



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 2021	Academic year of realisation of subject			2022/2023		
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 Electrical Engineering of Transport -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Leszek Jarzębowicz					
	Teachers	dr hab. inż. Leszek Jarzębowicz dr inż. Sławomir Judek					
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	Understanding the control principles of power electronic devices and converters and their applications. Acquisition of application skill of power electronic devices and their software.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_W04] has basic knowledge of methods of analysis of direct and alternating current circuits						
	[K6_U04] has the ability to self-educate, among other things, in order to improve professional qualifications						
	[K6_K05] can think and act in an entrepreneurial way						
	[K6_W05] has basic knowledge of the principles of operation of basic electronic, energy and power electronic components and systems						
	K6_W04	The ability to analyze basic power electronic circuits.			[SW1] Assessment of factual knowledge		
	K6_U04	Ability to analyze bibliographic resources. . Student can use hardware devices and software in applications for power electronic converters.			[SU4] Assessment of ability to use methods and tools		
	K6_K05	Chooses the power electronics converters to the set of application.			[SK5] Assessment of ability to solve problems that arise in practice		
K6_W05	Student can explain the operation of power electronic systems.			[SW1] Assessment of factual knowledge			

Subject contents	LECTURE Overview of high power electronic devices for different applications. Power switching devices and their electrical characteristics: diodes, switching transistors, thyristors. Electrical ratings of power switching devices. Power packages and module. Driving transistors and thyristors. Load, switch, and commutation considerations. Naturally commutating ac to dc converters - uncontrolled and controlled rectifiers. DC choppers. Two and four quadrant DC chopper. DC-DC switch mode converters: buck and boost circuits. Resonant converters: zero voltage and zero current switching. DC to AC voltage-source and current-source inverter. Intelligent power modules. Microcontrollers and interfaces. Outline of modulation theory in power electronics applications. Converters for DC and AC motors. Energy storage. Electrical power quality. Safe of operation area of power electronics devices in different environmental conditions. Energy sources and storage. LABORATORY Acquisition and processing of oscilloscope recordings. Two-state operation of power semiconductor devices. DC converters - uncontrolled. DC controlled rectifiers and their applications in drive systems. Design and testing of chopper dc/dc. DC-AC. DC to AC voltage-source inverter and their applications in drive systems. Servodrive - application of programmable motion controller.		
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
	Report from laboratory exercises	60.0%	30.0%
	Written exam	60.0%	70.0%
Recommended reading	Basic literature	Barlik R., Nowak M.: Energoelektronika. Elementy, podzespoły, układy. Oficyna Wyd. PW, 2014. Januszewski S., Świątek H., Zymmer K.: Przyrządy półprzewodnikowe mocy. Właściwości i zastosowania. WKiŁ, Warszawa, 1999. Nowak M., Barlik R.: Poradnik inżyniera energoelektronika. WNT, Warszawa, 1998. Szczęsny R.: Komputerowa symulacja układów energoelektronicznych. Wyd. Politechniki Gdańskiej, Gdańsk, 1999. Kaźmierkowski M. P., Matysik T. J.: Wprowadzenie do elektroniki i energoelektroniki. Oficyna Wyd. PW, 2005.	
	Supplementary literature	Mohan N.: Power electronics: a first course. John Wiley & Sons Inc. 2012. Januszewski S., Pytlak A., Rosnowska-Nowaczyk M., Świątek H.: Energoelektronika. WSiP, Warszawa 2012.	
	eResources addresses		
Example issues/example questions/tasks being completed	<ol style="list-style-type: none"> 1. AC/DC converters - types, operation controlled rectifier. 2. DC/AC inverters - voltage inverter topologies, PWM control. 3. Microprocessor control systems for converters - required parameters. 		
Work placement	Not applicable		