GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Disturbances in Electrical Power Systems, PG_00038475		
Field of study	Electrical Engineering		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Marek Olesz	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	15.0	15.0	0.0	0.0	60

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	60	10.0	30.0	100

Subject objectives

Acquiring knowledge of the causes, and consequences of disturbancs in electrical power systems. Acquiring skills for calculating currents and voltages transients during lightning phenomena, switching operations and short circuits in electrical power systems. Understanding the mechanisms and effects of disturbance on the selected electrical and electronic devices and methods of selection and tests of safety devices, especially surge arresters.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U08] e able to carry out tests on electrical power equipment, analyse disturbances in electrical power systems, record and assess the quality of electricity in the power network	measures disturbances with appropriate equipment and draws appropriate conclusions based on the measurements	[SU4] Assessment of ability to use methods and tools
[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	describes the power quality parameters and identifies the sources of disturbances on their basis	[SW1] Assessment of factual knowledge
[K7_K02] is aware of the impact of engineering activities on the environment, understands the the non-technical effects of those activities	appreciates the importance of self-improvement in the field of electromagnetic compatibility	[SK2] Assessment of progress of work

Subject contents

Course content – lecture

Lecture:
Short-circuits in low, medium and high voltage network. Influence of the type of neutral point earthing on the level of short-circuit currents and overvoltages. Currents of metallic and fault arc short-circuits, nearby and distant short-circuits. Parameters of fault arc. Influence of arc resistance on short-circuit currents. Fault arc resistance of transformer station and switchboards (aerial isolation and GIS). Fault arc effects limitation. Behaviour of switches and apparatuses under disturbance conditions.

Characteristics of voltage and time surges. Waveforms in long transmission lines. Propagation of electromagnetic waveforms in overhead and cable lines. Electric strength of long air insulating clearances. Critical time of stroke. Systems of operation of power networks and their impact on the level of overvoltages. Coordination of insulation and selection of test voltages. Limiting the level of overvoltages in power systems - lightning protection and overvoltage protection. Surge arresters - production technology, properties, parameters. Selection of surge arresters and their location. Diagnostics of surge arresters.

Devices used to registration of disturbances. Normative requirements regarding the power quality parameters. Influence of power supply parameters on the operation of electric energy receivers. Ways to improve the quality parameters of the supply voltage. Electromagnetic compatibility. Requirements for the immunity of devices to interference. Permitted levels of emissivity of devices. Permissible levels of electric and magnetic fields in the vicinity of electrical power equipment.

Course content – exercises

Classes:

Short-circuit calculations using the asymmetric components method in HV and MV networks. Calculations of waveforms in long transmission lines. Analysis of waveforms in systems with sparks and varistor surge arresters. Selection of parameters of surge arresters in MV and HV networks. Calculation of the allowable distances between arresters and protected devices.

Course content – laboratory

Laboratory exercises

Overvoltage propagation in power systems. Effect of the method of grounding the neutral point onovervoltage level. Distribution of surge arresters in the power system. Magnetic and electric field measurements. Transient state analysis during switching operations. Emission of higher harmonics by nonlinear receivers.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written tests	60.0%	25.0%
Written exam	60.0%	50.0%
Practical exercise	60.0%	25.0%

Recommended reading

Basic literature

1. Maksymiuk J.: Aparaty elektryczne. WNT, Warszawa, 1992.
2. Ciok Z., Maksymiuk J., Pochanke Z., Zdanowicz L.: Badanie urządzeń energoelektrycznych. WNT, Warszawa 1992.
3. Markiewicz H.: Urządzenia elektroenergetyczne. WNT, Warszawa 2008.
4. 4. Kacejko P., Machowski J.: Zwarcia w systemach elektroenergetycznych. WNT Warszawa 2002.
5. Flisowski Z. Technika wysokich napięć, WNT, Warszawa, 1988
6. Kosztaluk R. I inni: Technika badań wysokonapięciowych, WNT, Warszawa, 1985

	Supplementary literature	1. D. Duda, Z. Gacek, Przepięcia w sieciach elektroenergetycznych i ochrona przed przepięciami, Gliwice 2015 2. K. Żmuda, Elektroenergetyczne układy przesyłowe i rozdzielcze. Wybrane zagadnienia z przykładami, Gliwice 2012
	eResources addresses	
Example issues/ example questions/ tasks being completed	1 Discuss the phenomenon of back flashover in the overhead line insulation. 2 Discuss the mechanism of the lightning. 3 Impact stresses in isolation. 4 Discuss the phenomena occurring during switching off inductive currents. 5 Discuss the class A and class B instruments for the measurement of electric energy quality. 6. Protection of the isolation of capacitors. 7. Surge wave in the node connecting the cable line. 8 Switching on the capacitance (capacitor banks, unloaded lines, cables). 9 Construction and selection of metal oxide surge arresters. 10 Distribution of currents during short circuits in networks with isolated neutral point. 11. Deformation of load currents of the transformers. 12 Insulation coordination. 13 Arcs in enclosed switchgear. 14. Phenomena accompanying switching processes in the energy system. 15. How lightning conductors affect line impedance. 16. Effect of transformer grounding on surge level.	
Practical activites within the subject	Not applicable	

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