GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	High Voltage Engineering, PG_00038442		
Field of study	Electrical Engineering		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2023/2024
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	4	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Marek Olesz	
	Teachers	dr inż. Daniel Kowalak dr hab. inż. Marek Olesz	

Lesson types and methods of instruction							
	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	0.0	0.0	45
	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	45	7.0	48.0	100

Subject objectives	Understanding of phenomena in high voltage insulation systems		
Learning outcomes	Course outcome	Subject outcome	Method of verification
	K6_K01	Student appreciates the importance of self-expanding knowledge in the field of high voltage engineering	[SK5] Assessment of ability to solve problems that arise in practice [SK2] Assessment of progress of work
	K6_U05	The student is able to perform basic measurements confirming the electrical strength of the insulation system. The student is able to estimate safe separating distances.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject
	K6_W02	The student understands the conditions determining the occurrence of electrical discharges in gas, solid and liquid insulation, the mechanism of discharge development, the mechanisms of insulation degradation. The student understands the basics of overvoltage protection, the requirements for basic elements and insulation systems, the principles of their operation, taking into account the influence of the surrounding environment, allowing interpretation of regulations and standards.	[SW1] Assessment of factual knowledge

Subject contents	LECTURE Dielectrics, ionisation processes in gases, forms of dischargs, corona, impuls air strength, effect of field distribution, polarity, symmetry, dimensions, time and frequency on electric strength of gases. Compressed gases. Liquid dielectrics, effect of pressure, temperature, humidity, time and frequency, field distribution and electrode dimension on electric strength, applications. Solid dielectrics, mechanisms of breakdown, partial discharges, degradation, dielectric strength of composed insulation systems, surface and gliding discharges. Insulators, application, design, effect of field distribution, pollution and humidity, design of HV power cables and terminations. Lightning, basic parameters, overvoltages, propagation of waves in power lines and windings, principles and methods of lightning protection, co-ordination of insulation. Principles of diagnostics of insulation. LABORATORY Measurement of AC, DC and impuls high voltages. Effect of voltage distribution on discharge form in air at AC, DC and impuls voltages. Effect of ambient conditions on electric strength of air. Insulator testing in dry conditions and under rain. Oil evaluation, Model investigations of wave phenomena in long lines.
Prerequisites and co-requisites	acquaintance with principles of differencial ordinary and partial equations, integral calculus, theory of electric fields, kinetic-molecular theory of gases, principles of thermodynamics, and structure of atom

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory passing test	60.0%	40.0%
Written exam	60.0%	60.0%

Recommended reading

Basic literature	1. Z. Flisowski: "Technika Wysokich Napięć" (HV engineering), PWN Warszawa 2017. 2. Z. Gacek: "Wysokonapięciowa technika izolacyjna" (HV insulation technique), Wydawnictwo Politechniki Gliwickiej, Gliwice 2006 3. H. Boryń, A. Rynkowski, S. Wojtas: Laboratorium Techniki Wysokich Napięć. Wydawnictwo Politechniki Gdańskiej, 2007. 4. S. Szpor i inni, "Technika wysokich napięć" (HV engineering) WNT, Warszawa, 1978, 5. Ravindra Arora and Wolfgang Mosch, High Voltage and Electrical Insulation Engineering IEEE Press , 2011
Supplementary literature	1. H. Mo cicka-Grzesiak: Inżynieria wysokich napięć w elektroenergetyce, tom I, Wydawnictwo Politechniki Poznańskiej, Poznań 1996. 2. S. Szpor: Ochrona odgromowa. WNT 1978
eResources addresses	Adresy na platformie eNauczanie: TECHNIKA WYSOKICH NAPIĘĆ [ET][2023/24] - Moodle ID: 36064 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=36064

Example issues/ example questions/ tasks being completed

The streamer mechanism of spark

Dielectric loss coefficient

Breakdown mechanism of solid materials

Breakdown mechanism of liquid dielectrics

Measurement of DC high voltages

Measurement of AC high voltages

Measurement of impulse high voltages

The lightning protection of buildings

Principles of overvoltage protection for power systems and devices

Work placement

Not applicable