GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Physics of semiconductor devices, PG_00037293		
Field of study	Technical Physics		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2022/2023
Education level	first-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	3	Language of instruction	Polish
Semester of study	5	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Physics of Electronic Phenomena -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jędrzej Szmytkowski	
	Teachers	dr hab. inż. Jędrzej Szmytkowski	

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 this course is to understand fundamental physics of semiconductors and devices based on semiconductors.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_W07	Student knows how semiconductor devices work.	[SW1] Assessment of factual knowledge
K6_W02	The knowledge allows to analyze problems which concern semiconductors and devices based on them.	[SW1] Assessment of factual knowledge
K6_U01	Student knows how to use literature about semiconductors and devices based on them	[SU2] Assessment of ability to analyse information

Subject contents

Introduction to solid state physics (structure of crystalline solids, types of chemical bonds in solids, phonons, Fermi-Dirac and Bose-Einstein statistics, Fermi level in metals, electrical conduction in metals, band structure of solids, effective mass). Introduction to semiconductors (electronic hole, Fermi level in semiconductors, direct and indirect energy gap, equilibrium concentration, intrinsic and extrinsic semiconductors, donors and acceptors, generation and recombination of charge carriers, Hall effect, p-n junction). Introduction to semiconductor electrodynamics (mobility of carries, drift and diffusion equations, Poisson equation, continuity equation, space charge, dielectric relaxation, ambipolar transport equation, Shockley equation). Semiconductor devices (photoresistor, Hall effect sensor, magnetoresistor, thermistor, varistor, p-n diode, varicap, Zener diode, tunnel (Esaki) diode, Schottky diode, photovoltaic cell, photodiode, electroluminescence diode (LED), laser diode, bipolar junction transistor, field effect transistor JFET, field effect transistor MOSFET, thyristor). Thermionic effects in semiconductor devices. MOS capacitor, charge-coupled device (CCD). Integrated circuits. Semiconductor nanostructures and devices based on them.

Prerequisites and co-requisites

Completed courses in "Electricity and magnetism" and "Introduction to modern physics"

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written exam	50.0%	60.0%
Exercises	50.0%	40.0%

Recommended reading	Basic literature	1. C. Kittel "Introduction to solid state physics", PWN 2. A. van der Ziel "Fundaments of solid state electronics" WNT 3. J. Hennel "Introduction to semiconductor elektronics" WNT
	Supplementary literature	A.K. Jonscher "Fundaments of semiconductor devices" WNT
	eResources addresses	Uzupełniające Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	1. Electronic structure of solid states 2. Intrinsic and extrinsic semiconductors 3. Diode 4. Transistor 5. Laser diode	
Work placement	Not applicable	