GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	FACTS in Electric Power System, PG_00042321		
Field of study	Electrical Engineering		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2023/2024
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

Get to know the systems FACTS used in power systems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
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
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_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_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

Subject contents	**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. **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).
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
Report of laboratory exercises	50.0%	40.0%
Written exam	60.0%	60.0%

Recommended reading

Basic literature	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. 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	Adresy na platformie eNauczanie: UKŁADY FACTS W SYSTEMIE ELEKTROENERGETYCZNYM [ET][II][Niestacjonarne][2023/24] - Moodle ID: 36134 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=36134

Example issues/ example questions/ tasks being completed	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