



Subject card

Subject name and code	Electric Power Systems, PG_00038414						
Field of study	Electrical Engineering						
Date of commencement of studies	October 2020		Academic year of realisation of subject		2022/2023		
Education level	first-cycle studies		Subject group				
Mode of study	Part-time studies		Mode of delivery		at the university		
Year of study	3		Language of instruction		Polish		
Semester of study	5		ECTS credits		4.0		
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. Robert Małkowski				
	Teachers		dr hab. inż. Robert Małkowski				
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		7.0		63.0	100
Subject objectives	Presentation of the basic issues related to electric power system operation . In particular the power units and their participation in the control of voltage and frequency.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K6_U06		Student Explains regulation processes in power system in normal work state and after disturbance. Calculates chosen operation parameters of power grid with simplifying assumptions taken to consideration.		[SU1] Assessment of task fulfilment		
	K6_K01		The ability to acquire and verify knowledge about modern solutions used in the power industry		[SK2] Assessment of progress of work		
	K6_W09		Students can identify selected elements of power system objects and the ways of controlling them. They can indicate positive and negative influence they have on the environment.		[SW1] Assessment of factual knowledge		
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, under-voltage 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	Basic knowledge of electrotechnics devices, electrical machinery and electroenergetics.						
Assessment methods and criteria	Subject passing criteria		Passing threshold		Percentage of the final grade		
	Project		50.0%		40.0%		
	Midterm colloquium		50.0%		60.0%		

Recommended reading	Basic literature	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. 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	<ol style="list-style-type: none"> 1. In the graph of $f = g(t)$ indicate the operation of control systems ranges of primary and secondary control. 2. Equivalent circuit of the generator without a controller. Equivalent circuit of the generator with an ideal regulator. Present external characteristics for both cases in one figure. 3. Replace the negative effects of power system components operating at too high frequency. 4. Describe the impact of various factors on the choice of the deadband voltage of the regulator of the transformer. 	
Work placement	Not applicable	