GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Fundamentals of Power Electronics, PG_00055956		
Field of study	Power Engineering		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
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_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
[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

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	see table below

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory	50.0%	50.0%
Tests during the semester	50.0%	30.0%
Final test	60.0%	20.0%

Recommended reading		
	Basic literature	• Mohan N., Undeland T.M., Robbins W.P., Power Electronics: Converters, Applications and Design, 3rd Edition, John Willey & 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	• 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	• Compare IGBTs and MOSFETs, give basic parameters, characteristics andmethod 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 systemsfor photovoltaic energy sources
Work placement	Not applicable