



Subject card

Subject name and code	Command of Renewable Energy Sources Systems, PG_00042168						
Field of study	Power Engineering, Power Engineering, Power Engineering, Power Engineering, Power Engineering						
Date of commencement of studies	October 2020	Academic year of realisation of subject			2023/2024		
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	4	Language of instruction			Polish		
Semester of study	7	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Electrical Power Engineering -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jacek Klucznik					
	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	3.0		42.0	75	
Subject objectives	Presentation of basic issues related to the operation of renewable energy sources in the power system. Control of active and reactive power of wind power plants and photovoltaic plants. Controlling the operation of additional sources of reactive power: reactors, capacitor banks, static compensators (SVC) and reactive power generators (Statcom). Control of energy storage systems. NC RfG grid code, classification of power generation modules, requirements for modules A, B, C and D, how to ensure and verify them.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K6_U04	The student designs and analyses a reactive power control system in a wind or photovoltaic farm and verifies its compliance with the requirements of the NC RfG regulations			[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		
	K6_W05	The student knows the regulation possibilities of renewable sources in terms of active and reactive power. The student knows the requirements for renewable sources connected to the power grid.			[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		
Subject contents	Lecture: Active and reactive power generation by wind and photovoltaic power plants - PQ characteristics, control method, available control ranges control time.Reactive power management of a wind/photovoltaic farm. Voltage regulation. Review of documents and legal requirements for the integration of wind and photovoltaic farms into the electricity system. Laboratory: Analysis of the operation of renewable sources of the power system using the PowerFactory computing environment. Control of active and reactive power of wind and photovoltaic power plants. Control of additional sources of reactive power: reactors, capacitor banks,). Control of energy storage.						

Prerequisites and co-requisites	<p>Electric circuits theory</p> <p>Electrical machines.</p> <p>Electrical grids</p>		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Knowledge test in the subject (lecture)	60.0%	30.0%
	Assessment of the prepared report (laboratory)	60.0%	70.0%
Recommended reading	Basic literature	Machowski J., Lubośny Z., Białek J., Bumby J.: Power System Dynamics. Stability and Control. 3rd edition. Hoboken: John Wiley & Sons, 2020. 888 s. ISBN 9781119526346	
	Supplementary literature	Selected papers - Przegląd Elektrotechniczny, IEEE Xplore	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	<p>Selection of reactive power compensation equipment for a wind farm/photovoltaic farm.</p> <p>Assessment of farm response to frequency variation.</p> <p>Assessment of the farm's response to a short circuit.</p>		
Work placement	Not applicable		