GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Power Engineering Electronics, PG_00038438						
Field of study	Electrical Engineering						
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		4.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Power Electronics and Electrical Machines -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Ryszard Strzelecki				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	15.0	0.0	0.0	60
	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	60		8.0		32.0	100
Subject objectives	introduction to basic principles of power electronics energy conversion, introduction to the basic structures of power electronic systems, introduction to basic converter systems design methods.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_U01	He uses the terms from the field of power electronics, he can use knowledge from other modules and subjects.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
K6_K01	Ability to evaluate their skills and knowledge in the field of power electronics and the possibilities of various forms of self-education and further training.	[SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills [SK2] Assessment of progress of work
K6_W10	Be able to use criteria for evaluating power quality, distinguish applications the types of power electronic systems.	[SW1] Assessment of factual knowledge
K6_U08	Understands the operation of basic power electronic circuits. Be able to select components for rectifiers and for basic pulse circuits. Be able to determine the correctness of a design. Be able to develop design documentation.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
K6_W03	Be able to perform elementary analysis of basic power electronic circuits. Be able to determine the exposure of power electronic circuit elements.	[SW1] Assessment of factual knowledge

Subject contents	The meaning of power electronics within modern electrical engineering. Power electronics devices constructional features, operating principle and characteristics, thermal model. Diode rectifier operating principle, properties, interpretation the manufacturers data sheet. A multi-pulse diode rectifiers. A review of thyristors-based converters. Introduction to the fundamentals of the theory of modulation applied to power converters systems. DC-DC switched-mode converters. The single-phase voltage source inverter with square-wave output. Three-phase full-bridge inverter, the space vector modulation technique. PWM rectifiers, power factor corrections. Uninterruptible power supply solutions. Resonant-mode converters. Multilevel inverters. Electromagnetic compatibility. Practical converter design considerations: snubber circuits, drive circuits, design of magnetic components.
Prerequisites and co-requisites	General knowledge of electrical engineering, electronics, circuit theory . Ability to analyse electrical circuits in transient states.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
test of accounting exercises	60.0%	30.0%
exam	60.0%	40.0%
assessment of laboratory	60.0%	30.0%

Recommended reading

Basic literature	1. Nowak M., Barlik R. Poradnik inżyniera energoelektronika. Tom1, Wydawnictwo WNT, Warszawa 2014, wyd. II , 400 s 2. Nowak M., Barlik R, Rąbkowski J. Poradnik inżyniera energoelektronika. Tom 2, Wyd.WNT, Warszawa 2015, wyd.II 523 s. 3. Guziński J, Iwan K, Łuszcz J. Musznicki P.: Laboratorium Podstaw Energoelektroniki. Wyd. Politechniki Gdańskiej, Gdańsk 2011. Pomorska Biblioteka Cyfrowa, http://pbc.gda.pl/dlibra/info?mimetype=application/pdf&sec=false&handler=browser&content_url=/Content/15235/656_energoelektronika.pdf
Supplementary literature	1. Mohan N., Undeland T.M., Robbins W.P., Power Electronics: Converters, Applications and Design, 3rd Edition, John Willey & Sons, Inc, 2003. 2. Tunia H., Smirnow A., Nowak M., Barlik R.: Układy Energoelektroniczne. Warszawa: WNT 1998. 3. Kaźmierkowski M.P., Matysik J.T., Wprowadzenie do elektroniki i energoelektroniki, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005. 4. Dmowski A: Energoelektroniczne układy zasilania prądem stałym w telekomunikacji i energetyce. Warszawa: WNT 1998.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed

1. Voltage pulse is periodically fed to the input of ideal low-pass filter. It's rms value is E2. What is the mean of the voltage at the output of this filter?
2. Draw a diagram of a three-phase diode bridge rectifier coupled with the output LC filter and the resistance R as load. Assuming that the filter gets the smooth current with value J, draw three waveforms of currents: the currents in the two diodes of one of the branches of the bridge and the input current from the power supply.
3. Transformerless DC-DC boost type converter is operating in continuous mode. This system is powered from 5V, average value of the input current is 0.2 A at an output voltage of 12V. In the converter is used the MOSFET transistor with RDS (ON) = 50m. Estimate the conduction losses in the transistor assuming that the ripple current in the inductor are negligible.

Work placement	Not applicable