GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	PROGRAMMABLE CONTROLLERS, PG_00053202		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study 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	5	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Intelligent and Decision Support Systems -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jarosław Tarnawski	
	Teachers		

Lesson types

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

Understanding of the tasks, functions and location of PLC in the control system. Knowledge of PLC programming methods. Practical programming skills in ladder language and structured text. Ability to implement basic control algorithms in PLC. Understanding the principles of implementing more complex control algorithms. Ability to design and implement PLC cooperation with the SCADA system using dedicated and unified OPC communication servers. Using PLC to work in the loop (Hardware-in-the-loop), including connecting a physical object or real-time system.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U05] can use analytical and simulation methods to solve tasks in the field of automation and robotics and use various techniques to carry out engineering tasks related to automation and robotics devices and systems	The student is able to build a control system in the so-called hardware loop with the simulated object, PLC and SCADA system.	[SU5] Assessment of ability to present the results of task
[K6_W06] knows the structure of computers and microprocessors and the tasks of operating systems, has basic knowledge of the basics of computer software, drivers, microprocessor technology, design of simple algorithms and the operation of information networks	The student knows the structure of a PLC and is able to select the right PLC for the automation task. The student is able to include this device in the control system, configure and program it.	[SW1] Assessment of factual knowledge
[K6_K02] can work in a group taking on different roles in it	Working in a group, students acquire leader and subordinate skills.	[SK1] Assessment of group work skills

<table>
<tr><td>Subject contents</td><td>Course content – lecture
Control structures and the place of PLC in these structures.
Historical outline of the creation of PLCs replacing contactor-relay control systems.
Main features and requirements for PLC: reliability, flexibility, ease and programming capabilities, scalability, communication capabilities.
IEC-1131 and EN61131 standards.
Principle of operation of PLC. Duty cycle. PLC as devices that meet the real-time requirement.
Issues in the selection of PLC for the task of automating the technological process.
PLC programming methods, languages: ladder, instruction list, sequential function diagrams, function block diagrams, structured text.
Control and regulation algorithms in PLC. Embedded algorithms, methods of program implementation of simple control and regulation methods. Methods of implementing selected discrete control algorithms.
Communication issues in PLC: data exchange between controllers, data exchange with other elements of the control structure.
Limitations on the applicability of PLC.
PLC cooperation with supervisory control systems, SCADA data acquisition systems and databases using the universal OPC data exchange method.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Completed courses: Real-time systems, Industrial IT networks</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Oral theoretical examination</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>Laboratory assessment</td><td>50.0%</td><td>50.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. Legierski T., Kasprzyk J., Wyrwał J., Hajda J.: Programowanie sterowników PLC, Wydawnictwo Pracowni Komputerowej Jacka Skalmierskiego, Gliwice, 1998
2. Kwaśniewski J.: Programowalne sterowniki przemysłowe w systemach sterowania, ZP Roma-Pol, 1999
3. Pasierbński J., Legierski T.: Programowanie sterowników PLC, Wydawnictwo Pracowni Komputerowej Jacka Skalmierskiego,1998
4. Kasprzyk J.: Programowanie sterowników przemysłowych, WNT, 2013</td></tr>
<tr><td>Supplementary literature</td><td>5. Tatjewski P.: Sterowanie zaawansowane obiektów przemysłowych, Akademicka Oficyna Wydawnicza EXIT, 2002
6. Grega W., Metody i algorytmy sterowania cyfrowego w układach scentralizowanych i rozproszonych, Wydawnictwo AGH, 2004
7. Broel-Plater Bogdan, Układy wykorzystujące sterowniki PLC, PWN, 2015
8. Kwaśniewski J., Sterowniki PLC w praktyce inżynierskiej, btc, 2008</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Design and build a control system using PLC for a selected laboratory facility</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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