



## Subject card

Subject name and code	High Voltage Technique, PG_00055963						
Field of study	Power Engineering, Power Engineering, Power Engineering						
Date of commencement of studies	October 2021	Academic year of realisation of subject				2023/2024	
Education level	first-cycle studies	Subject group				Optional subject group 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 i Inżynierii Wysokich Napięć -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Marek Olesz				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	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 didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	30		2.0		18.0	50
Subject objectives	Knowledge of the phenomena occurring in high-voltage insulation systems						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K6_W05] has structured knowledge in the field of electrical engineering and electronics, necessary to understand the basics of operation and selection of electrical machines, electricity transmission systems and power electronic devices		The student understands the phenomena occurring in insulation systems and is able to assess their technical condition			[SW1] Assessment of factual knowledge	
	[K6_W03] knows the basics of automation and automatic regulation, knows the principles of the selection of electrical devices, drive systems and their control		The student has basic skills enabling the selection of measuring equipment and safe conduct of basic measurements of high-voltage devices			[SW1] Assessment of factual knowledge	
Subject contents	LECTURE Dielectrics, ionisation processes in gases, forms of discharges, corona, impulse air strength, effect of field distribution, polarity, symmetry, dimensions, time and frequency on electric strength of gases. Compressed gases. Liquid dielectrics, electric strength, mechanisms of breakdown and 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 and humidity, design of HV power cables and terminations. Lightning, basic parameters, overvoltages. Principles and methods of lightning protection, co-ordination of insulation. Principles of diagnostics of insulation. LABORATORY Measurement of AC, DC and impulse high voltages. Effect of voltage distribution on discharge form in air at AC, DC and impulse voltages. Effect of ambient conditions on electric strength of air. Insulator testing in dry conditions and under rain. Insulating oil testing. Study of wave transmission in long lines.						
Prerequisites and co-requisites	knowledge of fundamentals: ordinary and partial differential equations, integral calculus, electromagnetic field theory, kinetic-molecular theory of gases, thermodynamics, atomic structure						
Assessment methods and criteria	Subject passing criteria		Passing threshold			Percentage of the final grade	
			60.0%			40.0%	
			60.0%			60.0%	
Recommended reading	Basic literature		E. Kuffel, W.S. Zaengl and J. Kuffel, High Voltage Engineering Fundamentals. 2000.				
	Supplementary literature		M S Naidu and V Kamaraju, High Voltage Engineering.				
	eResources addresses						

<p>Example issues/ example questions/ tasks being completed</p>	<ol style="list-style-type: none"> <li>1. List and describe deionization processes in gases,</li> <li>2. Discuss the development Townsend discharge mechanism,</li> <li>3. What the Paschen law says,</li> <li>4. What is the phenomenon of corona discharges,</li> <li>5. Influence of polarity of the electrodes on static spark gap in gases,</li> <li>6. Electrical properties electronegative gases,</li> <li>7. Breakdown mechanisms of insulating liquids,</li> <li>8. Discuss the gliding discharge mechanism,</li> <li>9. Typical structures bushings and methods of preventing gliding discharges,</li> <li>10. Discuss the structure of modern medium voltage power cables,</li> <li>11. Discuss the characteristic parameters of the lightning stroke,</li> <li>12. Propagation of waves voltage power lines,</li> <li>13. Characterize types of lightning overvoltages in power networks,</li> <li>14. Discuss the basic principles and lightning protection measures used in the power system,</li> <li>15. Discuss the methods of measurement of high AC and DC voltages.</li> </ol>
<p>Work placement</p>	<p>Not applicable</p>