



Subject card

Subject name and code	High Voltage Engineering, PG_00038442						
Field of study	Electrical Engineering						
Date of commencement of studies	October 2021		Academic year of realisation of subject		2022/2023		
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	Katedra Elektrotechniki i Inżynierii Wysokich Napięć -> 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 dr inż. Piotr Leśniak				
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_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		
	K6_U05		The student is able to perform basic measurements confirming the electrical strength of the insulation system.		[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject		
	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		

Subject contents	LECTURE Dielectrics, ionisation processes in gases, forms of discharges, 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
	Written exam	60.0%	60.0%
	Laboratory passing test	60.0%	40.0%
Recommended reading	Basic literature	1. Z. Flisowski: "Technika Wysokich Napięć" (HV engineering), WNT Warszawa 1988. 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	
	Supplementary literature	1. H. Mościcka-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:	
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		