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	**Mathematics 2**							Course code	**CP1S02001**
								Course type	**obligatory**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**2**
	45	**45**						No. of ECTS credits	**8**
Entry requirements	Mathematics 1								
Course objectives	Understanding methods of solving ordinary differential equations of the n-th order with the use of classical methods and the operator method. Acquainting with differential and integral calculus of functions of several variables and its applications. Acquainting with the basics of the probability calculus and mathematical statistics. Acquainting with basic laws of logic. Introduction of elementary knowledge about graphs.								
Course content	Lecture: Overview of classical methods of solving differential equations. Calculation and properties of Laplace transform and Fourier transform. Application of the operator method to solving differential equations. Differential and integral calculus of several variables and its applications. Representation of different types of coordinate systems. Selected elements of the theory of probability and mathematical statistics. Discussion of the elements of logic and Boolean algebra. Combinational and sequential circuits, minimization of logic functions. Basic knowledge of graphs. Classes: Solving differential equations using classical and operator methods. Calculations of Laplace transform and inverse Laplace transform. Calculation of partial derivatives and their applications. Calculating integrals of functions of many variables using various types of coordinate systems. Random variable - discrete and continuous. Determining the distribution function and parameters of the distribution of a random variable. Interval estimation. Applications of Boolean algebra. Analysis of combinational and sequential systems. Using Karnaugh tables method to minimize logical functions. Performing operations on graphs.								
Teaching methods	Informative-problem lecture; Classes;								
Assessment method	Lecture: exam Classes: two tests								
Symbol of learning outcome	Learning outcomes							Reference to the learning outcomes for the field of study	

	Knowledge: the graduate knows and understands	
LO1	selected classical methods and the operator method for solving differential equations	CP1_W01
LO2	basic methods and tools of differential and integral calculus of multivariable functions used in engineering calculations	CP1_W01
LO3	basics of probability and estimation, basics of logic and graph theory	CP1_W01
	Skills: the graduate is able to	
LO4	solve differential equations with classical and operator methods	CP1_U06
LO5	calculate derivatives and integrals of functions of several variables and indicate their applications	CP1_U06
LO6	perform statistical analysis of a random variable, analyze logical functions and graphs	CP1_U06

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	Classes: two tests;	C
LO5	Classes: two tests;	C
LO6	Classes: two tests;	C

Student workload (in hours)		No. of hours
Calculation	Lecture attendance	45
	Classes attendance	45
	Preparation for the lecture exam; participation in the exam	58
	Preparation for classes	38
	Preparation for classes completion	9
	Participation in teacher-student sessions related to the module subject	5
	TOTAL	200

Quantitative indicators	Hours	ECTS
Student workload - activities that require direct teacher participation	97	3,9
Student workload - practical activities	97	3,9

Basic references	1. Gewert M., Skoczylas Z., Gewert M., Skoczylas Z., Analiza Matematyczna 2: definicje, twierdzenia, wzory. GiS, 2019. 2. Gewert M., Skoczylas Z., Gewert M., Skoczylas Z., Analiza Matematyczna 2: przykłady i zadania. GiS, 2019. 3. Gewert M., Skoczylas Z., Równania różniczkowe zwyczajne: teoria, przykłady, zadania. GiS, 2016. 4. Krysicki W., Bartos J. i in., Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach, cz. I-II. PWN, 2019.

	5. Wilson R. J., Wprowadzenie do teorii grafów. PWN, 2004.	
Supplementary references	1. Mozyrska D., Pawłuszewicz E., Stasiewicz R., Równania różniczkowe zwyczajne. PB, 2001. 2. Jurkowlaniec A., Rybarczyk A., Świetlicka A., Rachunek operatorowy. Metody rozwiązywania zadań. PWN 2018. 3. Kincaid D., Cheney W., Analiza numeryczna. WNT, 2006. 4. McQuarrie D., Matematyka dla przyrodników i inżynierów, t. 1-3. PWN, 2005. 5. Kowal J., Podstawy automatyki. T. 2, Uczelniane Wydawnictwa Naukowo-Dydaktyczne AGH, Kraków, 2007.	
Organisational unit conducting the course	Department of Automatic Control and Robotics	Date of issuing the programme
Author of the programme	dr inż. Kamil Borawski	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	**Physics**							Course code	**CP1S02002**
								Course type	**obligatory**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**2**
	30	**30**						No. of ECTS credits	**5**
Entry requirements	Mathematics 1								
Course objectives	Learning and understanding basic laws of classical physics and selected elements of modern physics. Understanding selected technical problems based on laws of physics. Acquiring skills in solving physics excercises.								
Course content	Lecture: Basic laws of classical mechanics. Vibrating movement. Gauss's law, Amper's law, Faraday's law of induction, Biot-Savart law. Electromagnetic waves. Fundamentals of modern physics. Body black, external photoelectric effect, Compton effect. The structure of the atom according to Bohr. Wave-corpuscular dualism. Band theory of conduction. Intrinsic and doped semiconductors. PN connector. Harmonic vibrations, damped and forced. Mechanical waves. Wave interference. Geometric and wave optics. Fermat's principle. The law of light reflection and refraction. Diffraction and interference of optical waves. Electricity and magnetism. Classes: Solving excercises in the field of classical mechanics, geometric and wave optics, oscillating motion, electricity and magnetism.								
Teaching methods	Informative-problem lecture; Classes;								
Assessment method	Lecture: exam Classes: two tests								

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
	Knowledge: the graduate knows and understands	
LO1	basic laws and principles of classical and modern physics	CP1_W01 CP1_W02
LO2	methods for solving typical problems of physics	CP1_W01 CP1_W02
	Skills: the graduate is able to	
LO4	analyze problems of classical physics, find and present their solutions based on the acquired knowledge	CP1_U02 CP1_U06
LO5	use the literature on a specific issue	CP1_U01

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	Classes: two tests;	C	
LO5	Classes: two tests;	C	
Student workload (in hours)		No. of hours	
Calculation	Lecture attendance	30	
	Classes attendance	30	
	Preparation for the lecture exam; participation in the exam	33	
	Preparation for classes	21	
	Preparation for classes completion	6	
	Participation in teacher-student sessions related to the module subject	5	
	TOTAL	125	
Quantitative indicators		Hours	ECTS
Student workload - activities that require direct teacher participation		67	2,7
Student workload - practical activities		62	2,5
Basic references	1. Resnick R, Halliday D., Fizyka 1, Fizyka 2. PWN, Warszawa 1999. 2. Resnick R, Halliday D., Walker J., Podstawy fizyki. T1 - T5, PWN, Warszawa 2015.		
Supplementary references	1. Resnick R., Halliday D., Walker J., Podstawy fizyki. Zbiór zadań. PWN, Warszawa 2005. 2. Feynman R. P., Leighton R. B., Sands M., Feynmana wykłady z fizyki, T1 -T3, PWN, Warszawa, 2014. 3. https://openstax.pl/pl/ - Fizyka dla szkół wyższych, tom 1-3.		
Organisational unit conducting the course	Department of Automatic Control and Robotics	Date of issuing the programme	
Author of the programme	dr Maciej Ciężkowski	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	**Electronic components and subsystems**							Course code	**CP1S02003**
								Course type	**obligatory**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**2**
	15		**30**					No. of ECTS credits	**3**
Entry requirements	Analogue technology and fundamentals of electronics								
Course objectives	Acquainting with basic electronic components and systems used in control systems. Acquiring the ability to measure parameters and characteristics of electronic components and circuits with the use of basic measuring instruments.								
Course content	Lecture: Basic electronic and electrical components in control systems: diodes, transistors, semiconductor power devices, operational amplifiers, comparators, optoelectronic elements, buttons and switches, relays, contactors, protection elements. Linear voltage stabilizers, DC/DC converters, power supplies. PWM control. Bridge H. Laboratory classes: Study of diodes and transistors. Semiconductor power devices. Continuous and pulsed control of transistors. Operational amplifiers in linear and nonlinear systems. Voltage comparators. Linear voltage stabilizers. DC/DC converters. Optoelectronic elements. Buttons, switches, contactors and relays. Bridge H.								
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	operating principles of basic electronic/electric components and electronic systems used in control systems	CP1_W03
LO2	selected principles and methods for the analysis and selection of electrical/electronic components and systems used in devices	CP1_W04

LO2	electrical/electronic components and systems used in devices, created for the needs of industry digitization	
	Skills: the graduate is able to	
LO4	obtain information from catalog cards and application notes, databases and other sources, also in a foreign language	CP1_U01
LO5	design, run and test a selected electronic circuit	CP1_U08 CP1_U11
LO6	prepare a report on the performed laboratory exercise, interpret the results and formulate conclusions	CP1_U04

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. Tietze U., Schenk Ch., Układy półprzewodnikowe. WNT, Warszawa 2009. 2. Horowitz P., Hill W., Sztuka elektroniki, cz. I i II. WKiŁ, Warszawa 2013. 3. Dobrowolski A., Elektronika: ależ to bardzo proste!. BTC, Legionowo 2013. 4. Platt C., Encyklopedia elementów elektronicznych. Helion, Gliwice 2021.
Supplementary references	1. Carter B., Mancini R., Wzmacniacze operacyjne teoria i praktyka, BTC, Legionowo 2011. 2. Pease R. A., Projektowanie układów analogowych: poradnik praktyczny. BTC, Legionowo 2005.
Organisational unit conducting the course	Department of Automatic Control and Robotics — Date of issuing the programme
Author of the programme	dr inż. Andrzej Karpiuk — 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	**Mechanical components and subsystems**							Course code	**CP1S02004**
								Course type	**obligatory**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**2**
	15				**30**			No. of ECTS credits	**3**

Entry requirements	Technical drawing
Course objectives	Getting to know the structure, operation and principles of selection of components and mechanical subassemblies used in the design of multi-component movement apparatus of industrial and service robots. Getting to know general principles and methods of design calculations and methods of selecting robots components. Acquisition of the ability to use CAD programs to implement a technical design of a robot of a selected kinematic structure.
Course content	Lecture: Structures of robots with open and closed kinematic chains. Classification of loads, rules of strength calculations taking into account possible damage mechanisms of selected structural components and mechanical joints. Calculation rules and methods of selecting components of the robot motion apparatus: tractive, wave, planetary, cycloidal transmissions, flat and ball joints, shafts, rolling and sliding bearings, rolling and sliding guides, ball screws, trapezoidal bolts, clutches and brakes. Rules for the use of standards. Use of CAx packages for design and engineering analysis of created projects. Specialistic workshop: Designing a selected structure of an industrial robot in the CAD environment and performing a numerical analysis of its kinematics and dynamics, modal analyzes and optimization of the structure using CAE tools. The result of the classes should be a completely completed robot project (industrial or service).
Teaching methods	Informative-problem lecture; Classes in computer methods and techniques with demonstration, instruction and discussion;
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	structure of basic mechanical components used in robot subassemblies	CP1_W01 CP1_W03
LO2	structure, purpose and operating principles of mechanical components	CP1_W02 CP1_W05

LO2	of the robot	
	Skills: the graduate is able to	
LO4	use appropriate CAD software to design a robot of a given kinematic structure	CP1_U06 CP1_U09
LO5	obtain and interpret information from literature and other sources, use documents and technical standards	CP1_U01 CP1_U02
LO6	work in a team developing projects of selected mechanical components of robots	CP1_U03
	Social competences: the graduate is ready to	
LO7	self-education and improvement of qualifications, use of own knowledge and experts opinions in order to solve design problems	CP1_K01

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
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 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. Honczarenko J., Roboty przemysłowe: budowa i zastosowanie, WNT, Warszawa 2011. 2. Mazanek E. (red), Przykłady obliczeń z podstaw konstrukcji maszyn, t. 1, połączenia, sprężyny, zawory, wały maszynowe. Wydawnictwo Naukowo-Techniczne, Warszawa, 2005. 3. Mazanek E. (red), Przykłady obliczeń z podstaw konstrukcji maszyn, t. 2, łożyska, sprzęgła i hamulce, przekładnie mechaniczne. Wydawnictwo Naukowo-Techniczne, Warszawa, 2005. 4. Kurmaz L. W., Kurmaz O. L., Projektowanie węzłów i części maszyn, Kielce 2006.

	5. Craig, J. J., Introduction to robotics: mechanics and control. Vol. 3. Upper Saddle River, NJ, USA, Pearson/Prentice Hall, 2005.	
Supplementary references	1. Morecki A., Podstawy robotyki. Teoria manipulatorów i robotów, WNT, Wydawnictwo poprawione, Warszawa, 2002. 2. Bazy online czasopism naukowych i wydawnictw naukowych z Biblioteki Politechniki Białostockiej. 5. Shetty D., Richard A. Kolk R. A., Mechatronics system design, Second Edition, SI, Cengage Learning 2011. 4. Heimann B., Gerth W., Popp K., Mechatronika. Komponenty, metody, przykłady. PWN, Warszawa 2001. 5. Kocańda S., Szala J., Podstawy obliczeń zmęczeniowych. Wydawnictwo Naukowe PWN, Warszawa 1997.	
Organisational unit conducting the course	Department of Automatic Control and Robotics	Date of issuing the programme
Author of the programme	dr inż. Roman Trochimczuk	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	**Python programming 1**							Course code	**CP1S02005**
								Course type	**obligatory**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**2**
	15				**30**			No. of ECTS credits	**3**
Entry requirements	Operating systems, C programming, Engineering software								
Course objectives	Acquainting with the basic mechanisms of the Python language enabling the creation of structured and object-oriented programs. Acquiring the ability to develop computer algorithms and their implementation in the form of structured and object-oriented programs in Python.								
Course content	Lecture: Introduction to Python. Program structure. Standard library. NumPy, Matplotlib, SciPy libraries. Jupyter Notebook environment. Data types (numeric, text). Operators. Letters, dictionaries, tuples, collections. The range function. Instructions that control the execution of the program: if / elif / else statement, for and while loops. Defining a function. Object-oriented programming elements. File handling. Specialistic workshop: Support for a selected environment for creating, analyzing and running Python programs. Create Python computer programs using variables, operators, lists, dictionaries, tuples, sets, conditional statements, loops, functions, files. Object-oriented programming in Python. Application of libraries (standard, NumPy, Matplotlib, SciPy) and Jupyter Notebook environment.								
Teaching methods	Informative-problem lecture; Classes in computer methods and techniques with demonstration, instruction and discussion;								
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	basic techniques of the Python language for structured and object-oriented programming	CP1_W07
LO2	basic programming structures used in Python	CP1_W07
	Skills: the graduate is able to	
LO4	write a simple Python program based on a given specification	CP1_U07
LO5	test the program by eliminating errors occurring in it	CP1_U07

LO6	use Python libraries in his/her own programs	CP1_U07 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. Sarbicki G., Python. Kurs dla nauczycieli i studentów. Wydanie II. Helion, Gliwice 2022. 2. Matthes E., Python. Instrukcje dla programisty. Wydanie II. Helion, Gliwice 2020. 3. Sweigart A., Automatyzacja nudnych zadań z Pythonem. Nauka programowania. Wydanie II. Helion, Gliwice 2021.		
Supplementary references	1. McKinney W., Python w analizie danych. Przetwarzanie danych za pomocą pakietów Pandas i NumPy oraz środowiska IPython. Wydanie II. Helion, Gliwice 2018. 2. Miles R., Python. Zacznij programować! Helion, Gliwice 2018. 3. https://docs.python.org/pl/3/ - Python, dokumentacja.		
Organisational unit conducting the course	Department of Electrical Engineering, Energoelectronics and Electroenergetics	Date of issuing the programme	
Author of the programme	dr inż. Jarosław Forenc	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	**3D prototyping and additive manufacturing**							Course code	**CP1S02006**
								Course type	**obligatory**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**2**
	15				**15**			No. of ECTS credits	**2**
Entry requirements	Technical drawing								
Course objectives	Introduction to the subject of rapid prototyping. Overview of measurement techniques, optical scanning, non-destructive testing of components. Cost-effectiveness and time-consuming of incremental techniques. Overview of techniques to accelerate the production Time Compression Technologies - TCT: Rapid Prototyping (RP), Virtual Prototyping (VP), Rapid Manufacturing (RM), Rapid Tooling (RT), Reverse Engineering (RE). Acquainting with the principles of 3D printing. Materials used in additive manufacturing technology. Discussion of the methods of stereolithography (SLA), thermoplastic extrusion (FDM), jet modeling (JM), powder printing (3DP), layered lamination (LOM) and laser bonding of powders (SLS / SLM and LENS). Presentation of the principles of building a model: thin-wall packaging model (container), volume model (furniture bracket), model of a truss frame (spatial structure). Getting to know the methods of surface finishing as well as their accuracy and strength. Overview of the principles of preparing a 3D-CAD model (CAD - Computer-Aided Design) and the structure of the STL file.								
Course content	Lecture: Optical measurement and scanning techniques. Techniques for Accelerating Manufacturing Time Compression Technologies - TCT: Rapid Prototyping (RP), Virtual Prototyping (VP), Rapid Manufacturing (RM), Rapid Tooling (RT), Reverse Engineering (RE). 3D printing, manufacturing principles: materials (polymers, metals, ceramics) and technologies used for additive manufacturing. Basics of polymer materials processing. Stereolithography (SLA), thermoplastic extrusion (FDM), jet modeling (JM), powder printing (3DP), layered lamination (LOM) and laser powder bonding (SLS / SLM and LENS) methods. Structure of devices for prototyping. Principles of model building: thin-wall, volumetric and truss frame model. Methods of surface finishing and their accuracy of model mapping (dimensional and quality control), the process of preparation and implementation of a new product for production. Principles of 3D-CAD (Computer-Aided Design) model preparation and STL file structure. Cost-effectiveness and time-consuming of incremental techniques. Specialistic workshop: Additive manufacturing technologies. Polymer processing technologies. Planning of the production process. 3D-CAD design. Accuracy of model mapping (dimensional and quality control). Project documentation.								

Teaching methods	Informative-problem lecture; Classes in computer methods and techniques with demonstration, instruction and discussion;	
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	additive manufacturing techniques	CP1_W12
LO2	selected problems of selection of mechanical components and systems	CP1_W05
	Skills: the graduate is able to	
LO4	design a 3D printing process	CP1_U10
LO5	develop technical documentation of components or systems manufactured by incremental technique	CP1_U04
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
Student workload (in hours)		No. of hours
Calculation	Lecture attendance	15
	Workshop attendance	15
	Preparation for lecture test(s)	6
	Preparation for specialistic workshop	7
	Preparation for workshop completion	2
	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		29 / 1,2
Basic references	1. Siemiński P., Budzik G., Techniki przyrostowe: druk 3D, drukarki 3D. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2015. 2. Czerwiński K., Czerwiński M., Pabich M. (Red.), Kruk P., Łączny J., Sadecki K., Drukowanie w 3D. InfoAudit, Warszawa 2013. 3. Milewski J. O, Additive manufacturing of metals: from fundamental technology to rocket nozzles, medical implants, and custom jewelry. Springer International Publ., Cham 2017.	

	4. Srivatsan T. S, Sudarshan T. S, Additive manufacturing: innovations, advances, and applications. CRC Press: Taylor & Francis, Boca, Raton 2016. 5. Kaziunas F. A., Świat druku 3D: przewodnik: kompendium wiedzy o druku 3D!. Helion, Gliwice 2014.	
Supplementary references	1. Mikulska A., Kotliński J., Badanie drukowanych części maszyn. Uniwersytet Technologiczno-Humanistyczny im. Kazimierza Pułaskiego, Radom 2019. 2. Chlebus E., Innowacyjne Technologie Rapid Prototyping - Rapid Tooling w rozwoju produktu. Oficyna wydawnicza Politechniki Wrocławskiej, Wrocław 2003. 3. Knosala R., Systemy komputerowego wspomagania procesów wytwórczych. Wyd. Pol. Śląskiej, Gliwice 1997.	
Organisational unit conducting the course	Department of Photonics, Electronics and Light Technology	Date of issuing the programme
Author of the programme	dr hab. inż. Piotr Miluski, 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	**Metrology**							Course code	**CP1S02007**
								Course type	**obligatory**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**2**
	15		**30**					No. of ECTS credits	**4**
Entry requirements	Analogue technology and fundamentals of electronics								
Course objectives	Acquainting with selected models of electric and geometrical quantities. Acquainting with measurements of geometrical quantities. Knowledge and understanding of the basic methods of measuring electrical quantities. Acquainting with DC and AC electric systems and measuring devices. Mastering the principles of operating measuring instruments used in industry (power supplies, signal generators, digital multimeters, digital oscilloscopes, measuring converters, electricity meters). Teaching methods of developing measurement results and methods of estimating the measurement uncertainty.								
Course content	Lecture: Basic concepts of metrology. Standards of electric and non-electric values. Estimating errors and uncertainty of measurements - examples. Measurements of geometric quantities. Measurements of basic electrical quantities - selected methods. Measuring instruments and measurements of geometrical and electrical quantities. Introduction to measurement data acquisition systems. Laboratory classes: Estimating errors and uncertainty in measurements of geometrical and electrical quantities. Multimeters - measurements of voltage, current, resistance. Measuring instruments of geometrical quantities. Measurement of parameters of periodic signals with a digital oscilloscope. Measurements of impedance parameters. Measurement of power and electricity in a single-phase AC circuit.								
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	units and standards of measurement	CP1_W01
LO2	basic concepts of metrology	CP1_W01
LO3	measuring methods of electric quantities	CP1_W03
	Skills: the graduate is able to	

LO4	measure basic geometric and electrical quantities	CP1_U06 CP1_U11
LO5	calculate limit errors and uncertainties using data sheets of measuring instruments	CP1_U01
LO6	correctly work-out and interpret measurement results	CP1_U04 CP1_U11
	Social competences: the graduate is ready to	
LO7	conduct measurements of geometrical and electrical quantities 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: exam;	W
LO2	Lecture: exam;	W
LO3	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
LO7	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 the lecture exam; participation in the exam	25
	Preparation for laboratory classes	19
	Preparation for laboratory classes completion	6
	Participation in teacher-student sessions related to the module subject	5
	TOTAL	100
Quantitative indicators		Hours / ECTS
Student workload - activities that require direct teacher participation		52 / 2,1
Student workload - practical activities		60 / 2,4
Basic references	1. Chwaleba A., Poniński M., Siedlecki A., Metrologia elektryczna. WNT, Warszawa 2014. 2. Jakubiec W., Malinowski J., Metrologia wielkości geometrycznych. WNT, Warszawa 2021. 3. Zakrzewski J., Kampik M., Sensory i przetworniki pomiarowe. Wydawnictwo Politechniki Śląskiej, Gliwice 2013. 4. Jakubiec W., Zator S., Majda P., Metrologia. PWE, Warszawa 2018, eBook.	
Supplementary references	1. Sroka R., Podstawy metrologii elektrycznej. Wydawnictwa AGH 2018. 2. Kamieniecki A., Współczesny oscyloskop: budowa i pomiary. Wydawnictwo BTC, Legionowo 2009. 3. Rydzewski J., Pomiary oscyloskopowe. Wydawnictwa Naukowo-Techniczne, Warszawa 2007. 4. Derlecki S., Metrologia elektryczna i elektroniczna, Wydawnictwo Politechniki Łódzkiej, Łódź 2010.	

	5. Webster J. G., Eren H., Measurement, instrumentation, and sensors handbook: spatial, mechanical, thermal, and radiation measurement. CRC/Taylor & Francis, 2014.	
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 1**							Course code	**CP1S02008**
								Course type	**elective**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**2**
		30						No. of ECTS credits	**2**
Entry requirements	-								
Course objectives	Improving language proficiency (listening, reading, interacting, producing, writing) at level B2 or higher, in line with the Common European Framework of Reference for Languages. Stimulating curiosity about the fundamental dilemmas of modern civilization and the issues of the field of study. Acquainting with the basic vocabulary of mathematical and technical sciences. Getting to know the rules and practicing self-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 discussed texts. Basic vocabulary of mathematical and technical sciences. Self-presentation in speech and writing.								
Teaching methods	Classes;								
Assessment method	Evaluation of inter-semester tests; modular tests, written and oral statements								

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 mathematical and technical sciences	CP1_U04 CP1_U05
LO5	better understand and formulate texts on various issues of the modern world, including those containing basic terminology in the field of mathematical and technical sciences	CP1_U04 CP1_U05
LO6	present in the oral and written form his/her profile of a student, the university and the field of study	CP1_U04 CP1_U05
	Social competences: the graduate is ready to	

LO7	take an active part in the discussion respecting the diversity of expressed opinions, views, cultural references	CP1_K02
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; modular tests, written and oral statements;	C
LO5	Evaluation of inter-semester tests; modular tests, written and oral statements;	C
LO6	Evaluation of inter-semester tests; modular tests, written and oral statements;	C
LO7	Evaluation of inter-semester tests; modular tests, written and oral statements;	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

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	**Physical education 2**							Course code	**CP1S02009**
								Course type	**elective**
Forms and number of hours of educational ectivities	L	C	LC	P	SW	FW	S	Semester	**2**
		30						No. of ECTS credits	**0**
Entry requirements	-								
Course objectives	Interest in physical culture and sports activities. Developing physical fitness, developing proper hygiene and health habits preparing for spending free time actively and effectively regenerating the body. Teaching and improvement of technical and tactical elements in practiced sports disciplines. Acquainting with sports equipment located in gyms and in the aerobics room and with the methods of its use. Getting to know the rules in gyms, enabling safe exercise.								
Course content	Classes: Sports disciplines: futsal, volleyball, basketball, table tennis, aerobics, strength training. Sports rules for sports disciplines exercised. Participation in departmental games. Conducting a proper warm-up. Developing basic motor skills. The technique of working on the equipment in the gym. Body shaping exercises. Methods of building muscle mass, shaping strength, power, local strength endurance. Methods of reducing adipose tissue. Preparation for independent exercise and planning a training unit in the gym and in the aerobics room. Practical applications of tactics and techniques in practiced sports games.								
Teaching methods	Classes;								
Assessment method	Test (a written essay on physical culture, sport or recreation for students with a full sick leave from p.e.								

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
	Skills: the graduate is able to	
LO4	apply the rules of safe use of sports facilities and devices to practice various sports disciplines	CP1_U12
LO5	follow basic rules and use tactical and technical elements of sports disciplines carried out during PE classes, cooperate in a team, participate in sports competition (group games) - applies to sports games classes	CP1_U01 CP1_U03

LO6	use technical skills during the game, carry out a correct warm-up, make a simplified training plan for him/herself and do exercises shaping the individual muscles and features of the muscular system	CP1_U01 CP1_U03
Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO4	Test (a written essay on physical culture, sport or recreation for students with a full sick leave from p.e.;	C
LO5	Test (a written essay on physical culture, sport or recreation for students with a full sick leave from p.e.;	C
LO6	Test (a written essay on physical culture, sport or recreation for students with a full sick leave from p.e.;	C
LO7	Test (a written essay on physical culture, sport or recreation for students with a full sick leave from p.e.;	C

Student workload (in hours)		No. of hours
Calculation	Classes attendance	30
	Preparation for classes completion	6
	Participation in teacher-student sessions related to the module subject	5
	TOTAL	41

Quantitative indicators	Hours	ECTS
Student workload - activities that require direct teacher participation	35	0
Student workload - practical activities	41	0

Basic references	1. Delavier F., Gundill M., Modelowanie sylwetki metodą Delaviera: ćwiczenia i programy treningu siłowego. PZWL, Warszawa, 2012. 2. Grządziel G., Piłka siatkowa. Wydawnictwo Akademii Wychowania Fizycznego im. Jerzego Kukuczki, Katowice, 2012. 3. Kuba L., Paruzel-Dyja M., Fitness: nowoczesne formy gimnastyki: podstawy teoretyczne: podręcznik dla instruktorów, studentów i nauczycieli wychowania fizycznego. Wydawnictwo Akademii Wychowania Fizycznego im. Jerzego Kukuczki, Katowice, 2013. 4. Valdericeda F., Futsal: taktyka i ćwiczenia taktyczne. MH, Ruda Śląska, 2012. 5. Wróblewski F., Koszykówka (historia, zasady, trening). Dragon, Bielsko-Biała, 2011.
Supplementary references	1. Clemenceau J-P., Delavier F., Stretching: ilustrowany przewodnik. PZWL, Warszawa, 2012. 2. Delavier F., Atlas treningu siłowego. PZWL, Warszawa, 2011. 3. Wołyniec J. (red.), Przepisy gier sportowych w zakresie podstawowym. BK, Wrocław, 2006. 4. Wróblewski F., Siatkówka, Dragon, Bielsko-Biała, 2010.

Organisational unit conducting the course	School of Physical Education and Sports	Date of issuing the programme
Author of the programme	dr Piotr Klimowicz	2022-06-07