Bialystok University of Technology
Faculty of Electrical Engineering

Field of study	**Industry Digitization**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Automatic control**							Course code	**CP1S04001**
								Course type	**obligatory**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**4**
	30		**30**					No. of ECTS credits	**6**
Entry requirements	Fundamentals of control								
Course objectives	Acquainting with the description and analysis methods of discrete control systems. Methods of implementation of digital control algorithms. Acquainting with modern automation components used in control systems.								
Course content	Lecture: Structure of a discrete automatic control system. Methods of determining a discrete analog of a continuous model. Discrete controllers, their implementation and tuning. Hardware controlled implementation of digital algorithms. Automatic control components in digital control systems. The role of sensors, measuring transducers and actuators in control systems. Static and dynamic properties of sensors and actuators. Principles of selection of automatic control devices. Laboratory classes: Continuous and discrete automatic control system. Sampling period and tuning of the discrete controller. Industrial controllers. Programmable logic controller (PLC) as a PID controller. Testing of industrial sensors, measuring transducers and actuators. Testing of automatic control systems for selected industrial processes.								
Teaching methods	Informative-problem lecture; Laboratory classes;								
Assessment method	Lecture: exam Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes								

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
	Knowledge: the graduate knows and understands	
LO1	advanced concepts of automatic control	CP1_W01
LO2	principles of implementation of digital control algorithms	CP1_W07
	Skills: the graduate is able to	
LO4	tune parameters of the controller	CP1_U06
LO5	design and run a digital control system	CP1_U08
LO6	apply principles of occupational health and safety in laboratory	CP1_U13

LO6	classes	
Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	Lecture: exam;	W
LO2	Lecture: exam;	W
LO4	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L
LO5	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L
LO6	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L
Student workload (in hours)		No. of hours
Calculation	Lecture attendance	30
	Laboratory classes attendance	30
	Preparation for the lecture exam; participation in the exam	44
	Preparation for laboratory classes	35
	Preparation for laboratory classes completion	6
	Participation in teacher-student sessions related to the module subject	5
	TOTAL	150

Quantitative indicators	Hours	ECTS
Student workload - activities that require direct teacher participation	67	2,7
Student workload - practical activities	76	3

Basic references	1. Kaczorek T., Dzieliński A., Dąbrowski W., Łopatka R., Podstawy teorii sterowania. WNT, Warszawa 2005. 2. Krzysztoszek K., Luft M., Pietruszczak D.. Podsiadły D., Zadania projektowe z teorii sterowania, cz. II. Układy wielowymiarowe, liniowe układy impulsowe, nieliniowe układy sterowania. Wyd. Polit. Radomskiej, Radom 2007. 3. Paraskevopoulos P. N., Digital Control Systems. Prentice Hall, 1996.
Supplementary references	1. Levine W. S., Control system fundamentals, Taylor & Francis, 2011.

Organisational unit conducting the course	Department of Automatic Control and Robotics	Date of issuing the programme
Author of the programme	dr hab. inż. Łukasz Sajewski, prof. PB	2022-06-07

Bialystok University of Technology
Faculty of Electrical Engineering

Field of study	**Industry Digitization**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Fluid drive systems**							Course code	**CP1S04002**
								Course type	**obligatory**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**4**
	15		**30**					No. of ECTS credits	**3**
Entry requirements	Mechanical components and subsystems								
Course objectives	Acquainting with basic concepts of hydraulic and pneumatic drive and control. Acquainting with graphic symbols of basic hydraulic and pneumatic elements used to build drive systems. Teaching principles of reading and understanding hydraulic and pneumatic diagrams of machines and technological devices as well as industrial automation systems. Teaching the basics of designing and practical building of drive and control systems of technological processes consisting of unified elements, acquiring the ability to operate them.								
Course content	Lecture: Basic concepts related to pneumatic and hydraulic fluid drives. Classification of fluid drives. Graphic symbols for hydraulic, pneumatic and mixed elements. Principles of reading and developing diagrams of pneumatic and hydraulic drive and control systems. Application areas and properties of the transmission medium. Generation, preparation and transmission of the medium. Pneumatic and hydraulic elements used in drive and control systems (pumps, valves, distributors, fluid preparation stations, etc.). Pneumatic actuators - cylinders and rotary actuators. Examples of industrial pneumatic drive and control systems. Directions of development of fluid drives. Laboratory classes: Basic pneumatic manual control systems, control systems enabling the change of piston movement parameters, implementation of pneumatic sequential control systems, structure and operation of the hydraulic system. Determination of the characteristics of the pump unit - overflow valve.								
Teaching methods	Informative-problem lecture; Laboratory classes;								
Assessment method	Lecture: one test Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes								

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
	Knowledge: the graduate knows and understands	
LO1	basic components of hydraulic/pneumatic drive/control systems	CP1_W03

LO1	basic components of hydraulic/pneumatic drive/control systems	
LO2	schematic diagrams of hydraulic/pneumatic control/drive systems	CP1_W03
LO3	graphic symbols of pneumatic/hydraulic components	CP1_W03
	Skills: the graduate is able to	
LO4	design and test a simple pneumatic system	CP1_U01
LO5	draw up a correct diagram of the tested pneumatic system	CP1_U03
LO6	apply principles of occupational health and safety in laboratory classes	CP1_U13
	Social competences: the graduate is ready to	
LO7	self-education and raising qualifications	CP1_K01
LO8	design pneumatic systems in a planned manner	CP1_K03

Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	Lecture: one test;	W
LO2	Lecture: one test;	W
LO3	Lecture: one test;	W
LO4	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L
LO5	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L
LO6	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L
LO7	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L
LO8	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L

Student workload (in hours)		No. of hours
Calculation	Lecture attendance	15
	Laboratory classes attendance	30
	Preparation for lecture test(s)	10
	Preparation for laboratory classes	9
	Preparation for laboratory classes completion	6
	Participation in teacher-student sessions related to the module subject	5
	TOTAL	75

Quantitative indicators	Hours	ECTS
Student workload - activities that require direct teacher participation	50	2
Student workload - practical activities	50	2

1. Szenajch W., Napęd i sterowanie pneumatyczne, WNT, Warszawa 1997.
2. Podręcznik firmy SMC Industrial Automation Polska: Sprężone powietrze i jego zastosowanie. Wydanie 3 poprawione.

Basic references	3. Siemieniako F., Karpovich S., Huścio T., Dajniak I., Ćwiczenia z automatyki. Napęd i sterowanie pneumatyczne, Wydawnictwo Politechniki Białostockiej, Białystok 2004. 4. Kotnis G., Budowa i eksploatacja układów hydraulicznych w maszynach, Wydawnictwo KaBe, Krosno 2011. 5. Huścio T., Kulesza Z., Kuźmierowski T., Siemieniako F. (red.), Napędy i sterowanie pneumatyczne, Wydawnictwa Politechniki Białostockiej, Białystok 2013.	
Supplementary references	1. Dindorf R., Napędy płynowe. Podstawy teoretyczne i metody obliczania napędów hydrostatycznych i pneumatycznych, Wydawnictwo Politechniki Świętokrzyskiej, 2009. 2. Milanowski J., Kiczkowiak T., Pneumatyczne układy sterowniczo – napędowe, Wydawnictwa Politechniki Koszalińskiej, Koszalin 1991. 3. Szenajch W., Pneumatyczne i hydrauliczne manipulatory przemysłowe, WNT, Warszawa 1992. 4. Osiecki A., Hydrostatyczny napęd maszyn, WN-T, Warszawa, 2004. 5. Norma PN-ISO 1219-2: 1998 – Napędy i sterowania hydrauliczne i pneumatyczne – Symbole graficzne i schematy układów.	
Organisational unit conducting the course	Department of Automatic Control and Robotics	Date of issuing the programme
Author of the programme	dr inż. Adam Kotowski	2022-06-07

Bialystok University of Technology
Faculty of Electrical Engineering

Field of study	**Industry Digitization**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Electric drive systems**							Course code	**CP1S04003**
								Course type	**obligatory**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**4**
	15		**30**					No. of ECTS credits	**3**
Entry requirements	Electronics components and subsystems								
Course objectives	Gaining knowledge in the field of structure and principles of operation of selected electric drive systems with DC motors, single and three-phase AC motors and stepper motors. Acquiring the ability to carry out basic calculations related to drives and their selection, determining the operating point and basic parameters of the selected drive system. Acquiring the ability to connect, start, test and measure the characteristics of simple drive systems. Acquisition of computer simulations of the characteristics of electromechanical drive systems with DC and AC motors.								
Course content	Lecture: Categorization, properties and application of electric drives. Electric drive systems - basic definitions, components, areas of application. Electrical equipment and protection of drive systems. Feedback, shaping mechanical characteristics of engines. Starting, adjusting the angular speed and braking the DC motor, three-phase AC motor. DC motor converter (block diagrams, operating principle, properties and applications). Frequency control of rotational speed of selected AC motors. Digital-analog speed/position control systems. Position control systems with stepper motors and servo drives. Linear drives. Selection of electric motors for working machines. Laboratory classes: Calculations of a fixed operating point and basic parameters of a drive system with a separately excited DC machine and asynchronous machines. Determination of electromechanical characteristics of converter drive systems with DC machines and asynchronous three-phase AC machines. Carrying out computer simulations of these systems.								
Teaching methods	Informative-problem lecture; Laboratory classes;								
Assessment method	Lecture: one test Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes								

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
	Knowledge: the graduate knows and understands	

LO1	mechanical characteristics of electric motors and working machines	CP1_W05
LO2	methods of speed control in selected DC/AC motor drive systems	CP1_W02
	Skills: the graduate is able to	
LO4	conduct tests and discuss the operation of the tested drive system; take measurements of electrical and mechanical quantities and correctly present the results and draw appropriate conclusions based on them	CP1_U01 CP1_U08 CP1_U11
LO5	conduct computer simulations of simple drive systems	CP1_U06 CP1_U11
LO6	apply principles of occupational health and safety in laboratory classes	CP1_U13

Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	Lecture: one test;	W
LO2	Lecture: one test;	W
LO4	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L
LO5	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L
LO6	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L

Student workload (in hours)		No. of hours
Calculation	Lecture attendance	15
	Laboratory classes attendance	30
	Preparation for lecture test(s)	10
	Preparation for laboratory classes	9
	Preparation for laboratory classes completion	6
	Participation in teacher-student sessions related to the module subject	5
	TOTAL	75

Quantitative indicators	Hours	ECTS
Student workload - activities that require direct teacher participation	50	2
Student workload - practical activities	50	2

Basic references	1. Przyborowski W., Suproniuk M., Wybrane zagadnienia eksploatacyjne oraz elementy obliczeń parametrów i charakterystyk maszyn elektrycznych, Wojskowa Akademia Techniczna, 2020. 2. Zdanowicz R., Podstawy robotyki. WPŚ, Gliwice, 2011. 3. Chodnikiewicz K., Moszczyński L., Zbiór zadań z podstaw napędu elektrycznego z rozwiązaniami, Warszawa, Oficyna Wydawnicza Politechniki Warszawskiej, 2014. 4. Łastowiecki J., Napędy elektryczne w automatyce i robotyce, Kielce, Wydawnictwo Politechniki Śląskiej, 2011.

	5. Bisztyga B., Sieklucki G., Zdrojewski A., Orzechowski T., Sykulski R., Modele i zasady sterowania napędami elektrycznymi. Wydawnictwo AGH, Kraków 2014.	
Supplementary references	1. Gieras J. F., Piech Z. J., Tomczuk B. Z., Linear synchronous motors: transportation and automation systems. CRC/Taylor & Francis, Boca Raton 2012. 2. Wildi T. I., Electrical Machines, Drives and Power Systems, Sixth Edition, Pearson Education International, 2006. 3. Sieklucki G., Automatyka napędu, Wydawnictwa AGH Kraków 2009. 4. Przepiórkowski J., Silniki elektryczne w praktyce elektronika. Wydawnictwo BTC, Warszawa 2007. 5. Przyborowski W., Kamiński G., Maszyny elektryczne, Warszawa, Oficyna Wydawnicza Politechniki Warszawskiej, 2014.	
Organisational unit conducting the course	Department of Electrical Engineering, Energoelectronics and Electroenergetics	Date of issuing the programme
Author of the programme	dr inż. Adam Kuźma	2022-06-07

Bialystok University of Technology
Faculty of Electrical Engineering

Field of study	**Industry Digitization**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Programming of mobile applications**							Course code	**CP1S04004**
								Course type	**obligatory**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**4**
	15				**30**			No. of ECTS credits	**3**
Entry requirements	C programming, Python programming 1, Python programming 2								
Course objectives	Gaining knowledge of programming mobile devices. Acquisition of practical skills in creating mobile applications in the Android environment.								
Course content	Lecture: Mobile platforms, an introduction to Android. XML, Kotlin - preparation for Android programming. Structure and resources of the application in the Android system. User interface concept. Content providers, services, notifications. Dialogs, sensor support. Multimedia and network communication. Specialistic workshop: Development environment for the Android platform. Basic Android SDK tools. Design of the user interface - controls, layouts, menus. Create applications that use dialogues, services, and notifications. Support for sensors, multimedia and network communication.								
Teaching methods	Informative-problem lecture; Specialization workshop;								
Assessment method	Lecture: one test Specialistic workshop: evaluation of reports, individual progress, discussion and activity at workshop								

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
	Knowledge: the graduate knows and understands	
LO1	life cycle and principles of operation of mobile applications	CP1_W12
LO2	process of designing, developing and testing applications for mobile devices	CP1_W06 CP1_W07
	Skills: the graduate is able to	
LO4	design and create a fully functional application that works on mobile devices	CP1_U07
LO5	create graphical interfaces using user interaction tools	CP1_U07
LO6	develop applications that support hardware components	CP1_U08

Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed	
LO1	Lecture: one test;	W	
LO2	Lecture: one test;	W	
LO4	Specialistic workshop: evaluation of reports, individual progress, discussion and activity at workshop;	Ps	
LO5	Specialistic workshop: evaluation of reports, individual progress, discussion and activity at workshop;	Ps	
LO6	Specialistic workshop: evaluation of reports, individual progress, discussion and activity at workshop;	Ps	
Student workload (in hours)		No. of hours	
Calculation	Lecture attendance	15	
	Workshop attendance	30	
	Preparation for lecture test(s)	9	
	Preparation for specialistic workshop	12	
	Preparation for workshop completion	4	
	Participation in teacher-student sessions related to the module subject	5	
	TOTAL	75	
Quantitative indicators		Hours	ECTS
Student workload - activities that require direct teacher participation		50	2
Student workload - practical activities		51	2
Basic references	1. Zapata B. C., Android Studio: podstawy: najlepsze IDE dla programistów platformy Android!, Helion, Gliwice, 2016. 2. Griffiths D., Griffiths D., Android programowanie aplikacji, Helion, Gliwice, 2018 3. Płonkowski M., Android Studio. Tworzenie aplikacji mobilnych, Helion, Gliwice, 2017		
Supplementary references	1. Dokumentacja SDK on-line: http://developer.android.com		
Organisational unit conducting the course	Department of Photonics, Electronics and Light Technology	Date of issuing the programme	
Author of the programme	dr inż. Krzysztof Konopko	2022-06-07	

COURSE DESCRIPTION CARD

BIALYSTOK UNIVERSITY OF TECHNOLOGY		**Faculty of Electrical Engineering**	
Field of study	Industry Digitization	**Level and form of study**	Full-time first-cycle (BSc) studies
A group of modules /specialty	Common subject	**Education profile**	General
Course name	PLCs programming E	**Course code**	CP1S04005
		Course type	Mandatory

Course form(s)	**L**	**C**	**LC**	**P**	**SW**	**FW**	**S**	**Semester**	**4**
and number of hours	30		45					**ECTS credits**	**7**

The programme is valid from	2025/2026
Introductory courses	CP1S01005, CP1S03001, CP1S03003
Course objectives	Introduction to configuring, programming and operating PLC/PAC programmable logic controllers. Overview of the architecture and operation of PLC/PAC and Embedded PC systems. Introduction to the LAD, SFC, STL and FBD programming languages. Programming of combinational and sequential systems, binary control, and implementation of discrete PID/PD/PI algorithms in PLCs.
Framework programme content	Definition and architecture of a Programmable Logic Controller (PLC); operating principle and scan cycle. PLC modules and peripheral devices. Architecture and operation of A/D and D/A converters. Program structure, addressing, PLC data types and variables. PLC memory management. Programming languages: SFC, STL, FBD and LAD. PLC program elements; implementing logic operations. Designing combinational and sequential control algorithms. Programming timers and counters. Programming flip-flops. Discrete PID/PD/PI algorithms. Advanced PLC features: cyclic and hardware interrupts, PWM generators, basic motion control, and high-speed counters. PLC communication functions. Characteristics and capabilities of PAC and Embedded PC controllers. Data logging and integration with cloud services. PLC hardware configuration. PLC memory areas for I/O, variables and constants. Basic bit operations. Programming combinational and sequential controls. Programming with timers, pulse counters, comparison functions, floating-point math, data transfer, function blocks and data blocks. Program-control functions. Selection and configuration of PLC expansion modules. PLC simulator handling. Data structures and arrays. Programming PWM/PTO pulse generators and DC motor control. Encoder handling, PID control programming and tuning. Programming data logging, web server and HMI panels.
Other information about the course	content of the course refers to the principles of sustainable development the course is related to the scientific activity conducted at the University

Calculation:

Student workload related to:	**Total number of hours**	**including contact**	**including practical**
participation in lectures	30	30	
participation in other forms of activities	45	45	45
participation in an examination	5,5	5,5	2,1
completion of professional training	0	0	0
preparation for passing a lecture/an examination	10		
preparation for practical classes	84,5		84,5
			0
			0
			0
			0
			0
			0
Total number of hours:	**175**	**81**	**132**
Total number of ECTS credits:	**7**	**3,2**	**5,3**

Expected discipline learning outcomes	Knowledge	Skills	Social competence

Objectives and framework content prepared by	Arkadiusz Mystkowski, DSc. PhD Eng. Assoc. Prof.	Date:	3.09.2025
Implementation in the academic year	**2025/2026**		

Programme content

	Lecture
1	Definition and architecture of a Programmable Logic Controller (PLC); operating principle and scan cycle.
2	PLC modules and peripheral devices. Architecture and operating principle of A/D and D/A converters.
3	Program structure, addressing, PLC data types and variables. PLC memory management.
4	Programming languages: SFC, STL, FBD and LAD. PLC program elements.
5	Implementing logic operations. Designing combinational and sequential control algorithms.
6	Programming timers and counters. Programming flip-flops.
7	Discrete PID/PD/PI algorithms.
8	Advanced PLC features: cyclic and hardware interrupts.
9	PWM generators, basic motion control functions.
10	Handling high-speed counters.
11	PLC communication functions.
12	Characteristics and capabilities of PAC and Embedded PC controllers.
13	Data logging functions and integration with cloud services.
	Laboratory
1	Logic operations.
2	Floating-point operations.
3	Timer circuits.
4	Pulse counters.
5	Cyclic, time-based and hardware interrupts.
6	Data blocks, arrays, structures and functions.
7	Programming in SCL language.
8	A/D and D/A converters; handling analog process variables.

	9	HMI operator panel handling.
	10	PID control systems.
Teaching methods	L	Informative/problem-based lecture, discussion.
	LC	laboratory exercises
	-	
Teaching methods	-	
Forms of crediting	L	Written exam, two midterm tests, and an extra optional homeworks to increase the mark.
	LC	Evaluation of entry quizzes, reports, discussions and in-class activity
Conditions of crediting	L	Written exam pass/grade scale: (≤49%) 2.0 (fail); (50%–60%) 3.0; (61%–70%) 3.5; (71%–80%) 4.0; (81%–90%) 4.5; (91%–100%) 5.0.
	LC	The final assessment depends on the completeness of the individual lab tasks, homework tasks, report preparation and its presentation.

Outcome symbols -

Knowledge: the student knows and understands	**Expected learning outcomes**	**Expected learning outcomes defined for the field of study**		
		Knowlegde	Skills	Social competence
E1	arithmetic and logic operations in STL, LAD and FBD languages	CP1_W07		
E2	binary functions implemented in PLC	CP1_W07		
E3	the architecture and operating principle of PLC controllers	CP1_W07, CP1_W06		
Skills: the student can				
E4	program arithmetic/logic functions in PLCs as well as PID/PD/PI controllers		CP1_U07	
E5	commission and test complex binary control algorithms on PLCs		CP1_U07	
E6	program combinational and sequential systems in LAD and SFC		CP1_U07	
Social competence: the student is ready to				
E7	critical self-assessment of knowledge in PLC programming			CP1_K01

Outcome symbols

	Methods of verification of learning outcomes	**Course form subject to verification**
E1	Written exam; completion of laboratory reports	W, LC
E2	Written exam; completion of laboratory reports	W, LC
E3	Written exam; completion of laboratory reports	W, LC
E4	Written exam; completion of laboratory reports	LC
E5	Written exam; completion of laboratory reports	LC
E6	Written exam; completion of laboratory reports	LC
E7	Written exam; completion of laboratory reports	W, LC

Basic references	1	Bee, L., PLC and HMI development with Siemens TIA Portal. Publisher, 2022.
	2	The TIA Portal Tutorial Center.
	3	Siemens Automation Cooperates with Education (SCE).
	4	Siemens TIA Portal Official Training Manuals (PDF).
Supplementary references	1	Teacher's materials, projects and instructions.
	2	https://support.industry.siemens.com/
Course coordinator	Arkadiusz Mystkowski, DSc. PhD Eng. Assoc. Prof.	**Date:** 3.09.2025

Bialystok University of Technology
Faculty of Electrical Engineering

Field of study	**Industry Digitization**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Computer networks and wireless systems**							Course code	**CP1S04006**
								Course type	**obligatory**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**4**
	15		**30**					No. of ECTS credits	**3**
Entry requirements	Operating systems								
Course objectives	Acquainting with principles of functioning of modern computer networks and selected wireless systems. Acquisition of basic skills in the practical configuration, administration, research and analysis of wired and wireless computer networks.								
Course content	Lecture: Basic concepts related to computer networks. Networks classification and their main topologies. Kinds, general principles of operation and scope of applications of selected wireless communication systems. Description of the communication process using the layered OSI model. Basic network devices and transmission media. Basics of structure, configuration, use and administration of wired and wireless local networks (LAN, WLAN): Ethernet, Wi-Fi. Concept and implementation of virtual local area networks (VLANs). Basic and auxiliary protocols used in packet networks: IP, UDP, TCP, ARP, ICMP. Addressing devices on networks with IPv4 and IPv6 protocols. Static and dynamic routing in the IP network. Organization and operation of the DNS domain name system. Laboratory classes: Configuration and testing of LAN and WLAN networks. Use protocol analyzer software and network tools available on operating systems to observe and analyze selected types of network traffic, test connections, and obtain device status information in the context of network services. Research and analysis of protocols used in TCP/IP networks. Performing configuration of specific functionalities in professional network devices.								
Teaching methods	Informative-problem lecture; Laboratory classes;								
Assessment method	Lecture: one test Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes								

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
	Knowledge: the graduate knows and understands	
LO1	architecture, operation, technologies and devices used in wired and	CP1_W10

LO1	wireless local networks	
LO2	features and functions of basic and auxiliary protocols used in computer networks	CP1_W10
LO3	operating principles applications of selected wireless communication systems	CP1_W10
	Skills: the graduate is able to	
LO4	practically analyze the operation of basic and auxiliary network protocols using protocol analyzer software	CP1_U06
LO5	configure specific functionalities of stations and transmission devices in LAN and WLAN networks and check the correctness of their communication using typical network tools	CP1_U06 CP1_U08
LO6	use the English-language documentation of network devices (e.g. routers, switches) in order to find and use a method of their configuration	CP1_U05

Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	Lecture: one test; Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	W L
LO2	Lecture: one test; Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	W L
LO3	Lecture: one test;	W
LO4	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L
LO5	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L
LO6	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L

Student workload (in hours)		No. of hours
Calculation	Lecture attendance	15
	Laboratory classes attendance	30
	Preparation for lecture test(s)	10
	Preparation for laboratory classes	9
	Preparation for laboratory classes completion	6
	Participation in teacher-student sessions related to the module subject	5
	TOTAL	75

Quantitative indicators	Hours	ECTS
Student workload - activities that require direct teacher participation	50	2
Student workload - practical activities	50	2

1. Tanenbaum A. S., Wetherall D. J., Sieci komputerowe. Wydanie V, Helion, Gliwice 2012.
2. Spurgeon C. E., Zimmerman J., Ethernet. Biblia administratora. Helion, Gliwice 2014.

Basic references	3. Roshan P., Leary J., Bezprzewodowe sieci LAN 802.11. Podstawy. Wydawnictwo PWN-MIKOM, Warszawa 2006. 4. Józefiok A., CCNA 200-301. Zostań administratorem sieci komputerowych Cisco. Helion, Gliwice 2020. 5. Dokumentacja urządzeń wykorzystywanych w laboratorium.	
Supplementary references	1. Praca zbiorowa, Vademecum teleinformatyka, tom I, II. IDG, Warszawa 1999, 2002. 2. Dokumenty RFC (dostępne w witrynie http://www.rfc-editor.org).	
Organisational unit conducting the course	Department of Photonics, Electronics and Light Technology	Date of issuing the programme
Author of the programme	dr inż. Andrzej Zankiewicz	2022-06-07

Bialystok University of Technology
Faculty of Electrical Engineering

Field of study	**Industry Digitization**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Sensors and measurement systems**							Course code	**CP1S04007**
								Course type	**obligatory**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**4**
	15				**30**			No. of ECTS credits	**3**
Entry requirements	Metrology, Digital signal processing								
Course objectives	Acquainting with basic measurement methods and measuring systems: temperature, rotational speed, parameters of mechanical vibrations and other physical quantities. Acquainting with the basics of sensor technology, signal conditioning systems and computer measuring systems. Developing principles of application and the ability to operate specialized instruments for measuring physical quantities, programmable devices and computer measuring systems.								
Course content	Lecture: Measurement and measurement methods. Computer measuring systems - classification and their characteristics. Measurement sensors - parameters, structure and principle of operation. Basic measurement signals - types and characteristics. The process of converting analog signals to digital and digital to analog. Parameters of industrial measuring transducers. Fundamentals of measurement path design, selection of sensors, converters and measurement data transmission methods. Calculation of errors and uncertainty of measurements. Specialistic workshop: Measurement, acquisition and representation of real digital and analog signals coming from measuring sensors. Determination of static and dynamic characteristics of transducers. Computer examination of dynamic properties of resistance and thermoelectric converters. Computer systems for measuring mechanical stresses, parameters of vibrating motion, temperature. Industrial temperature measurements. Measurements of rotational speed of machines. Mass, liquid flow and pressure measurements.								
Teaching methods	Informative-problem lecture; Specialization workshop;								
Assessment method	Lecture: exam Specialistic workshop: evaluation of reports, individual progress, discussion and activity at workshop								

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
	Knowledge: the graduate knows and understands	
LO1	physical basics of sensors operation	CP1_W01
LO2	basic principles of signal processing	CP1_W02

LO2	basic principles of signal processing	
LO3	measurement methods and components of a computer measurement system	CP1_W04
	Skills: the graduate is able to	
LO4	select the sensor for the application	CP1_U02
LO5	handle specialized gauges of physical quantities, programmable devices and computer measurement systems	CP1_U06 CP1_U11
LO6	estimate accuracy of the measurement	CP1_U04 CP1_U11
	Social competences: the graduate is ready to	
LO7	creative work-out of measurement results	CP1_K04

Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	Lecture: exam;	W
LO2	Lecture: exam;	W
LO3	Lecture: exam;	W
LO4	Specialistic workshop: evaluation of reports, individual progress, discussion and activity at workshop;	Ps
LO5	Specialistic workshop: evaluation of reports, individual progress, discussion and activity at workshop;	Ps
LO6	Specialistic workshop: evaluation of reports, individual progress, discussion and activity at workshop;	Ps
LO7	Specialistic workshop: evaluation of reports, individual progress, discussion and activity at workshop;	Ps

Student workload (in hours)		No. of hours
Calculation	Lecture attendance	15
	Workshop attendance	30
	Preparation for the lecture exam; participation in the exam	11
	Preparation for specialistic workshop	11
	Preparation for workshop completion	3
	Participation in teacher-student sessions related to the module subject	5
	TOTAL	75

Quantitative indicators	Hours	ECTS
Student workload - activities that require direct teacher participation	52	2,1
Student workload - practical activities	49	2

Basic references	1. Hejn K., Leśniewski A., Systemy pomiarowe. Oficyna Wydawnicza Politechniki Warszawskiej, 2017. 2. Gajek A., Juda Z., Czujniki, Wydawnictwa Komunikacji i Łączności WKŁ, 2021. 3. Jakubiec J., Błędy i niepewności danych w systemie pomiarowo-sterującym. Wydawnictwo Politechniki Śląskiej, Gliwice 2010. 4. Arendarski J., Niepewność pomiarów. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2013. 5. Zakrzewski J., Kampik M. Sensory i przetworniki pomiarowe. Wydawnictwo Politechniki Śląskiej, Gliwice 2013.

Supplementary references	1. Zięba A., Analiza danych w naukach ścisłych i technice, Wydawnictwo Naukowe PWN, 2016. 2. Suchocki K., Sensory i przetworniki pomiarowe: laboratorium, Wydawnictwo Politechniki Gdańskiej, Gdańsk, 2016. 3. Tłaczała W., Środowisko LabVIEW w eksperymencie wspomaganym komputerowo, Wydawnictwo WNT, 2017. 4. Rząsa M., Kiczma B., Elektryczne i elektroniczne czujniki temperatury. Wydawnictwa Komunikacji i Łączności WKŁ, 2005. 5. Stabrowski M., Cyfrowe przyrządy pomiarowe, Wydawnictwo Naukowe PWN, 2003.	
Organisational unit conducting the course	Department of Electrical Engineering, Energoelectronics and Electroenergetics	Date of issuing the programme
Author of the programme	dr hab. inż. Adam Idźkowski, prof. PB	2022-06-07

Bialystok University of Technology
Faculty of Electrical Engineering

Field of study	**Industry Digitization**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Foreign language 3**							Course code	**CP1S04008**
								Course type	**elective**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**4**
		30						No. of ECTS credits	**2**

Entry requirements	Foreign language 2
Course objectives	Continue to improve language proficiency (listening, reading, interaction, production, writing) at level B2 in line with the Common European Framework of Reference for Languages. Stimulating curiosity about fundamental dilemmas of modern civilization and issues of the field of study. Extending the basic terminology of the field of study. An exercise in the form of a multimedia presentation.
Course content	Classes: Topics related to academic life, current problems of social life and dilemmas of modern civilization and problems of the studied field. Language and grammar issues in the discussed texts. Basic terminology in the field of study (part 2) The form of a multimedia presentation related to the field of study.
Teaching methods	Classes;
Assessment method	Evaluation of inter-semester tests; mofular tests, written and oral statements, written and oral homeworks

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
	Skills: the graduate is able to	
LO4	understand and formulate oral statements to a greater extent, provided that they relate to a well-known subject, also those containing basic terminology in the field of the studied field	CP1_U01 CP1_U05
LO5	understand and formulate to a greater extent texts on various issues of the modern world, including those containing the basic terminology of the field of study	CP1_U01 CP1_U05
LO6	prepare and present a multimedia presentation related to the subject of the field of study	CP1_U01 CP1_U04
	Social competences: the graduate is ready to	
LO7	take an active part in the discussion respecting the diversity of	CP1_K02

LO7	expressed opinions, views, cultural references	
Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO4	Evaluation of inter-semester tests; mofular tests, written and oral statements, written and oral homeworks;	C
LO5	Evaluation of inter-semester tests; mofular tests, written and oral statements, written and oral homeworks;	C
LO6	Evaluation of inter-semester tests; mofular tests, written and oral statements, written and oral homeworks;	C
LO7	Evaluation of inter-semester tests; mofular tests, written and oral statements, written and oral homeworks;	C

Student workload (in hours)		No. of hours
Calculation	Classes attendance	30
	Preparation for classes	9
	Preparation for classes completion	6
	Participation in teacher-student sessions related to the module subject	5
	TOTAL	50

Quantitative indicators	Hours	ECTS
Student workload - activities that require direct teacher participation	35	1,4
Student workload - practical activities	50	2

Basic references	1. Murphy R., English Grammar in Use, Cambridge: Cambridge University Press 2010. 2. Cieplicka M., Torzewska W., Русский язык. Kompendium tematyczno-leksykalne 2, Wagros 2008. 3. Długokęcka J., Chadaj S., Język niemiecki zawodowy w branży elektronicznej, informatycznej i elektrycznej, WSIP 2013. 4. McCarthy M., Academic Vocabulary in Use, Cambridge: Cambridge University Press 2010. 5. Chwatow S., Hajczuk R., Русский язык в бизнесе, WSiP 2000. 6. Kuhn Ch., Niemann R. M., Winzer-Kiontke B., Studio d - Die Mittelstufe B2, Cornelsen Verlag 2010. 7. Foley M., My Grammar Lab, Pearson 2012. 8. Granatowska H., Danecka I., Как дела? 2. Wyd. Szkolne PWN 2003. 9. Koithan U., Schmitz H., Sieber T., Sonntag R., Aspekte Mittelstufe Deutsch, Langenscheidt 2007. 10. Milczarek W., Język rosyjski od A do Z. Repetytorium, Kram. 2007.
Supplementary references	1. Longman Dictionary of Contemporary English. Harlow: Pearson Education 2011. 2. Kowalska N., Samek D., Praktyczna gramatyka języka rosyjskiego, REA 2004. 3. Nietrzebka M., Ostalak S., Alles klar Grammatik, WSIP 2004. 4. Kuca Z., Język rosyjski w biznesie dla średniozaawansowanych, WSiP 2007. 5. Kostka G., Elektroniker fuer Energie- und Gebaeudetechnik, Fundacja VCC. 6. Samek D., Rozmówki polsko-rosyjskie, REA 2009. 7. Słownik naukowo-techniczny polsko-niemiecki, niemiecko-polski. WNT 2006, 2007. 8. Słownik naukowo-techniczny rosyjsko-polski. WNT 2009. 9. Corbeil J-C., Archambault A., Wielojęzyczny słownik wizualny, leksykon tematyczny, Wydawnictwo Wilga 1996.

Organisational unit conducting the course	School of Foreign Languages	Date of issuing the programme
Author of the programme	mgr Dorota Ostrowska	2022-06-07