



Subject card

Subject name and code	FACTS in Electric Power System, PG_00042321						
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					
Mode of study	Part-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	2	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. Robert Kowalak					
	Teachers	dr hab. inż. Robert Kowalak					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	10.0	0.0	10.0	0.0	0.0	20
	E-learning hours included: 0.0						
	UKŁADY FACTS W SYSTEMIE ELEKTROENERGETYCZNYM [Niestacjonarne][2022/23] - Moodle ID: 28555 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=28555						
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	20	7.0	48.0	75		
Subject objectives	Get to know the systems FACTS used in power systems.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K7_U03	The student knows the latest technology in the field of FACTS, and is aware of the emergence of ever new technical solutions.			[SU2] Assessment of ability to analyse information		
	K7_W01	The student defines the problems and risks associated with the work of power transmission systems. Lists the ways of their elimination. It presents the latest solutions used worldwide to improve the working conditions of power systems - FACTS systems. Describes the various solutions and applications FACTS systems. Evaluate their suitability for the regulation of the electricity system in different stages of work.			[SW3] Assessment of knowledge contained in written work and projects		
	K7_U02	The student knows the solution of FACTS devices, which are used in electric power systems. Assess the impact of these devices on the generation and transmission of electricity.			[SU3] Assessment of ability to use knowledge gained from the subject		
	K7_W02	The student defines the problems and risks associated with the work of power transmission systems. Lists the ways of their elimination. It presents the latest solutions used worldwide to improve the working conditions of power systems - FACTS systems. Describes the various solutions and applications FACTS systems. Evaluate their suitability for the regulation of the electricity system in different stages of work.			[SW3] Assessment of knowledge contained in written work and projects		

Subject contents	<p>LECTURE Electricity grid system and occurring changes. Problems in controlling the operation of the system. The need for new systems to control the system. New objects in the system: source and load. Scope of power electronics in power system. High power electronics connectors and their properties. Scheme of the electronics systems encountered in power systems: APC systems, FACTS, APF. FACTS systems. The impact of FACTS systems in the system - adjustable voltages and power flows. Construction and operation - integrated bypass systems, serial and series-shunt systems. The importance of these systems for the electricity system, the function of regulators. The future of the FACTS system. DC link. Structure and principle of operation. Impact on power systems. Scope.</p> <p>LABORATORY Modeling of FACTS systems work chosen (shunt compensators static systems, serial connections, DC). FACTS systems work study based on available physical models (HVDC, UPFC, STATCOM, SVC).</p>		
Prerequisites and co-requisites	Knowledge of the electricity system (structure, regulatory processes, risks, etc.).		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam	60.0%	60.0%
	Report of laboratory exercises	50.0%	40.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Acha E., Fuerte-Esquivel C. R., Ambriz-Perez H., Angeles-Comacho C.: FACTS Modelling and Simulaton In Power Networks, John Wiley & Sons, LTD, 2004. 2. Aririllaga J., Smith B.: AC-DC Power System Analysis, London 1998, The Institution of Electrical Engineers. 3. Machowski J.: Regulacja i stabilność systemu elektroenergetycznego, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2007. 4. Sood V. K.: HVDC and FACTS Controllers. Applications of Static Converters in Power Systems. Kluwer Academic Publishers Boston, 2004. 5. Zajczyk R.: Modele matematyczne systemu elektroenergetycznego do badania elektromechanicznych stanów nieustalonych i procesów regulacyjnych, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2003. 	
	Supplementary literature	Publications IEEE, IEE, CIGRE.	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Division modern power electronic devices supporting the work of the power system 2. Dividing the FACTS devices on groups 3. What are hybrid systems FACTS - characteristics 4. SVC devices- application, the connection to the system, advantages, disadvantages. 5. STATCOM devices - application, the connection to the system, advantages, disadvantages. 		
Work placement	Not applicable		