



Subject card

Subject name and code	FACTS in Electric Power System, PG_00042321						
Field of study	Electrical Engineering						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2024/2025		
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						
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	Familiarization with the types and structure of FACTS devices used in power systems. Learning about the features of these devices and their impact on the operation of the power system. Assessment of the impact of these devices on the operation of the power system.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W02] has an in-depth and structured knowledge of electrical measurements electrical measurements, the methods and equipment used for electrical measurements of non-electrical quantities, he/she knows the principles of testing operation tests of electrical equipment, has a structured knowledge of electricity quality issues	Becomes familiar with the impact of FACTS devices on the power quality of the electric power grid. Performs an assessment of the impact of selected FACTS devices on power system operation.			[SW1] Assessment of factual knowledge		
	[K7_W05] has detailed knowledge of the regulatory processes in the electricity system electricity system, electricity safety and electricity safety automation	Performs computer simulations and assesses the impact of selected FACTS systems on the operation of the power system.			[SW1] Assessment of factual knowledge		
	[K7_U02] is able to prepare and deliver a short oral presentation on a selected technical topic	Participates in the discussion of potential applications of FACTS devices.			[SU3] Assessment of ability to use knowledge gained from the subject		
	[K7_U03] is able to obtain information from literature, databases and other sources, also in English, draw conclusions, formulate and fully justify opinions. substantiate opinions; is able to identify directions for further learning and implement the process of self-education	Searches for information on FACTS devices.			[SU2] Assessment of ability to analyse information		

Subject contents	<p>LECTURE: The electric power system and the changes occurring in it. Problems in the control of system operation. The need for new devices to regulate the operation of the system. New objects in the system: sources and loads. The scope of application of power electronics in the electric power system. Power electronic switches of high power and their characteristics. Systematics of power electronic devices encountered in electric power systems: APC, FACTS, APF. FACTS devices and their systematics. Impact of FACTS devices on the power system - regulation of voltages and power flows. Construction and principle of operation - shunt, series and series-shunt devices. The importance of these devices for the power system, the regulatory functions performed. The future of FACTS devices. Hybrid FACTS devices. DC links, structures and principle of operation, impact on power systems.</p> <p>LABORATORY: Modeling the operation of selected FACTS devices (shunt static compensators, series devices, energy storage). Studying the operation of FACTS devices based on models (SVC, STATCOM, TCSC, BESS). Familiarization with the construction of FACTS devices (SVC, STATCOM, TCPAR).</p>											
Prerequisites and co-requisites	Knowledge of the electricity system (structure, regulatory processes, risks, etc.).											
Assessment methods and criteria	<table border="1" data-bbox="451 533 1487 640"> <thead> <tr> <th data-bbox="451 533 794 568">Subject passing criteria</th> <th data-bbox="794 533 1137 568">Passing threshold</th> <th data-bbox="1137 533 1487 568">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="451 568 794 604">Written exam</td> <td data-bbox="794 568 1137 604">60.0%</td> <td data-bbox="1137 568 1487 604">60.0%</td> </tr> <tr> <td data-bbox="451 604 794 640">Report of laboratory exercises</td> <td data-bbox="794 604 1137 640">50.0%</td> <td data-bbox="1137 604 1487 640">40.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Written exam	60.0%	60.0%	Report of laboratory exercises	50.0%	40.0%
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Written exam	60.0%	60.0%										
Report of laboratory exercises	50.0%	40.0%										
Recommended reading	Basic literature	<p>Acha E., Fuerte-Esquivel C. R., Ambriz-Perez H., Angeles-Comacho C.: FACTS Modelling and Simulaton in Power Networks, John Wiley &amp; Sons, LTD, 2004.</p> <p>Airillaga J., Smith B.: AC-DC Power System Analysis, London 1998, The Institution of Electrical Engineers.</p> <p>Sood V. K.: HVDC and FACTS Controllers. Applications of Static Converters in Power Systems. Kluwer Academic Publishers Boston, 2004.</p> <p>Zajczyk R.: Modele matematyczne systemu elektroenergetycznego do badania elektromechanicznych stanów nieustalonych i procesów regulacyjnych, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2003.</p> <p>Kowalak R.: Kompensatory i ich wpływ na pracę systemu elektroenergetycznego, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2019.</p>										
	Supplementary literature	<p>Machowski J.: Regulacja i stabilność systemu elektroenergetycznego, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2007.</p> <p>Barlik R., Nowak. M.: Technika tyrystorowa. Wydawnictwa Naukowo-Techniczne, wydanie trzecie, Warszawa 1994.</p> <p>Strzelecki R., Supronowicz H.: Filtracja harmonicznych w sieciach zasilających prądu przemiennego, Wydawnictwo Adam Marszałek, Toruń 1998.</p>										
	eResources addresses	<p>Adresy na platformie eNauczanie: UKŁADY FACTS W SYSTEMIE ELEKTROENERGETYCZNYM [ET] [Niestacjonarne][2024/25] - Moodle ID: 43447 <a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=43447">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=43447</a></p>										
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. Division modern power electronic devices supporting the work of the power system</li> <li>2. Dividing the FACTS devices on groups</li> <li>3. What are hybrid systems FACTS - characteristics</li> <li>4. SVC devices- application, the connection to the system, advantages, disadvantages.</li> <li>5. STATCOM devices - application, the connection to the system, advantages, disadvantages.</li> </ol>											
Work placement	Not applicable											

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