



Subject card

Subject name and code	Fundamentals of Power Electronics, PG_00055956						
Field of study	Power Engineering, Power Engineering, Power Engineering						
Date of commencement of studies	October 2023		Academic year of realisation of subject		2025/2026		
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		2.0		
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						
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		2.0		18.0	50
Subject objectives	The aim of the course is to familiarize students with the basic systems of power electronic converters, including their construction, control methods, use and problems of their use in modern power engineering. The classic topologies of converter systems, their applications in modern power engineering and selected latest solutions for controlling electrical machines and renewable energy sources will be presented.						
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 are able to choose a power electronic converter to cooperate with the system electromechanical.		[SW1] Assessment of factual knowledge		
	[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		Fundamentals of Power Electronics are aimed at presenting the importance of modern power electronic systems in practice energy engineer. Students will learn about the basic elements and power electronic systems and with problems that may arise when using them. As a result, students will become familiar with the most commonly used ones system topologies, the possibilities of their application and control, and understand the phenomena and physical processes occurring in switches and systems power electronics.		[SW1] Assessment of factual knowledge		

Subject contents	Lectures: 1. The importance of power electronics in modern electricity. Basic power electronic switches 2/3 AC/DC systems - rectifiers 4/5. Elementary low power converters - DC/DC, 6/7 Elementary DC/AC converters (inverters). 8. Outline of modulation theory applied to converter systems. 9. Elementary AC/AC converters. 10 Resonant converters. 11. Power converter control systems. 12/13 Energy aspect in converter systems, high-speed circuit breakers, power quality, uninterruptible power supply systems, active filters. 14/15. Selected issues of power electronic systems: network distortions, protection circuits, interferences. Laboratory: 1. Single-phase diode rectifier 2. Power transistors (IGBT) 3. Thyristors 4. Single-phase voltage inverter 5. AC controller 6. Isolated DC-DC converters		
Prerequisites and co-requisites	Knowledge of the theoretical basis and methods of analysis of electrical circuits.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Final test	60.0%	20.0%
	Tests during the semester	50.0%	30.0%
	Laboratory	50.0%	50.0%
Recommended reading	Basic literature	<ul style="list-style-type: none">• Mohan N., Undeland T.M., Robbins W.P., Power Electronics: Converters, Applications and Design, 3rd Edition, John Wiley & Sons, Inc, 2003.• Williams, Barry W, Principles and Elements of Power Electronics, B. W. Williams, 2006• Rashid, Muhammad H. Power Electronics Handbook: Devices, Circuits, and Applications. Burlington, MA: Academic, 2006.	
	Supplementary literature	<ul style="list-style-type: none">• Bose, Bimal K. Modern Power Electronics and AC Drives. New Delhi: PHI Learning, 2012.• Piotr Musznicki The conducted EMI in DC-DC converters Walter de Gruyter GmbH & Co KG, 2018	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	<ul style="list-style-type: none">• Compare IGBTs and MOSFETs, give basic parameters, characteristics and method of application.• Describe the sub-periods of operation of a single-phase voltage inverter.• What is the method of tracking the optimal working point (MPPT) in converter systems for photovoltaic energy sources		
Work placement	Not applicable		