



## Subject card

Subject name and code	Programmable Controllers, PG_00055958						
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				4.0	
Learning profile	general academic profile	Assessment form				exam	
Conducting unit	Department of Power Electronics and Electrical Machines -> Faculty of Electrical and Control Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Ireneusz Mosoń				
	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	15.0	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		6.0		49.0	100
Subject objectives	Acquisition by students basic knowledge about programmable controllers - their structure, principle of operation, implementation in control systems - and the skill of programming programmable controllers.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K6_W03] knows the basics of automation and automatic regulation, knows the principles of the selection of electrical devices, drive systems and their control		Student describes the role and functions that programmable controllers perform in automatic control systems. Analyses requirements of control tasks and creates control algorithms. Writes, debugs and tests programs of low and medium complexity for control of different objects, in particular in power engineering. Creates user functions and function blocks. Creates simple visualisation applications.			[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge	
	[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		Student describes types and structures of programmable controllers. Explains principle of programmable controller operation and principle of execution of the user program. Student selects programmable controllers for specific applications and knows how to design simple control systems with programmable controllers.			[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge	

Subject contents	<p>LECTURE Programmable controllers in control systems. Types, structure and principle of operation. Execution of the user program. Process image memory. Hardware characteristics. Fundamentals of programming. PN-EN 61131-3 standard. Programming model. Programming languages. Data types and declaration of variables. Program organisation units: programs, functions and function blocks. Creation of user functions and function blocks. Structuring of user programs. Factors of program quality. Networking programmable controllers (network structures, communication interfaces and transmission media, methods of media access control). Communication protocols in fieldbuses. Industrial Ethernet; protocols in industrial Ethernet. Design of programmable controllers based control systems. Selection of a programmable controller depending on an application. Realization of human - machine interface (HMI). LABORATORY Program for a conveyor control (I and II). Counting events, arithmetic and comparison functions. Implementation of the timer with time holding input. Control program of three pumps. Counting impulses with signalisation of the limit exceeded. Creation of a user function block. Programmable controllers operation in the network (master - active slave). PROJECT Creation of control programs (in IL, LD, FBD, ST and CFC languages) and their debugging with the use of program simulator (virtual controller). Creation of visualisation applications. Creation of control algorithms; grafical elements of the algorithms; SFC diagram. Description of chosen control object (preference : from power engineering). Creation and starting-up a control program with visualisation for the chosen object.</p>														
Prerequisites and co-requisites	Basic knowledge on electronics and digital technique.														
Assessment methods and criteria	<table border="1" data-bbox="448 551 1495 689"> <thead> <tr> <th data-bbox="448 551 794 584">Subject passing criteria</th> <th data-bbox="794 551 1141 584">Passing threshold</th> <th data-bbox="1141 551 1495 584">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 584 794 618">Project</td> <td data-bbox="794 584 1141 618">100.0%</td> <td data-bbox="1141 584 1495 618">30.0%</td> </tr> <tr> <td data-bbox="448 618 794 651">Laboratory</td> <td data-bbox="794 618 1141 651">80.0%</td> <td data-bbox="1141 618 1495 651">30.0%</td> </tr> <tr> <td data-bbox="448 651 794 689">Written exam or test</td> <td data-bbox="794 651 1141 689">50.0%</td> <td data-bbox="1141 651 1495 689">40.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Project	100.0%	30.0%	Laboratory	80.0%	30.0%	Written exam or test	50.0%	40.0%
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Recommended reading	<table border="1" data-bbox="448 696 1495 1686"> <tbody> <tr> <td data-bbox="448 696 794 1317">Basic literature</td> <td colspan="2" data-bbox="794 696 1495 1317"> <p>Kacprzak S.: Programowanie sterowników PLC zgodnie z normą IEC 61131-3 w praktyce. Wydawnictwo BTC, Legionowo, 2011.</p> <p>Kasprzyk J.: Programowanie sterowników przemysłowych. WNT, Warszawa, 2006.</p> <p>Mosoń I.: Programmable controllers - Part 1. Politechnika Gdańska, Gdańsk, 2010.</p> <p>Mosoń I.: Sterowniki programowalne - Część 2. Politechnika Gdańska, Gdańsk, 2010.</p> <p>PN-EN 61131-1: 2004. Sterowniki programowalne - Część 1: Postanowienia ogólne.</p> <p>PN-EN 61131-3: 2004. Sterowniki programowalne - Część 3: Języki programowania.</p> </td> </tr> <tr> <td data-bbox="448 1317 794 1686">Supplementary literature</td> <td colspan="2" data-bbox="794 1317 1495 1686"> <p>Gilewski T.: Szkoła programisty PLC. Sterowniki przemysłowe. Wydawnictwo Helion, Gliwice, 2017.</p> <p>Broel-Plater B.: Układy wykorzystujące sterowniki PLC. Projektowanie algorytmów sterowania. Wydawnictwo Naukowe PWN, Warszawa, 2009.</p> <p>Kwaśniewski J.: Sterowniki PLC w praktyce inżynierskiej. Wydawnictwo BTC, Legionowo, 2008.</p> </td> </tr> <tr> <td data-bbox="448 1686 794 1686">eResources addresses</td> <td colspan="2" data-bbox="794 1686 1495 1686"></td> </tr> </tbody> </table>			Basic literature	<p>Kacprzak S.: Programowanie sterowników PLC zgodnie z normą IEC 61131-3 w praktyce. Wydawnictwo BTC, Legionowo, 2011.</p> <p>Kasprzyk J.: Programowanie sterowników przemysłowych. WNT, Warszawa, 2006.</p> <p>Mosoń I.: Programmable controllers - Part 1. Politechnika Gdańska, Gdańsk, 2010.</p> <p>Mosoń I.: Sterowniki programowalne - Część 2. Politechnika Gdańska, Gdańsk, 2010.</p> <p>PN-EN 61131-1: 2004. Sterowniki programowalne - Część 1: Postanowienia ogólne.</p> <p>PN-EN 61131-3: 2004. Sterowniki programowalne - Część 3: Języki programowania.</p>		Supplementary literature	<p>Gilewski T.: Szkoła programisty PLC. Sterowniki przemysłowe. Wydawnictwo Helion, Gliwice, 2017.</p> <p>Broel-Plater B.: Układy wykorzystujące sterowniki PLC. Projektowanie algorytmów sterowania. Wydawnictwo Naukowe PWN, Warszawa, 2009.</p> <p>Kwaśniewski J.: Sterowniki PLC w praktyce inżynierskiej. Wydawnictwo BTC, Legionowo, 2008.</p>		eResources addresses					
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Example issues/ example questions/ tasks being completed	<p>Principle of operation of a programmable controller. What is the proces image memory and what are the advantages and disadvantages of its usage?</p> <p>Programming languages of programmable controllers. What are the differences between functions and function blocks?</p> <p>Network operation of programmable controllers; media access control methods.</p> <p>Writing, debugging and testing control programs of specified control objects with simple visualisations.</p>														
Work placement	Not applicable														