



Subject card

Subject name and code	Power Quality in Smart Grids, PG_00065893						
Field of study	Hydrogen Technologies and Electromobility						
Date of commencement of studies	October 2022	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	3	Language of instruction				Polish	
Semester of study	6	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. Jarosław Łuszcz					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	15.0	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	6.0		34.0		100
Subject objectives	Ability to assess the quality of electrical energy. Ability to perform basic energy quality measurements.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K6_U05] can use analytical and simulation methods, prepare and for the formulation and solution of tasks in the field of hydrogen technologies, automation and robotics, electrical engineering, use various techniques to carry out engineering tasks related to electrical devices, hydrogen installations, control and robotics systems		uses simulation and analytical methods to assess power quality			[SU4] Assessment of ability to use methods and tools	
	[K6_W08] has knowledge in the field of energy storage systems: mechanical, thermal, electrical and others, knows the basics of thermodynamics and fluid mechanics, as well as the construction and operation of thermal energy equipment, hydrogen installations, process equipment, including renewable energy sources		uses systematized knowledge in the field of electricity quality issues			[SW1] Assessment of factual knowledge	
	[K6_K02] can work in a group taking on different roles in it		solves energy quality problems by working in a team			[SK1] Assessment of group work skills	
Subject contents	<p>Definitions of basic power quality parameters.</p> <p>Effects of improper power quality on powered devices and power grids.</p> <p>Causes of increased power quality degradation in smart grids.</p> <p>Impact of renewable energy on power quality.</p> <p>Impact of distributed energy on power quality.</p> <p>Impact of energy storage and car charging stations on power quality.</p> <p>Specificity of power quality requirements in smart grids.</p> <p>Impact of power quality on device operation disturbances in smart grids.</p>						

Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Tests during the semester	50.0%	50.0%
	Reports from tests performed	50.0%	50.0%
Recommended reading	Basic literature	<p>Hanzelka, Zbigniew, Jakość dostawy energii elektrycznej: zaburzenia wartości skutecznej napięcia. Komitet Elektrotechniki Polskiej Akademii Nauk. Kraków: Wydawnictwa AGH, 2013.</p> <p>Kowalski, Zbigniew, Jakość energii elektrycznej. Łódź: Wydawnictwo Politechniki Łódzkiej, 2007.</p> <p>R. C. Dugan, M. F. McGranaghan, S. Santoso, H. W. Beaty 2012: Electrical Power Systems Quality, 3th edition, The McGraw-Hill Companies, Inc., NY, USA, 2012, ISBN 978-0071761550.</p> <p>Baggini, A.B. Handbook of Power Quality; Wiley Online Library: Hoboken, NJ, USA, 2008; ISBN 9780470065617.</p>	
	Supplementary literature	<p>Łuszcz, Jarosław, Ed., Power Quality Issues in Distributed Generation. InTech, Oct. 21, 2015. doi: 10.5772/59895.</p> <p>G. Romero, Ed., Power Quality Harmonics Analysis and Real Measurements Data. InTech, Nov. 23, 2011. doi: 10.5772/699.</p> <p>Łuszcz, Jarosław, Voltage Harmonics Measuring Issues in Medium Voltage Systems. Power Quality Harmonics Analysis and Real Measurements Data, InTech, 23 Nov. 2011. Crossref, doi: 10.5772/16411.</p> <p>A. Zoba, Ed., Power Quality Issues. InTech, Apr. 17, 2013. doi: 10.5772/3373.</p> <p>Łuszcz, Jarosław, High Frequency Harmonics Emission in Smart Grids. Power Quality Issues, InTech, 17 Apr. 2013. Crossref, doi: 10.5772/52874.</p> <p>Hanzelka, Zbigniew i in. Instalacje fotowoltaiczne w systemie elektroenergetycznym: jakość dostaw energii elektrycznej, warunki techniczne przyłączenia instalacji PV. Warszawa: PWN, 2024.</p> <p>Wasiak, Irena. Sterowanie jakością energii elektrycznej w elektroenergetycznych sieciach rozdzielczych z wykorzystaniem półprzewodnikowych kompensatorów równoległych. Łódź: Wydawnictwo Politechniki Łódzkiej, 2006.</p> <p>Zbigniew Hanzelka i Andrzej Firlit Ed, <i>Elektrownie ze źródłami odnawialnymi: zagadnienia wybrane</i>. Kraków: Redakcja Wydawnictwa AGH, 2015.</p> <p>Smolarczyk, Adam i in. <i>Harmoniczne w systemach elektroenergetycznych</i>. Wydanie I. Warszawa: Oficyna Wydawnicza Politechniki Warszawskiej, 2023.</p> <p>Strzelecki, Ryszard, and Grzegorz Benysek Ed., Power Electronics in Smart Electrical Energy Networks. London: Springer, 2008.</p> <p>Benysek, Grzegorz, and Marian Pasko Ed., <i>Power Theories for Improved Power Quality</i>. New York: Springer, 2012.</p> <p>Bak-Jensen, Birgitte, and Birgitte Bak-Jensen. <i>Distribution Power Systems and Power Quality</i>. Basel, Switzerland: MDPI 2020.</p>	

	eResources addresses	Adresy na platformie eNauczenie:
Example issues/ example questions/ tasks being completed	Analysis of the results of long-term recording of power quality parameters	
Work placement	Not applicable	

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