Josephson junction.   9. Spritronic devices.   10. Semiconductor lething.   10.1. Crystal growth and epitaxy.   10.2. Film formation.   10.3. Lithography and etching.   10.4. Impurity deping.   Prerequisites Completed courses in the field of basics of nanotechnology and solid state physics (or physics of materials).   Prerequisites Completed courses in the field of basics of nanotechnology and solid state physics (or physics of materials).	Subject contents	1. Introduction.						
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Recommended reading	Basic literature	1. S.O. Kasap "Principles of electronic materials and devices", McGraw- Hill, 2006, 3rd ed. (El 178223-00-00/01)
		2. S.M. Sze, Kwok K. Ng, Physics of Semiconductor Devices, John Wiley & Sons, 2007, 3rd ed. (FM 304796-00-00/01)
	Supplementary literature	1. S.M. Sze, M.K. Lee Semiconductor Devices, Physics and Technology,
		John Wiley & Sons, 2012, 3rd ed.
	eResources addresses	Adresy na platformie eNauczanie:
		Solid state electronics and nanoelectronics - Moodle ID: 30022 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=30022
Example issues/ example questions/ tasks being completed	Describe metal-semiconductor junct	ion
	Describe MOS diode	
	Describe single electron transistor	
	Describe quantum-cascade laser	
Work placement	Not applicable	