GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Industrial Computer Networks, PG_00038099		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2022/2023
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	2	Language of instruction	Polish
Semester of study	4	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Control Systems Engineering -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Jarosław Tarnawski	
	Teachers	dr inż. Jarosław Tarnawski mgr inż. Tomasz Karla	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	0.0	30

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	30	2.0	18.0	50

Subject objectives

Understanding of importance of communication in control systems. Knowledge of industrial conditions and requirements for industrial communication devices. Knowledge of media (transmission channels) and hardware for industrial networks. Understanding of importance of real-time transmission and real-time media access. Redundant methods of increasing reliability in industrial networks. Practical skills in wired and wireless communication. Skills in security of computer networks and access authorization.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_W06	The student knows the individual elements of the control system, can use them and communicate using IT networks.	[SW1] Assessment of factual knowledge
K6_U05	The student is able to build an information exchange flow for the synthesis of the control system	[SU1] Assessment of task fulfilment
K6_K02	The student is able to work in a group to communicate a dozen or so devices and build a distributed control system.	[SK2] Assessment of progress of work
K6_W09	The student knows the basic security methods in PSI issues.	[SW1] Assessment of factual knowledge

Subject contents

The information structure of the control systems. Importance of communication in automation. Requirements for industrial communication devices. Basic ideas of industrial fieldbus. Norm IEC 61158 and IEC 61784. Transmission channels: copper cables (2 wires, coaxial, twisted), fiber cable, radio waves. Serial communications and applications (RS232, RS422, RS485). Routers and managed switches as basic industrial network infrastructure. Network topologies (bus, ring, star, tree, mesh) also with redundancy. Medium access mechanisms. Real-time medium access requirement as the important factor in control systems. Ethernet as native non-industrial network and mechanisms of improvements for Ethernet industrial applications. Profibus as the example of real-time industrial network. CAN, EIB and LonWorks general-purpose industrial networks. Wireless networking radiomodems, WiFi, Bluetooth, ZigBee. Communication protocols. Modbus as the typical protocol in control systems. OPC as modern, unified automation communications data exchange system. Network and protocol tunneling. Virtual private networks. Network security methods of hardware and software protection of industrial networks.

Prerequisites and co-requisites

Computer Networks and Internet Technologies

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Practical exercise	50.0%	50.0%
	Colloquium	50.0%	50.0%
Recommended reading	Basic literature	Douglas E. Comer, Sieci komputerowe i intersieci, WNT, 2000 Andrew Tanenbaum, Sieci komputerowe, Helion, 2004 Krzysztof Nowicki, Ethernet sieci, mechanizmy, Infotech, 2006 Kwiecień Andrzej, Analiza przepływu informacji w komputerowych sieciach przemysłowych, Pracownia Komputerowa Jacka Skalmierskiego, 2004 Włodzimierz Solnik, Zbigniew Zajda, Komputerowe sieci przemysłowe Profibus DP i MPI, Oficyna Wydawnicza Politechniki Wrocławskiej, 2007	
	Supplementary literature	Rafał Pawlak, Okablowanie strukturalne sieci, Helion, 2006 Pendergast, Brekke, Modemy, Mikom, 1996 Mielczarek, Szeregowe interfejsy cyfrowe, Helion, 1993	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	1 Make a comparison of communication interfaces RS232C and RS485. 2 Characterize the types and features of Profibus network. 3 Specify industrial version of Ethernet 4 Specify the types and characteristics of OPC communication technology. 5 List and describe the mechanisms for protection against transmission errors in the CAN network. 6 Describe the wireless communication technologies, depending on the range. 7 Describe data exchange model (with figures of frames) in the MODBUS protocol.		
Work placement	Not applicable		