GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Equipment and Systems for Supplying Industrial Objects, PG_00048271		
Field of study	Electrical Engineering		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2024/2025
Education level	first-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	5	ECTS credits	6.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Electrical Engineering of Transport -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Dariusz Karkosiński	
	Teachers	dr hab. inż. Dariusz Karkosiński	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	30.0	0.0	0.0	0.0	60

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	60	5.0	85.0	150

Subject objectives

Knowledge of power system components, construction and principles of the selection of electrical equipment and cable lines to supply for the industrial drives.

Skills design of power supply network and control and signaling through programs supporting (CAE).

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_K01	He/She provides the basics of acquiring current knowledge and regulations in the field of industrial electrical engineering. Knows how to prepare for exams for independent functions in construction.	[SK5] Assessment of ability to solve problems that arise in practice
K6_K05	The student distinguishes the requirements of the Machinery Directive, including the categories of emergency stop, redundancy and diversification in motor power control systems.	[SK5] Assessment of ability to solve problems that arise in practice
K6_U09	He/She performs appropriate calculations and selects equipment in terms of long-term load and short-circuit strength	[SU3] Assessment of ability to use knowledge gained from the subject
K6_W10	He/She is able to apply the principles of rational use and conversion of electricity when designing power networks and devices	[SW3] Assessment of knowledge contained in written work and projects
K6_U10	He/she prepares single-line and three-line diagrams of low-voltage power circuits and networks, as well as control and regulation systems for electric drives in accordance with current European standards	[SU3] Assessment of ability to use knowledge gained from the subject

Subject contents	**LECTURE** Graphic symbols, alpha-digital signs of electrical equipment used in power supply systems. Power distribution systems for industrial plants and public buildings. Distribution systems of power supply for large industrial facilities. Transformer substations and distribution networks of medium and high voltage. Devices and equipment selection and operating. Design of cable lines and busbars. Construction and operation of power switches. Protection against ever-current and over-voltage. Redundant power supply sources. Automatic transfer switching equipment (ATSE). Electrical-power protective automation. Microprocessor-based protective relays. Microprocessor protective relays for electric motors and power units. Implementing the requirements of the Machinery Directive, including the emergency stop category, redundancy and diversification in the power control systems of motors. Systems and communication networks for power utility automation according to the EN (IEC) 61850 standard. The architecture of distributed automation systems of distribution substations. **EXERCISES** Intensive course of development schemes and the supply system design documentation using aided design of EPLAN Electric P8. Programming the security parameters of power - the work assisted software tools available known manufacturers of the apparatus. Design of power supply system for three industrial electric drives, in particular: installation of interior equipment includes power switchgear (including circuit breakers, switches, fuses), cables and busbars; manual control systems and emergency stop; signalling elements.
Prerequisites and co-requisites	Basis for electrical engineering and electrical instalation

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Practical exercise	50.0%	50.0%
Midterm colloquium	50.0%	50.0%

Recommended reading

Basic literature	1. S. Niestępski i in., Instalacje elektryczne - budowa, projektowanie i eksploatacja, Warszawa 2001. 2. Strojny J., Strzalka J.: Projektowanie urzadzen elektroenergetycznych. Uczelniane Wydawnictwo Naukowo-Dydaktyczne AGH, Krakow 2008. 3. Markiewicz H.: Urządzenia elektroenergetyczne. WNT, War-szawa 2008. 4. Ciok Z., Maksymiuk J. i inni: Badanie urządzeń elektroenergetycznych. WNT, Warszawa 1992. 5. Praca zbiorowa (red. Kujszczyk S.): Elektroenergetyczne sieci rozdzielcze, Tom 1. I 2. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2004.
Supplementary literature	1. Markiewicz H.: Instalacje elektryczne. WNT, Warszawa 2007. Musiał E.: Instalacje i urządzenia elektroenergetyczne. WSiP, Warszawa 2008. 2. Winkler W., Wiszniewski A.: Automatyka zabezpieczeniowa w systemach elektroenergetycznych. WNT, Warszawa 2004. 3. Kowalik R., Januszewski M., Smolarczyk A.:Cyfrowa elektroenergetyczna automatyka zabezpieczeniowa. Oficyna Wydawn. Politechniki Warszawskiej, Warszawa 2006. 4. D. Karkosiński, Nowe trendy w budowie automatycznych urzadzeń przelaczajacych SZR/SPP niskiego napiecia. Gdanskie Dni Elektryki SEP 2008. 5. Lakervi E., Holmes E.J.: Electricity Distribution Network Design. 2nd Edition. London 2007.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	1. What color should the drive enable button be? And what is the illuminated drive enable button, in which the backlight indicates the drive operation? 2. YAKy 4x 70 mm2 cable laid in the ground should be extended with YKY cable. What is the smallest cross-section of each wire of this cable? How to connect the wires of both cables? 3. What does the symbol YKYFty 0.6 / 1kV 3x35SM / 16RE mean? 4. What does the symbol YKSLY 15x2.5 nr mean? 5. Show the diagram of the main GWP circuit breaker realized with the use of the shunt release of the power circuit breaker and two remote hand buttons. 6. Show the diagram of the main GWP circuit breaker, realized with the use of the undervoltage release of the power switch and two remote hand buttons. 7. What phenomenon limits the maximum length of contactor control circuits? Provide a method of eliminating the influence of this phenomenon. 8. What phenomena occurring in induction motors limit the time of supply switching realized by the ATS-ATS system? Give ways to eliminate the impact of this phenomenon. 9. Replace actuators of ATSE - ATS systems. How is the power supply of ATSE - SZR automatics realized? 10. Present the power and control diagram with passive electric interlocks of the ATS system consisting of Q1, Q2 and Q3 circuit breakers intended for operation with a hidden reserve. 11. Present the power and control diagram with active electric interlocks of the ATS system consisting of Q1, Q2 and Q3 circuit breakers intended for operation with a hidden reserve. 12. What power supplies are required for a 5-story building and which for a 20-story building? 13. In which facilities is a GWP fire main switch required? 14. List all possible states and positions of the 630A compact circuit breaker in the withdrawable version with the overload release and short-circuit release. 15. What color should be the insulation of the DC control circuit conductor and what should be the neutral conductor insulation of the power circuit? 16. What solutions are used to provide power to category III (high) reliability consumers? 17. What is the main difference between a circuit breaker and a circuit breaker? 18. What does it mean that circuit breakers are selective? Present an example of the current-time characteristics of a selective and non-selective circuit breaker. 19. When adapting the machine with inverter drive to the requirements of the Machinery Directive, the stop category should be changed from "0" to category "1". What additional apparatus or circuitry will be needed and what will be its function, assuming that braking will be performed by an inverter? When during a stop can the power to the drive be disconnected? 20. What is the difference between a category "1" and a category "2" emergency stop ?. Give an example of an emergency stop device according to category "2". 21. What is the difference between a construction project (BP) of an electrical installation and a technical design (PT) of an electrical installation? 22. What does the electrical drawing "201" show and what does "301"? 23. What is the difference in the equipment of the power supply system according to the first and second coordination? 24. What is the diversification of the ACB main contact mapping? 25. What are withdrawable circuit breakers used for? 26. What devices can be used to protect the motor against overload and which ones against part-phase power supply? 27. The motor with a rated power of 160kW is powered by a contactor with the following data: maximum rated power of the motor 160kW for the AC3 utility category and 440V voltage. As a result of the modernization of the operation diagram of the drive, frequent short-term engine switching (jogging) was introduced. Which category of use does the modernized drive fall into? What are the necessary changes to the contactor?
Work placement	Not applicable