GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Programmable controlers, PG_00058358		
Field of study	Hydrogen Technologies and Electromobility		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
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	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department Of Intelligent And Decision Support Systems -> Faculty Of Electrical And Control Engineering -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Jarosław Tarnawski	
	Teachers		

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	0.0	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	4.0	26.0	75

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_U07] can build and analyze models of systems and systems in the field related to hydrogen devices and installations as well as control and automation systems	The student is able to build a control system in the so-called hardware loop with the simulated object, PLC and SCADA system.	[SU4] Assessment of ability to use methods and tools
[K6_K04] can react in abnormal and emergency situations, threats to health and life when using automation and robotics components and systems in hydrogen devices and installations	The student knows the principles of PLC self-diagnosis. The student is able to take into account emergency states in the control system.	[SK5] Assessment of ability to solve problems that arise in practice
[K6_W07] knows the basics of computer programming, digital circuits, microprocessor technology, design of simple algorithms, principles of operation of computer networks	The student is able to build and program a distributed network control system.	[SW1] Assessment of factual knowledge
[K6_W14] knows and understands at an advanced level the principles, methods and techniques of programming and the principles of creating computer software or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, as well as the organization of the work of systems using computers or these devices	The student is able to program PLC in LD and ST languages. The student knows the benefits of creating hybrid programs. The student knows the principles of programming in IL, FBD and SFC languages.	[SW1] Assessment of factual knowledge

Subject contents

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.

Prerequisites and co-requisites

Knowledge of computer and microcontroller programming methods

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory assessment	50.0%	50.0%
Oral theoretical examination	50.0%	50.0%

Recommended reading

Basic literature	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
Supplementary literature	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
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed

Design and build a control system using PLC for a selected laboratory facility

Work placement

Not applicable

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