



## Subject card

Subject name and code	Electric Power Systems, PG_00042162						
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		2022/2023		
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	6		ECTS credits		2.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Zakład Przekształtników i Magazynowania Energii -> Department of Power Electronics and Electrical Machines -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Robert Małkowski				
	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		17.0	50
Subject objectives	Student Explains regulation processes in Power grid in normal work state and after disturbance. Describes controllers used to maintain correct operation of power grid. Chooses correct operation algorithms for those controllers. Calculates chosen operation parameters of power grid with simplifying assumptions taken to consideration.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K6_W08		The student explains the control processes taking place in the power system in normal operation and in selected fault conditions.		[SW1] Assessment of factual knowledge		
	K6_U03		The student describes the control systems used to maintain the correct operation of the power system. Selects the appropriate algorithms for the operation of these systems. Calculates selected quantities of power system operation with adopted simplifying assumptions.		[SU2] Assessment of ability to analyse information		
Subject contents	LECTURES Generator as a object to aim regulation in power system. Control systems of synchronic generators, their limitations in operation in normal and emergency states. Relations between basic electric parameters in power grid. Fluctuations of electrical frequency in power grid, its causes and effects. Frequency regulation in power grid. Protective Automatic : under-frequency load shedding systems, undervoltage load shedding systems. LABORATORY Coupling parameters of simple power grid model elements (generators, transformers, power lines ) to conduct research including various load level in modeled power grid. Calculating load flow. Dependencies of voltage changed and/or transformer tap controllers moves on voltage levels and load flow in analyzed grid.						
Prerequisites and co-requisites							
Assessment methods and criteria	Subject passing criteria		Passing threshold		Percentage of the final grade		
	technical report		50.0%		40.0%		
	written test		50.0%		60.0%		

Recommended reading	Basic literature	1. Hellmann W., Szczerba Z.: Regulacja częstotliwości i napięcia w systemie elektroenergetycznym. Warszawa: WNT 1978.2. Kożuchowski J.: Sterowanie systemów elektroenergetycznych. Warszawa: PWN 1981.3. Machowski Jan: Regulacja i stabilność systemu elektroenergetycznego, Oficyna Wydawnicza Politechniki Warszawskiej, 2007.
	Supplementary literature	1. Kowalik R.: Teletechnika. Podstawy dla elektroenergetyków. Wyd. Politechniki Warszawskiej 1999.2. J. Machowski, J. Bialek, J. Bumby : "Power System Dynamics and Stability". John Wiley & Sons, Chichester, New York, 1997.
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	1. On the graph $f = g(t)$ , indicate the operation intervals of the primary and secondary control systems.2. Equivalent diagram of a generator without a regulator. Equivalent diagram of a generator with an ideal regulator. In one drawing, present the characteristics for both cases.3. Replace the negative effects of the operation of power system components with too high frequency.4. Describe the influence of particular factors on the selection of the insensitivity zone of the transformer voltage regulator	
Work placement	Not applicable	