



Subject card

Subject name and code	Network Programming, PG_00016975						
Field of study	PROGRAMOWANIE SIECIOWE						
Date of commencement of studies	February 2025		Academic year of realisation of subject		2025/2026		
Education level	second-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	1		Language of instruction		Polish		
Semester of study	2		ECTS credits		3.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Electric Drives and Energy Conversion -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Piotr Kołodziejek				
	Teachers						
Lesson types	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						
	eNauczanie source address: https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33809						
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		7.0		38.0	75
Subject objectives	Definitions and topics in computer networks, types of transmission, network topologies, network protocol stack, TCP/IP, network addressing, ports, network socket interface, network configuration and diagnostics, client-server communication architecture, event-driven programming, multithreaded data transmission programming, prioritization of data transmission and client handling, introduction to basic cryptographic algorithms, network communication in industrial applications using dedicated client-server applications, network communication through a web browser with a server application, Modbus TCP protocol for industrial communication, communication protocols in power systems, and IoT communication principles in smart electrical grids (Smart Grid).						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_U12] can program and implement network applications with typical protocols		The student describes the differences in application programming and their properties when using the TCP and UDP protocols.		[SU1] Ocena realizacji zadania		
	[K7_K02] can interact and work in a group assuming various roles and identify priorities for the achievement of a specific task		The student explains the sequences functions called in the application client and server to establish communication with the use of connection protocol with transmission control and no control transmission.		[SK5] Ocena umiejętności rozwiązywania problemów występujących w praktyce		
	[K7_W02] has a structured knowledge of the application of information systems to improve the reliability, efficiency, speed and mobility of control and management systems		Can work in group taking different roles in it. The student explains phases of the network application project design.		[SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym		

Subject contents	Course content – lecture Definitions and topics in computer networks, types of transmission, network topologies, network protocol stack, TCP/IP, network addressing, ports, network socket interface, network configuration and diagnostics, client-server communication architecture, event-driven programming, multithreaded data transmission programming, prioritization of data transmission and client handling, introduction to basic cryptographic algorithms, network communication in industrial applications using dedicated client-server applications, network communication through a web browser with a server application, Modbus TCP protocol for industrial communication, communication protocols in power systems, and IoT communication principles in smart electrical grids (Smart Grid). Course content – laboratory Exercise 1. Introduction to Network Communication TCP/IP Basics Basic networking terms (IP addressing, ports, TCP and UDP protocols). Connection configuration, frame analysis with Wireshark, launching a simple TCP server and TCP client (Python, C, Visual C++). Exercise 2. TCP and UDP Socket Programming in ANSI C TCP and UDP properties. Tests. Exercise 3. TCP and UDP Socket Programming in Python Exercise 4. TCP and UDP Socket Programming in C++ Exercise 5. Simulation of Measuring AMI Meter Parameters over a Network Exercise 6. Remote Control over the Network TCP server controlling an actuator (e.g., a relay) using a microcontroller with Ethernet or a Raspberry Pi, and a client application sending commands from a PC. Network Application Project		
Prerequisites and co-requisites	Basic knowledge on computer networks and C/C++ programming.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lectures colloquium	50.0%	50.0%
	Laboratory tasks and project	100.0%	50.0%
Recommended reading	Basic literature	1. Sosinsky Barrie: Sieci komputerowe - Biblia, Helion, 2011. 2. A. Sopala: Pisanie programów internetowych, Mikom, 2000. 3. A. Jones, J. Ohlund Programowanie sieciowe Microsoft Windows, RM, 2000. 4. Eckel Bruce, Thinking in Java., IV edition 5. Beej's Guide to Network Programming Using Internet Sockets: http://beej.us/guide/bgnet/ 6. Andrew S. Tanenbaum, David J. Wetherall <i>Computer Networks</i>, 5th Edition, Pearson, 2011 7. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff <i>Unix Network Programming: The Sockets Networking API</i>, Volume 1, 3rd Edition, Addison-Wesley, 2003 8. Olivier Hersent, David Boswarthick, Omar Elloumi <i>The Internet of Things: Key Applications and Protocols</i>, 2nd Edition, Wiley, 2012. 9. Jan Axelson <i>Ethernet: The Definitive Guide to Industrial Networking</i>, Newnes, 2020. 10. John S. Rinaldi <i>Modbus: The Everyman's Guide to Modbus</i>, Real Time Automation, 2015. 11. James Northcote-Green, Robert G. Wilson <i>Control and Automation of Electrical Power Distribution Systems</i>, CRC Press, 2007. 12. Stephen Blume <i>Electric Power System Basics for the Nonelectrical Professional</i>, 2nd Edition, Wiley-IEEE Press, 2016. 13. S.G. Srivani <i>Smart Grid: Technology and Applications</i>, Wiley, 2015. 14. <i>Modbus Application Protocol Specification</i>, Modbus Organization, https://modbus.org. 15. <i>IEEE 2030 Standard for Smart Grid Interoperability of Energy Technology and Information Technology Operation with the Electric Power System (EPS)</i>, IEEE, 2011. 16. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff <i>Unix Network Programming: The Sockets Networking API</i>, Volume 1, 3rd Edition, Addison-Wesley, 2003.	
	Supplementary literature		
	eResources addresses		

Example issues/ example questions/ tasks being completed	Event programming of client-server applications in a natural prototyping environment, application of connection and connectionless network sockets, design of a multi-threaded "server" application to support network communication with basic "client" applications and a web browser, design of a virtual measuring instrument for monitoring selected industrial processes.
Practical activities within the subject	Not applicable

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