GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	FACTS in Electric Power System, PG_00042321		
Field of study	UKŁADY FACTS W SYSTEMIE ELEKTROENERGETYCZNYM		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
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 -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Robert Kowalak	
	Teachers		

Lesson types

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_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] Ocena umiejętności analizy informacji
[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] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu
[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] Ocena wiedzy faktograficznej
[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] Ocena wiedzy faktograficznej

<table>
<tr><td>Subject contents</td><td>Course content – lecture
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.

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).</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of the electricity system (structure, regulatory processes, risks, etc.).</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Report of laboratory exercises</td><td>50.0%</td><td>40.0%</td></tr>
<tr><td>Written exam</td><td>60.0%</td><td>60.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>Acha E., Fuerte-Esquivel C. R., Ambriz-Perez H., Angeles-Comacho C.: FACTS Modelling and Simulaton in Power Networks, John Wiley & Sons, LTD, 2004.

Aririllaga J., Smith B.: AC-DC Power System Analysis, London 1998, The Institution of Electrical Engineers.

Sood V. K.: HVDC and FACTS Controllers. Applications of Static Converters in Power Systems. Kluwer Academic Publishers Boston, 2004.

Zajczyk R.: Modele matematyczne systemu elektroenergetycznego do badania elektromechanicznych stanów nieustalonych i procesów regulacyjnych, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2003.

Kowalak R.: Kompensatory i ich wpływ na pracę systemu elektroenergetycznego, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2019.</td></tr>
<tr><td>Supplementary literature</td><td>Machowski J.: Regulacja i stabilność systemu elektroenergetycznego, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2007.

Barlik R., Nowak. M.: Technika tyrystorowa. Wydawnictwa Naukowo-Techniczne, wydanie trzecie, Warszawa 1994.

Strzelecki R., Supronowicz H.: Filtracja harmonicznych w sieciach zasilających prądu przemiennego, Wydawnictwo Adam Marszałek, Toruń 1998.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>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.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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