GDAŃSK UNIVERSITY OF TECHNOLOGY

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 2023	Academic year of realisation of subject	2025/2026
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. Wrires, 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	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 excided. 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.
Prerequisites and co-requisites	Basic knowledge on electronics and digital technique.

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written exam or test	50.0%	40.0%
	Laboratory	80.0%	30.0%
	Project	100.0%	30.0%

Recommended reading	Basic literature	Kacprzak S.: Programowanie sterowników PLC zgodnie z normą IEC 61131-3 w praktyce. Wydawnictwo BTC, Legionowo, 2011.
		Kasprzyk J.: Programowanie sterowników przemysłowych. WNT, Warszawa, 2006.
		Mosoń I.: Programmable controllers - Part 1. Politechnika Gdańska, Gdańsk, 2010.
		Mosoń I.: Sterowniki programowalne - Część 2. Politechnika Gdańska, Gdańsk, 2010.
		PN-EN 61131-1: 2004. Sterowniki programowalne - Część 1: Postanowienia ogólne.
		PN-EN 61131-3: 2004. Sterowniki programowalne - Część 3: Języki programowania.
	Supplementary literature	Gilewski T.: Szkoła programisty PLC. Sterowniki przemysłowe. Wydawnictwo Helion, Gliwice, 2017.
		Broel-Plater B.: Układy wykorzystujące sterowniki PLC. Projektowanie algorytmów sterowania. Wydawnictwo Naukowe PWN, Warszawa, 2009.
		Kwaśniewski J.: Sterowniki PLC w praktyce inżynierskiej. Wydawnictwo BTC, Legionowo, 2008.
	eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	Principle of operation of a programmable controller. What is the proces image memory and what are the advantages and disadvantages of its usage?
	Programming languages of programmable controllers. What are the differences betwen functions and function blocks?
	Network operation of programmable controllers; media access control methods.
	Writing, debugging and testing control programs of specified control objects with simple visualisations.
Work placement	Not applicable