



## Subject card

Subject name and code	Power Engineering Electronics, PG_00038095						
Field of study	Automation, Robotics and Control Systems						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2024/2025		
Education level	first-cycle studies	Subject group					
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	2	Language of instruction			Polish		
Semester of study	4	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Electrified Transportation -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Leszek Jarzębowicz					
	Teachers	dr inż. Sławomir Judek dr hab. inż. Leszek Jarzębowicz					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	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	30		6.0		39.0	75
Subject objectives	Gaining knowledge about power electronic devices and power converters. Acquiring the ability to determine the operating parameters of selected converters.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_K05] can think and act in an entrepreneurial way	He/She selects power devices and converters for given applications.			[SK5] Assessment of ability to solve problems that arise in practice		
	[K6_W05] has basic knowledge of the principles of operation of basic electronic, energy and power electronic components and systems	He/She explains the principle of operation of power converters.			[SW1] Assessment of factual knowledge		
	[K6_U04] has the ability to self-educate, among other things, in order to improve professional qualifications	He/She uses previously learned programs to analyze the operation of converter systems.			[SU4] Assessment of ability to use methods and tools		
	[K6_W04] has basic knowledge of methods of analysis of direct and alternating current circuits	He/She analyses the operation of power converters based on circuit diagrams.			[SW1] Assessment of factual knowledge		
Subject contents	LECTURE: Introduction to power electronics. Measurement equipment. Passive elements. Diodes. Uncontrolled rectifiers. SCR thyristors. Controlled rectifiers. GTO thyristors. BJT, IGBT and MOSFET transistors. DC/DC converters. DC/AC converters (voltage inverters). Gate drivers. SiC and GaN transistors. Cooling of power devices. Electromagnetic disturbances in power converters. "Intelligent" IPM and ASIPM power modules. Microprocessor control of power converters.  LAB: Oscilloscope-based measurements. Dual-state operation of power devices. Uncontrolled rectifiers. Controlled rectifiers. DC/DC power converters. Voltage-output inverters. Servodrive - energy conversion and motion programming.						
Prerequisites and co-requisites	Basic knowledge on electrical engineering and electronics.						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam	60.0%	70.0%
	Reports and tests from laboratory exercises	60.0%	30.0%
Recommended reading	Basic literature	<p>[1] Barlik R., Nowak M.: Energoelektronika. Elementy, podzespoły, układy. Oficyna Wyd. PW, 2014.</p> <p>[2] Januszewski S., Świątek H., Zymmer K.: Przyrządy półprzewodnikowe mocy. Właściwości i zastosowania. WKiŁ, Warszawa, 1999.</p> <p>[3] Nowak M., Barlik R.: Poradnik inżyniera energoelektronika. WNT, Warszawa, 1998.</p> <p>[4] Szczęsny R.: Komputerowa symulacja układów energoelektronicznych. Wyd. Politechniki Gdańskiej, Gdańsk, 1999.</p> <p>[5] Kaźmierkowski M. P., Matysik T. J.: Wprowadzenie do elektroniki i energoelektroniki. Oficyna Wyd. PW, 2005.</p>	
	Supplementary literature	<p>[6] Mohan N.: Power electronics: a first course. John Wiley &amp; Sons Inc. 2012.</p> <p>[7] Januszewski S., Pytlak A., Rosnowska-Nowaczyk M., Świątek H.: Energoelektronika. WSiP, Warszawa 2012.</p>	
	eResources addresses	<p>Adresy na platformie eNauczanie: Energoelektronika [ARiSS][2024/25] - Moodle ID: 42951 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=42951">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=42951</a></p>	
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. AC/DC converters - types, operation controlled rectifier.</li> <li>2. DC/AC inverters - voltage inverter topologies, PWM control.</li> <li>3. Properties of various power devices.</li> </ol>		
Work placement	Not applicable		

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