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 2022	Academic year of realisation of subject	2023/2024
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		

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_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 an information exchange flow for the synthesis of the control system	[SU1] Assessment of task fulfilment
[K6_W09] has knowledge in the field of security of ICT systems and networks	The student knows the basic security methods in PSI issues.	[SW1] Assessment of factual knowledge
[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 individual elements of the control system, can use them and communicate using IT networks.	[SW1] Assessment of factual knowledge
[K6_K02] can work in a group taking on different roles in it	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

<table>
<tr><td>Subject contents</td><td>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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Computer Networks and Internet Technologies</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>Colloquium</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>Practical exercise</td><td>50.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>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</td></tr>
<tr><td>Supplementary literature</td><td>Rafał Pawlak, Okablowanie strukturalne sieci, Helion, 2006 Pendergast, Brekke, Modemy, Mikom, 1996 Mielczarek, Szeregowe interfejsy cyfrowe, Helion, 1993</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>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.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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