



Subject card

Subject name and code	Programmable Controllers, PG_00038103						
Field of study	Electrical Engineering						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2025/2026		
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			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	30.0	15.0	15.0	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		6.0		34.0	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_K01	Student understands how important is to widen permanently his knowledge and skills concerning programmable controllers and their applications. For this purpose he is able to use current technical documentations and publications.			[SK5] Assessment of ability to solve problems that arise in practice		
	K6_U07	Student selects programmable controllers for specific applications and knows how to design simple control systems with programmable controllers. Student analyses requirements of control tasks and creates control algorithms. Writes, debugs and tests programs of low and middle complexity for control of different control objects. Creates user functions and function blocks. Creates simple visualisation applications.			[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment		
	K6_W08	Student describes types and structures of programmable controllers. Explains principle of programmable controller operation and principle of execution of the user program. Student describes the role and functions that programmable controllers perform in automatic control systems.			[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. Interaction with a controlled process. Digital, analog and special input/output circuits. Fundamentals of programming. PN-EN 61131-3 standard. Programming model. Programming languages. Data types and declaration of variables. Addressing. Program organization units - programs, functions and function blocks. Creation of user functions and function blocks. Structuring of user programs. Factors of a program quality. Networking programmable controllers. Network structures. Communication interfaces and transmission media. Methods of media access control. Communication protocols (Suconet K, Modbus RTU, Profibus DP, AS-i). Industrial Ethernet (protocols: Modbus TCP, Powerlink, Profinet). Design of programmable controllers based control systems. Selection of a programmable controller depending on an application. Realization of a human - machine interface (HMI). SCADA programs.</p> <p>TUTORIALS Number systems used in programmable controllers. Data types and functions of their conversion. Creation of control algorithms; graphical elements of the algorithms. Programming software Easy soft CoDeSys. Creation of control programs (in IL, LD, FBD, ST, CFC languages) and their debugging with the use of program simulator (virtual controller). Creation of visualisation applications. Programming of control of sequential processes in SFC language.</p> <p>LABORATORY Programming software Sucosoft S40 (structure; configuring control systems; editing, debugging, testing and documenting programs). Program for a conveyor control - I and II. Conversion functions and arithmetic operators. Counting events and compiler options. Creation of the user function block. Modifying programs and changing variable values in On-line mode. Programming PS4-200 and PS4-150 series controllers in the network (master - active slave).</p>														
Prerequisites and co-requisites	Basic knowledge on electronics and digital technique.														
Assessment methods and criteria	<table border="1" data-bbox="448 642 1487 786"> <thead> <tr> <th data-bbox="448 642 794 678">Subject passing criteria</th> <th data-bbox="794 642 1141 678">Passing threshold</th> <th data-bbox="1141 642 1487 678">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 678 794 714">Written exam</td> <td data-bbox="794 678 1141 714">50.0%</td> <td data-bbox="1141 678 1487 714">40.0%</td> </tr> <tr> <td data-bbox="448 714 794 750">Laboratory</td> <td data-bbox="794 714 1141 750">80.0%</td> <td data-bbox="1141 714 1487 750">30.0%</td> </tr> <tr> <td data-bbox="448 750 794 786">Practical exercise</td> <td data-bbox="794 750 1141 786">60.0%</td> <td data-bbox="1141 750 1487 786">30.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Written exam	50.0%	40.0%	Laboratory	80.0%	30.0%	Practical exercise	60.0%	30.0%
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Written exam	50.0%	40.0%													
Laboratory	80.0%	30.0%													
Practical exercise	60.0%	30.0%													
Recommended reading	Basic literature	<ol style="list-style-type: none"> 1. Kacprzak S.: Programowanie sterowników PLC zgodnie z normą IEC 61131-3 w praktyce. Wyd. BTC, Legionowo, 2011. 2. Kasprzyk J.: Programowanie sterowników przemysłowych. WNT, Warszawa, 2006. 3. Kwaśniewski J.: Sterowniki PLC w praktyce inżynierskiej. Wyd. BTC, Legionowo, 2008. 4. Brok S., Muszyński R., Urbański K., Zawirski K.: Sterowniki programowalne. Wyd. Politechniki Poznańskiej, Poznań, 2000. 5. Mosoń I.: Sterowniki programowalne - Część 1 (ang.). Politechnika Gdańska, Gdańsk, 2010. 6. Mosoń I.: Sterowniki programowalne - Część 2. Politechnika Gdańska, Gdańsk, 2010. 													
	Supplementary literature	<ol style="list-style-type: none"> 1. Legierski T., Kasprzyk J., Hajda J., Wyrwał J.: Programowanie sterowników PLC. Wyd. Pracowni Komputerowej Jacka Skalmierskiego, Gliwice, 1998. 2. Ruda A., Olesiński R.: Sterowniki programowalne PLC. Wyd. COSIW SEP, Warszawa, 2003. 3. Pietruszewicz K., Dworak P.: Programowalne sterowniki automatyki PAK. Wyd. Nakom, Poznań, 2007. 													
	eResources addresses	Adresy na platformie eNauczanie:													
Example issues/ example questions/ tasks being completed	<p>Principle of operation of a programmable controller. What is the process 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.</p> <p>Writing, debugging and testing control programs of specified control objects with simple visualisations.</p>														
Work placement	Not applicable														