



Subject card

Subject name and code	Industrial Switching Equipment, PG_00038417									
Field of study	Electrical Engineering									
Date of commencement of studies	October 2020		Academic year of realisation of subject		2022/2023					
Education level	first-cycle studies		Subject group							
Mode of study	Part-time studies		Mode of delivery		at the university					
Year of study	3		Language of instruction		Polish					
Semester of study	5		ECTS credits		4.0					
Learning profile	general academic profile		Assessment form		assessment					
Conducting unit	Department of Mechatronics and High Voltage Engineering -> Faculty of Electrical and Control Engineering									
Name and surname of lecturer (lecturers)	Subject supervisor Teachers		dr inż. Daniel Kowalak							
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM			
	Number of study hours	20.0	20.0	0.0	0.0	0.0	40			
	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	40		3.0		57.0	100			
Subject objectives	The purpose of the course is to acquaint the student with the basic types of different designs LV and HV electrical apparatus. Acquisition knowledge about the rated parameters of the electrical switches and procedures for variety of low voltage and high voltage electrical apparatus for the selected configuration of industrial switchgears. Acquisition knowledge regarding the procedure for the necessary calculations for the proper variety of electric power apparatus.									
Learning outcomes	Course outcome		Subject outcome		Method of verification					
	K6_K01		The student is able to organize the training materials necessary to solve the engineering problems. He is aware of legal responsibility in case of using illegal sources.		[SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills					
Subject contents	General information about the switching apparatus (classification, types and purpose of switches). Environmental and climate exposure of electrical switches. Exposure voltage insulation of power electric devices. Current exposure of electric apparatus in working and short-circuit conditions. Switching electric arc, switching technics, arc quenching in AC and DC circuits (methods of arc quenching). Exposure of contacts in switches. Arc switching processes (rated, short-circuit, inductive and capacitive currents switching on and off). Classification and variety of electrical apparatus - LV and HV contacts switches (disconnectors, earthing switches, contactors, circuit breakers). LV and HV electric fuses. Cooperation and coordination of the electric power switches. Current and voltage transformers, current and voltage converters.									
Prerequisites and co-requisites	Knowledge of the subjects: Electrical Circuits, High Voltage Technique, Metrology, Electrical Power Systems									
Assessment methods and criteria	Subject passing criteria		Passing threshold		Percentage of the final grade					
	Exercises		60.0%		40.0%					
	Lecture		60.0%		60.0%					

Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Au A., Maksymiuk J., Pochanke Z.: Podstawy obliczeń aparatów elektroenergetycznych, WNT Warszawa 1976. 2. Bessei H.: Bezpieczniki od A do Z, 2012 Kerschensteiner Verlag, Lappersdorf 3. Ciok. Z.: Procesy łączeniowe w układach elektroenergetycznych, WNT Warszawa 1976 4. Kacejko P., Machowski J.: Zwarcia w systemach elektroenergetycznych, WNT Warszawa 2002 5. Lipski T.: Bezpieczniki niskonapięciowe, WNT Warszawa 1968 6. Maksymiuk J.: Aparaty elektryczne", WNT Warszawa 1992 7. Maksymiuk J., Nowicki J.: Aparaty elektryczne i rozdzielnicze wysokich i średnich napięć, Oficyna wydawnicza Politechniki Warszawskiej, Warszawa 2014 8. Markiewicz H.: Aparaty elektryczne, PWN Warszawa 1989 9. Musiał E.: Instalacje i urządzenia elektroenergetyczne", WSiP Warszawa 1998 10. Wiszniewski A.: Przekładniki w elektroenergetyce, WNT Warszawa 1992
	Supplementary literature	<ol style="list-style-type: none"> 1. Flisowski Z.: Technika wysokich napięć, WNT Warszawa 1992 2. Kahl T.: Sieci elektroenergetyczne, WNT Warszawa 1981 3. Kotlarski W., Grad J.: Aparaty i urządzenia elektryczne", WSiP Warszawa 1997 4. Królikowski C.: Inżynieria łączenia obwodów elektrycznych wielkich mocy, Wyd. Politechniki Poznańskiej, Poznań 1998
	eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> 1. Specify the definition and basic parameters describing the disconnector, earthing switch, contactor and circuit breaker. 2. Mention the basic voltage, current and environmental exposure of electric power switches. 3. Describe the basic conditions of arc quenching in DC and AC circuit. 4. Describe the method of low-voltage quenching arc in switches equipped with metal deionization plates. 5. Compare method of arc quenching in vacuum and SF6. 6. Compare method of arc quenching in air and oil. 7. Explain the principle of operation of electric fuses and expulsion fuses. 8. Describe of electrical and mechanical exposures of electric contacts. 9. Explain the process of switching on and off of transformers. 10. Explain the process of switching on and off of (capacitor) bank. 11. Explain the operating principle and variety conditions of current and voltage inductive transformers. 12. Introduce basic conditions for the correct variety of electrical switches in a variety of circuit configurations.
Work placement	Not applicable