



Subject card

Subject name and code	Disturbances in Electrical Power Systems, PG_00038347						
Field of study	Electrical Engineering						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2022/2023		
Education level	second-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	Part-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	1	ECTS credits			4.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Mechatronics and High Voltage Engineering -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Marek Olesz					
	Teachers	dr hab. inż. Marek Olesz dr inż. Jacek Katarzyński dr inż. Daniel Kowalak					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	20.0	0.0	10.0	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	5.0		65.0	100	
Subject objectives	The aim of the teaching subject is to train highly qualified specialists with expertise in the effect and reduce the effects of noises, as well as electrical equipment research.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K7_K02	student calculates the levels of overvoltages and short-circuit currents and on this basis selects the appropriate parameters of the power equipment			[SK5] Assessment of ability to solve problems that arise in practice		
	K7_W02	student recognizes the basic types of interference and their source in the power system			[SW1] Assessment of factual knowledge		
	K7_U08	It combines knowledge of diagnostic measurements of devices and power quality analyzers			[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information		
Subject contents	<p>Lecture Short-circuits in low- and high voltage network. Currents of metallic and fault arc short-circuits, nearby and distant short-circuits. Parameters of fault arc. Influence of arc resistance on short-circuit currents. Fault arc resistance of transformer station and switchboards (aerial isolation and GIS). Fault arc effects limitation. Short-circuits in specific systems and electric objects, e.g. marine installations, high-voltage power electronics systems. Behaviour of switches and apparatuses under disturbance conditions. Changes of voltage (voltage dip). Solid state, hybrid and limiting switches. Influence of disturbances on control and monitoring systems. Overvoltages and its influence on electric system. Lightning surges and switching overvoltages. Limiting the effects of overvoltages - surge and overvoltage protection. Operation of apparatus and devices under overvoltage conditions. Monitoring of disturbances. Devices used to registration of disturbances. Analysis of disturbances. Operation of electrical transducers under disturbances. Testing devices immunity to disturbances. Disturbances modelling.</p> <p>Laboratory 1. Hybrid limiters 2. Devices for detection and fault arc switching 3. Models of earthing 4. Overvoltage varistor limiters 5. Measurement methods of disturbances in electrical network 6. Analysis of electrical energy quality in electrical power engineering systems</p>						
Prerequisites and co-requisites							

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam	50.0%	60.0%
	Practical exercise	60.0%	40.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Maksymiuk J.: Aparaty elektryczne. WNT, Warszawa, 1992. 2. Ciok Z., Maksymiuk J., Pochanke Z., Zdanowicz L.: Badanie urządzeń energoelektrycznych. WNT, Warszawa 1992. 3. Markiewicz H.: Urządzenia elektroenergetyczne. WNT, Warszawa 2008. 	
	Supplementary literature	<ol style="list-style-type: none"> 1. Mrówka Z.: Kierunki rozwoju komputerowych sieci przemysłowych, przegląd rozwiązań, porównanie parametrów. P.P.H.W. PROLOG Sp. z o.o., Warszawa, 2001. 2. Germanek D.: Sieci przemysłowe PROFIBUS. Standard światowy. SIEMENS A.G., 2002. 3. Kacejko P., Machowski J.: Zwarcia w systemach elektroenergetycznych. WNT, 2013. 4. Wyłącznik SENTRON. Komunikacja. SIEMENS A.G., 2004. 	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<p>1.Characteristics of short-circuit current I_k" for different cable cross-sections. 2. Characteristics of the ground fault current I_d depending on the grounding resistor. Influence of the line parameters on the shape of short-circuit current. 3. Characteristics of the surge current as a function of the angle of switching on the transformer.</p>		
Work placement	Not applicable		