GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Voltage Regulation of the Power System, PG_00042319		
Field of study	Electrical Engineering		
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. Jacek Klucznik	
	Teachers	dr hab. inż. Robert Kowalak dr hab. inż. Jacek Klucznik	

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

eNauczanie source addresses:
Moodle ID: 3781 REGULACJA NAPIĘCIA W SYSTEMIE ELEKTROENERGETYCZNYM [ET] [Niestacjonarne][2025/26]
https://enauczanie.pg.edu.pl/2025/course/view.php?id=3781

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

The student recognises the voltage control processes in the power system with the specificity of high, medium and low voltage networks. The student is acquainted with voltage control devices and systems, and how to model, analyse and design them.

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	The student masters the principles of equipment involved in the control of voltage and reactive power in the power system.	[SW3] Assessment of knowledge contained in written work and projects
[K7_U02] is able to prepare and deliver a short oral presentation on a selected technical topic	Students will be able to prepare and present orally, in a concise and substantive manner, a selected technical topic related to voltage regulation in the power system, using relevant literature sources and multimedia tools.	[SU5] Assessment of ability to present the results of task
[K7_W05] has detailed knowledge of the regulatory processes in the electricity system electricity system, electricity safety and electricity safety automation	Students will analyse the operation of the electrical grid, select and evaluate the operation of voltage control systems.	[SW3] Assessment of knowledge contained in written work and projects
[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	Students will be able to critically evaluate and compare various technical solutions in the field of voltage control, formulate opinions on them and justify them logically and based on acquired data.	[SU1] Assessment of task fulfilment

Subject contents

Course content – lecture
Criteria and constraints for voltage regulation in power systems. Technical constraints, standards. Control criteria. Algorithms and control system structure. Algorithms of area regulation. Rational structure of the control system for voltage levels and reactive power distribution. Controllers of individual devices: generators, transformers, shunt reactors and capacitor banks, compensators. Constructions, algorithms, selection of settings. Group regulators of generation nodes ARNE and network nodes ARST. Master regulators. Determination of setpoints for group regulation. Involvement of wind and photovoltaic farms in voltage regulation. Voltage problems in MV and LV networks related to the connection of renewable sources and ways to mitigate them.

Course content – laboratory
Analysis of the voltage and reactive power control system of a synchronous generator. Development of a generator model with an automatic voltage regulator (AVR) in the PowerFactory environment. Analysis of the U=f(Q) characteristic. Investigation of the impact of regulator settings (Kp, Ki). Comparison of different types of algorithms (P, PI, droop control).

Analysis of the control system of a transformer with a tap changer. Development of a model containing lines and a transformer in PowerFactory. Simulation of voltage regulation during load changes. Selection of parameters: dead band, delay time, tap step.

Prerequisites and co-requisites

Passed subjects Electrical Circuits and Electrical Power Engineering.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Knowledge test	50.0%	30.0%
Evaluation of laboratory raport	50.0%	70.0%

Recommended reading

Basic literature	[1] P. Kundur, *Power System Stability and Control*. New York, NY: McGraw-Hill, 1994.
Supplementary literature	----
eResources addresses	

Example issues/ example questions/ tasks being completed

1. Performing the selection of synchronous generator control system settings.
2. Analysing the operation of a HV/SN transformer controller
3. Discussing types and methods of controlling reactive power sources in the power system
4. Selecting the location of a regulating transformer in the MV network

Practical activites within the subject

Not applicable

Document generated electronically. Does not require a seal or signature.