GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Computer Control Systems, PG_00038129		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2024/2025
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	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Faculty Of Electrical And Control Engineering -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Jarosław Tarnawski	
	Teachers	dr inż. Jarosław Tarnawski	

Lesson types and methods of instruction

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	8.0	57.0	125

Subject objectives

The aim of the subject is to integrate knowledge from various fields and previously completed subjects for the purpose of synthesis of a computer control system. The student will learn about the aspects of implementing a control system in a centralized and distributed version. The student will implement a hierarchical control system consisting of direct, supervisory and optimizing layers. The student will learn about the advanced industrial control infrastructure in the form of a DCS system. The student will acquire practical skills in the field of decision support - multi-objective and multi-attribute approaches.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_K02] can work in a group taking on different roles in it	During laboratory classes on the synthesis of advanced control system performs tasks in groups by changing roles within the team.	[SK2] Assessment of progress of work
[K6_W07] has basic knowledge related to control and automation systems	Defines the role of all necessary system elements and synthesizes the control system.	[SW1] Assessment of factual knowledge
[K6_U07] can build and analyze models of systems and systems in the field related to control systems and automation	Implements an advanced computer control system using industrial infrastructure.	[SU5] Assessment of ability to present the results of task

Subject contents	LECTURE Control system structures: classic, multi-layer, centralized, distributed. Tasks and requirements for a computer control system (CCS). Information structure of CCS. Selection of tools and methods for practical implementation of individual control structures. Implementation issues of selected complex control algorithms and direct control algorithms in computer devices: programmable logic controllers, programmable automation controllers, industrial computers. LABORATORY Implementation of a distributed control system without information exchange and with information exchange, taking into account communication issues. Implementation of a SCADA system - supervisory control taking into account, among others, coordination of the work of all control layers. Acquisition and archiving of process data. Implementation of the optimizing layer using optimizers from the Matlab/Simulink package.
Prerequisites and co-requisites	Finished courses: - Dynamic Systems - Real Time Systems - Programmable Logic Controllers - Industrial Communication Networks

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Practical exercise	50.0%	30.0%
Written exam	50.0%	40.0%
Midterm colloquium	50.0%	30.0%

Recommended reading

Basic literature	National Institute of Standards and Technology, Guide to Industrial Control Systems (ICS) Security - Supervisory Control and Data Acquisition (SCADA) systems, Distributed Control Systems (DCS), and ... such as Programmable Logic Controllers (PLC), CreateSpace Independent Publishing Platform, 2013 Astrom K., Wittenmark B., Computer-Controlled Systems: Theory and Design, Dover Publications, 2011 Efim N. Rosenwasser, Bernhard P. Lampe, Computer Controlled Systems: Analysis and Design with Process-orientated Models (Communications and Control Engineering), Springer, 2012 Korbicz J., Kościelny J., Modelowanie, diagnostyka i sterowanie nadrzędne procesami Implementacja w systemie DiaSter, WNT, 2009 Tatjewski P. Sterowanie zaawansowane obiektów przemysłowych, Akademicka Oficyna Wydawnicza EXIT, 2002 Grega W. Metody i algorytmy sterowania cyfrowego w układach scentralizowanych i rozproszonych, Wydawnictwo AGH, 2004
Supplementary literature	Tyson-Macaulay, Cybersecurity for Industrial Control Systems: SCADA, DCS, PLC, HMI, and SIS, Auerbach Publications; 1st edition, 2016 Trybus L. Regulatory wielofunkcyjne, WNT, 1992 Niederliński A. Systemy komputerowe automatyki przemysłowej, tom 1, Sprzęt i oprogramowanie, WNT, 1984. Niederliński A. Systemy komputerowe automatyki przemysłowej, tom 2, Zastosowania, WNT, 1985.

	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	What are the differences between a centralized and distributed control system? List the main features and advantages of predictive control. State the differences between direct and indirect adaptive control. Present the structure of a hierarchical control system and define the tasks of each layer. What is the AHP method used for? What are the principles of control system design?	
Work placement	Not applicable	

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