



Subject card

Subject name and code	Fundamentals of Power Electronics, PG_00042053						
Field of study	Power Engineering, Power Engineering						
Date of commencement of studies	October 2023	Academic year of realisation of subject				2024/2025	
Education level	first-cycle studies	Subject group				Obligatory subject group in the field of study 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				Polish	
Semester of study	4	ECTS credits				4.0	
Learning profile	general academic profile	Assessment form				assessment	
Conducting unit	Department of Power Electronics and Electrical Machines -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Piotr Musznicki				
	Teachers		dr hab. inż. Piotr Musznicki				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	0.0	0.0	45
	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	45		10.0		45.0	100
Subject objectives	The aim of the course is to familiarize students with the basic of power electronics converters including their construction, methods of control, application and problems of their. Classical topologies are presented and newest selected issues, especially for the control of electrical machines and for renewable energy sources.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K6_W03] knows the basics of automation and automatic regulation, knows the principles of the selection of electrical devices, drive systems and their control		Students know the principle of operation of basic power converters, they can select them in converter systems, drive systems and renewable energy sources, they know the influence of power electronic systems on the quality of energy in the power grid and energy receivers.			[SW3] Assessment of knowledge contained in written work and projects	
	[K6_W05] has structured knowledge in the field of electrical engineering and electronics, necessary to understand the basics of operation and selection of electrical machines, electricity transmission systems and power electronic devices		Students know the principle of operation of basic power converters, they can select them in converter systems, drive systems and renewable energy sources, they know the influence of power electronic systems on the quality of energy in the power grid and energy receivers.			[SW1] Assessment of factual knowledge	
Subject contents	Lecture:1. The role of Power Electronics. Basic elements.2/3 Rectifiers 4/5 DC/DC low power converters 6/7 DC/AC Inverters 8. Basic and method of modulation used in PE. 9 AC/AC converters 10. Resonant converters 11 Control systems. 12/13 Energetic aspects in PE, fast switches, quality of conversion energy, ups and active filters 14/16 Selected problems in PE converters, electromagnetic compatibility, signal distortion, secure circuit.Laboratory:1-phase diode rectifier 2.Power transistors IGBT 3. Thyristors 4. 1-phase voltage inverter 5.AC/AC converter 6. Transformerless DC/DC converters						
Prerequisites and co-requisites	Basic knowledge of theoretical laws and analysis method in electrical circuit.						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Endterm colloquium	60.0%	40.0%
	Midterm colloquium	50.0%	30.0%
	Laboratory	60.0%	30.0%
Recommended reading	Basic literature	1. Williams, Barry W. "Principles and elements of Power Electronics." University of Strathclyde, Glasgow (2006). 2. Mohan N., Undeland T.M., Robbins W.P., Power Electronics: Converters, Applications and Design, 3rd Edition, John Willey & Sons, Inc, 2003. 3. Rashid, Muhammad H. Power electronics handbook: devices, circuits and applications. Academic press, 2010.	
	Supplementary literature	1. Ross, J. Neil. The essence of power electronics. Pearson PTR, 1997. 2. Vodovozov, Valery. Introduction to Power electronics. Bookboon, 2010. 3. Chryssis, George C. High-frequency switching power supplies. McGraw-Hill, 1989.	
	eResources addresses	Adresy na platformie eNauczenie: Fundamentals of Power Electronics [Energy Technologies][EE][I] [2024/25] - Moodle ID: 43106 https://enauczenie.pg.edu.pl/moodle/course/view.php?id=43106	
Example issues/ example questions/ tasks being completed	characteristics of semiconductor devices as power electronics switches construction and operation principle of diode rectifiers structure and operating principle of the selected pulsed DC-DC converter construction and operation of the voltage inverter the impact of power electronic converters on the power grid improving the quality of electricity through the use of a power electronic converter		
Work placement	Not applicable		

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