

。 GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	High voltage engineering, PG_00058360								
Field of study	Hydrogen Technologies and Electromobility								
Date of commencement of studies	October 2022		Academic year of realisation of subject			2024/2025			
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	3		Language of instruction			Polish			
Semester of study	6		ECTS credits			2.0			
Learning profile	general academic profile		Assessment form			assessment			
Conducting unit	Katedra Elektrotechniki -> 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	Projec	:t	Seminar	SUM	
	Number of study hours	15.0	0.0	15.0	0.0		0.0	30	
	E-learning hours included: 0.0								
Learning activity and number of study hours	Learning activity	Participation in classes includ plan	n didactic ed in study	lactic Participation in n study consultation hours		Self-study		SUM	
	Number of study hours	30		2.0		18.0		50	
Subject objectives	Knowledge of phenomena occurring in high-voltage insulation systems using gaseous, liquid and solid dielectrics. Introduction to lightning and surge protection. Mastering measurement procedures related to performing voltage tests on insulation systems.								
Learning outcomes	Course outcome		Subject outcome			Method of verification			
	[K6_W02] has basic knowledge of physics and chemistry including electrostatics, electromagnetism, electrodynamics, wave motion, acoustics, mechanics, thermodynamics, optics, solid state physics; including knowledge necessary to understand the basic physical phenomena occurring in hydrogen devices, systems and installations as well as automation and robotics systems		 defines the conditions under which an electric discharge may occur in gas, solid and liquid insulation, defines the basic lightning and surge protection systems 			[SW1] Assessment of factual knowledge			
	[K6_U06] has the preparation necessary to work in an industrial environment, applies the principles of occupational health and safety [K6_K01] is aware of the need for continuous education and self- improvement in the field of the profession of an electrician and knows the possibilities of further advoction		 performs basic measurements confirming the electrical strength of the insulating system calculates safe insulation distances independently expands knowledge in the field of high- voltage technology towards the classification of high-voltage systems 			[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SK2] Assessment of progress of work [SK5] Assessment of ability to solve problems that arise in practice			

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.						
and co-requisites	fields, kinetic-molecular theory of gases, principles of thermodynamics, and structure of atom						
Assessment methods	Subject passing criteria	Passing threshold	Percentage of the final grade				
and criteria	writting test	60.0%	60.0%				
	Laboratory passing test	60.0%	40.0%				
Recommended reading	 Z. Flisowski: "Technika Wysokich Napięć" (HV engineering), P¹ Warszawa 2017. Z. Gacek: "Wysokonapięciowa technika izolacyjna" (HV insulat technique), Wydawnictwo Politechniki Gliwickiej, Gliwice 2006 H. Boryń, A. Rynkowski, S. Wojtas: Laboratorium Techniki Wysokich Napięć. Wydawnictwo Politechniki Gdańskiej, 2007. B. Florkowska, J. Furgał, "Technika wysokich napięć", Wydawnictwa AGH, 2017 S. Szpor i inni, "Technika wysokich napięć" (HV engineering) WNT, Warszawa, 1978, Ravindra Arora and Wolfgang Mosch, High Voltage and Electri Insulation Engineering IEEE Press , 2011 						
	Supplementary literature 1. H. Mościcka-Grzesiak: Inżynieria wysokich napięć w elektroenergetyce, tom I, Wydawnictwo Politechniki Poznańsk Poznań 1996. 2. S. Szpor: Ochrona odgromowa. WNT 1978						
	eResources addresses						
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						

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