Bialystok University of Technology									
Field of study	**Automatic Control and Robotics**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Fundamentals of robotics**							Course code	**MYARS03001**
								Course type	**obligatory**
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	Semester	**3**
	30	**15**	**30**	**0**	**0**	**0**	**0**	No. of ECTS credits	**7**
Entry requirements	Technical mechanics								
Course objectives	Acquainting with basic knowledge related to robotics and the structure and application of robots and their components. Manipulator kinematics and dynamics. Introduction to programming of industrial robots.								
Course content	Lecture: Robot classification, kinematic structures, concepts in the theory of machines and mechanisms. Simple and inverse kinematics problem. Denavit-Hartenberg notation (D-H). Introduction to modeling of multi-body systems dynamics. Sensors and actors used in robots. Types of mechanical gears used in the structure of robot arms. Vision systems, image recognition methods as elements of robot control systems. Fundamentals of programming, programming languages and program structures. Exercises: Kinematics analysis and introduction to the manipulator dynamics. Laboratory: Programming of real industrial manipulators.								
Teaching methods	Informative-problem lecture; Classes; Laboratory classes;								
Assessment method	Lecture: exam Classes: 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
LO1	knows the basic terms related to the theory of machines and mechanisms, robot and robotics	AR1_W01 AR1_W06
LO2	is able to define and knows the principle of operation of individual components of the robot	AR1_W05
LO3	knows the methods and tools for programming the robot	AR1_W05
LO4	can determine the DH parameters necessary to solve the tasks of the kinematics of a robot or manipulator	AR1_W02 AR1_U01 AR1_U02
LO5	can determine the basic dynamics of the manipulator mechanism	AR1_U01 AR1_U02 AR1_U03
LO6	can, preserving the rules of health and safety, program the industrial manipulator	AR1_U03 AR1_U04 AR1_U12 AR1_K02

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; Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	W L
LO4	Classes: one test;	C
LO5	Classes: one test;	C
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
	Classes attendance	15
	Laboratory classes attendance	30
	Preparation for the lecture exam; participation in the exam	36
	Preparation for classes	22
	Preparation for classes completion	3

	Preparation for laboratory classes	28	
	Preparation for laboratory classes completion	6	
	Participation in teacher-student sessions related to the module subject	5	
	TOTAL	175	
Quantitative indicators		Hours	ECTS
Student workload - activities that require direct teacher participation		82	3,3
Student workload - practical activities		109	4,4
Basic references	1. Honczarenko J., Roboty przemysłowe: budowa i zastosowanie. WNT, Warszawa, 2010. 2. Zdanowicz R., Podstawy robotyki. WPŚ, Gliwice, 2011. 3. Szkodny T., Zbiór zadań z podstaw robotyki. WPŚ, Gliwice, 2013. 4. Craig J. J., Wprowdzenie do robotyki. Mechanika i sterowanie. WNT, Warszawa, 2003. 5. Spong M. W., Vidyasagar M.: Dynamika i sterowanie robotów, WNT, Warszawa, 1997.		
Supplementary references	1. Kozłowski K., Dutkiewicz P., Wróblewski W., Modelowanie i sterowanie robotów. PWN, Warszawa, 2003. 2. Buratowski T., Postawy robotyki. Uczelniane Wydawnictwa Naukowo-Techniczne AGH, Kraków 2006. 3. Wittbrodt E., Adamiec-Wójcik I., Wojciech S. Dynamics of flexible multibody systems: rigid finite element method. Springer Science & Business Media, 2007. 4. Adamiec-Wójcik I., Modelling dynamics of multibody systems using homogenous transformations. Wydawnictwo ATH, 2003. 5. Morecki A., Knapczyk J., Podstawy robotyki. WNT, Warszawa, 1999.		
Organisational unit conducting the course	Katedra Automatyki i Robotyki	Date of issuing the programme	
Author of the programme	dr inż. Roman Trochimczuk	2019-09-23	

Bialystok University of Technology									
Field of study	**Automatic Control and Robotics**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Kinematics and dynamics of mechanisms**							Course code	**MYARS03002**
								Course type	**obligatory**
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	Semester	**3**
	15	**0**	**0**	**15**	**0**	**0**	**0**	No. of ECTS credits	**3**
Entry requirements	Technical mechanics								
Course objectives	Acquainting with the methods of kinematic and dynamic analysis of selected mechanisms.								
Course content	Lecture: Kinematics of parallel structures. The method of rigid and flexible finite elements. Fundamental principles of rigid and flexible mechanisms. Holonomic and nonholonomic systems. Analysis of mechanisms subjected to self and forced vibrations. Structural analysis of mechanisms. Denavit-Hartenberg systems. Kinematic analysis of selected mechanisms. Lagrange equations of the 1st and 2nd kind with reference to manipulators. Project: Determination of dynamics of robotic systems using MATLAB and Adams software.								
Teaching methods	Informative-problem lecture; Project classes;								
Assessment method	Lecture: one test Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes								

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
LO1	knows and can correctly classify holonomic and nonholonomic systems	AR1_W02 AR1_W05 AR1_U01
LO2	can determine the motion parameters of kinematic chains	AR1_U01 AR1_U08
LO3	knows and can solve the task of dynamics using rigid or flexible finite elements	AR1_W03 AR1_W05 AR1_U01 AR1_U08
LO4	knows and can analyze a simple dynamic system subjected to self or forced vibrations	AR1_W03 AR1_W05 AR1_U01 AR1_U08
LO5	can apply Lagrange method to determine motion equations	AR1_U01 AR1_U04 AR1_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
LO3	Lecture: one test; Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	W P
LO4	Lecture: one test; Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	W P
LO5	Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	P

Student workload (in hours)		No. of hours
Calculation	Lecture attendance	15
	Project attendance	15
	Preparation for lecture test(s)	13
	Preparation for project classes	16
	Working on projects (including preparation of presentations)	6
	Preparation for projects completion	5
	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	35	1,4
Student workload - practical activities	47	1,9

Basic references	1. Cannon R.H., Dynamika układów fizycznych, WNT, Warszawa, 2003. 2. Morecki A., Podstawy robotyki. Teoria manipulatorów i robotów, WNT, Wydawnictwo poprawione, Warszawa, 2002. 3. Honczarenko J., Roboty przemysłowe: budowa i zastosowanie. WNT, Warszawa 2011.	
Supplementary references	1. Craig J.J., Introduction to robotics: mechanics and control. Pearson Education, Harlow 2004. 2. Uicker, J. J. Jr., Pennock G. R. and Shigly J. E., Theory of machines and mechanisms, Oxford University Press, Third Edition, 2008. 3. Angeles J., Keceskementhy A., Kinematics and dynamics of multi-body systems, Springer Publisher, 1995. 4. Norton R. L., Design of machinery: an introduction to the synthesis and analysis of mechanisms and machines, McGraw-Hill, Fifth Edition, 2011. 5. Bevan T., Theory of machines, Published by Pearson Education, Third Edition, 2009.	
Organisational unit conducting the course	Katedra Automatyki i Robotyki	Date of issuing the programme
Author of the programme	dr inż. Andrzej Koszewnik	2019-09-23

Bialystok University of Technology									
Field of study	**Automatic Control and Robotics**							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	**MYARS03003**
								Course type	**obligatory**
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	Semester	**3**
	15	**0**	**30**	**0**	**0**	**0**	**0**	No. of ECTS credits	**4**
Entry requirements	Electrotechnics and electronics								
Course objectives	Acquiring knowledge about the structures 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 working point and basic parameters of the selected drive system. Acquiring the ability to combine, run, test and conduct measurements of the characteristics of simple drive systems. Acquiring the ability to conduct computer simulations of electromechanical characteristics of drive systems with DC and AC motors.								
Course content	Lecture: Classification, properties and applications of electric drives. Electric drive systems - basic definitions, subassemblies, areas of application. Feedback, shaping of motor mechanical characteristics. Starting, angular speed control and braking of DC motor, single-phase and three-phase AC motor. DC converter drives with DC motor (block diagrams, principle of operation, properties and applications). Frequency adjustment of the rotational speed of selected AC motors. Digital and analogue systems of angular velocity and position control. Position control systems with stepper motors and servo drives. Linear drives. Selection of electric motors for working machines. Electrical equipment and protection of drive systems. Laboratory: Calculation of the working point and basic parameters of the drive system with the DC drive and the asynchronous machine. Determination of electromechanical characteristics of a drive system with a DC-powered DC motor, a serial DC machine and asynchronous three-phase AC machines. Conducting computer simulations of these systems.								
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
LO1	understands and can describe the mechanical characteristics of electric motors and working machines	AR1_W06 AR1_U04
LO2	knows the methods of speed control in selected drive systems with DC and AC motors	AR1_W06 AR1_W08
LO3	can plan and carry out measurements of mechanical characteristics of the selected drive system	AR1_U04
LO4	can realize and discuss the operation of the tested drive system, is ready to evaluate it at the engineering level	AR1_U04 AR1_K02
LO5	can measure electrical and mechanical quantities and correctly develop results and draw conclusions based on them	AR1_U02 AR1_U04
LO6	can work individually and in a team with the application of health and safety rules at the workplace and exchange opinions on the implementation of the task	AR1_U11 AR1_U09 AR1_U12

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

	during the classes;		
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 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. Antal L., Zagadnienia maszyn, napędów i pomiarów elektrycznych. Wrocław: Oficyna Wydawnicza Politechniki Wrocławskiej, 2009. 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. Orłowska-Kowalska T., Bezczujnikowe układy napędowe z silnikami indukcyjnymi, Wrocław: Oficyna Wydawnicza Politechniki Wrocławskiej, 2003.		
Supplementary references	1. Gieras J. F., Piech Z. J., Tomczuk B. Z., Linear synchronous motors: transportation and automation systems, Boca Raton: CRC/Taylor & Francis, 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	Katedra Energoelektroniki i Napędów Elektrycznych	Date of issuing the programme	
Author of the programme	dr inż. Adam Kuźma	2019-09-23	

Bialystok University of Technology									
Field of study	**Automatic Control and Robotics**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Computer aided design in mechanical engineering**							Course code	**MYARS03004**
								Course type	**obligatory**
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	Semester	**3**
	15	**0**	**0**	**30**	**0**	**0**	**0**	No. of ECTS credits	**4**
Entry requirements	Technical drawing in mechanical engineering								
Course objectives	Acquainting with the place of CAD systems in integrated design and manufacturing systems. Overview of basic types of CAD models. Discussing the possibility of using solid models in the design of parts and devices in automatic control and robotics. Presentation of the possibilities of using CAD models in the design of robotic subassemblies in the form of open and closed kinematic chains. Acquiring the ability to create parametric models of parts and assemblies and creating technical drawings based on solid models. Getting to know how to create animations and visualizations based on the 3D model.								
Course content	Lecture: The structure of the integrated CIM design and manufacturing system. Place of CAD systems in integrated design and manufacturing systems. Types of CAD models. Advantages and possibilities of solid modeling. The use of CAD models in CAM and CAE systems. Geometric modeling of mechanical systems in automatic control and robotics. The use of CAD models in the design of robotic subassemblies in the form of open and closed kinematic chains. The use of vector and raster graphics for the needs of creating 3D models. Formats of vector and raster graphics. Project: Creating and editing parametric models of parts. Development of technical documentation of 2D parts, based on 3D models. Modeling of subassemblies using the "bottom-up" method. Implementation of a team project for robotic applications. Generating workshop drawings of parts and assembly drawings of the device. Performing motion analysis of a robotic subassembly.								
Teaching methods	Informative-problem lecture; Project classes;								
Assessment method	Lecture: one test Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes								

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
LO1	knows and classifies types of CAD models	AR1_W03 AR1_W04 AR1_W07 AR1_U03 AR1_U08
LO2	knows and can use CAD models in manufacturing processes and in numerical calculations of structure strength	AR1_W03 AR1_W07 AR1_U03 AR1_U08
LO3	knows and can use CAD models in rapid prototyping methods and reverse engineering processes	AR1_W03 AR1_W07 AR1_U06 AR1_U08
LO4	can edit solid models	AR1_U03 AR1_U06 AR1_U08
LO5	can create a model subassembly based on models of parts	AR1_U03 AR1_U06 AR1_U08
LO6	can determine physical properties of the solid object and carry out the analysis of the movement of the robotic subassembly	AR1_U03 AR1_U08
LO7	is able to develop the 2D documentation of the subassembly based on its 3D model	AR1_U06 AR1_U08
LO8	is ready to learn continuously	AR1_K

		01
Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	Lecture: one test; Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	W P
LO2	Lecture: one test; Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	W P
LO3	Lecture: one test; Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	W P
LO4	Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	P
LO5	Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	P
LO6	Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	P
LO7	Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	P
LO8	Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	P
Student workload (in hours)		No. of hours
Calculation	Lecture attendance	15
	Project attendance	30
	Preparation for lecture test(s)	14
	Preparation for project classes	18
	Working on projects (including preparation of presentations)	12
	Preparation for projects 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		50 / 2
Student workload - practical activities		71 / 2,8
Basic references	1. Fischer U. [i in.]: Poradnik mechanika, opracowanie w j. polskim Potrykus J., Wydawnictwo REA, 2014. 2. Keska P., SolidWorks 2013, Modelowanie części, złożenia, rysunki, Wydawnictwo CADvantage, 2013. 3. Kurmaz L, Kurmaz O., Podstawy konstruowania węzłów i części maszyn: podręcznik konstruowania, 2011.	
Supplementary references	1. Czasopisma branżowe (np., Design News Polska, Projektowanie i Konstrukcje Inżynierskie). 2. Lombard M., „SolidWorks 2011 Parts Bible", Wiley Publishing, 2011. 3. Lombard M., „SolidWorks 2011 Asemmblies Bible", Wiley Publishing, 2011. 4. SolidWorks Rysunki, Wydawnictwo CNS Solutions, 2012. 5. Portale internetowe (np., www.3dcad.pl, www.solidworks.com, www.cns.pl).	
Organisational unit conducting the course	Katedra Mechaniki i Informatyki Stosowanej	Date of issuing the programme
Author of the programme	dr inż. Paweł Dzienis	2019-09-23

Bialystok University of Technology									
Field of study	**Automatic Control and Robotics**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Signal theory**							Course code	**MYARS03005**
								Course type	**obligatory**
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	Semester	**3**
	30	**0**	**0**	**15**	**0**	**0**	**0**	No. of ECTS credits	**4**
Entry requirements	Mathematics II, Electrotechnics and electronics								
Course objectives	Gaining basic knowledge in the field of signal theory, including theoretical foundations of description and analysis of signals, and development of the ability to describe and analyze signals in the domain of time and frequency, especially with the use of digital technology.								
Course content	Lecture: Introduction to the theory of signals, classification of signals. Description of determinate signals. Description of random signals. The problem of analog-digital coding - sampling, quantization and signal coding, rules of correct signal sampling. Analysis of periodic signals in the frequency domain. Spectral analysis of signals using the continuous and discrete Fourier transform. Short-term Fourier transform. Basic types of signal modulation. Introduction to filtration, description and analysis of digital filters. Project: Determining basic parameters of signals. Generating waveforms. Spectral analysis of signals. Spectral analysis using time windows. Sampling and reconstruction of signals.								
Teaching methods	Informative-problem lecture; Project classes;								
Assessment method	Lecture: exam Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes								

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
LO1	knows and understands issues related to the theory of signals and methods of their processing	AR1_W06
LO2	can apply basic software packages to the presentation of results and data analysis	AR1_U03
LO3	can develop a simple documentation on the implementation of the engineering task and prepare a text containing a discussion of the results of this task	AR1_U06
LO4	can work independently and in a team	AR1_U11

Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	Lecture: exam;	W
LO2	Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	P
LO3	Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	P
LO4	Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	P

Student workload (in hours)		No. of hours
Calculation	Lecture attendance	30
	Project attendance	15
	Preparation for the lecture exam; participation in the exam	18
	Preparation for project classes	20
	Working on projects (including preparation of presentations)	6
	Preparation for projects 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		52	2,1
Basic references	1. Izydorczyk J., Płonka G., Tyma G., Teoria sygnałów. Helion, Warszawa, 2006. 2. Szabatin J., Podstawy teorii sygnałów. WKŁ, Warszawa 2003. 3. Wojnar A., Teoria Sygnałów, WNT, Warszawa, 2009 (WydawnictwoII). 4. Zieliński T., Cyfrowe przetwarzanie sygnałów. Od teorii do zastosowań, WKŁ, Warszawa 2009. 5. Lyons R., Wprowadzenie do cyfrowego przetwarzania sygnałów. WKŁ, Warszawa 2010.		
Supplementary references	1. Pasko M., Walczak J., Teoria sygnałów, Wydawnictwo Politechniki Śląskiej, Gliwice,1999. 2. Zieliński T., Cyfrowe przetwarzanie sygnałów, WKŁ, 2005. 3. Schilling R.J., Harris S.L., Introduction to digital signal processing using MATLAB, Cengage Learning, 2012.		
Organisational unit conducting the course	Katedra Automatyki i Robotyki	Date of issuing the programme	
Author of the programme	dr hab. inż. Jolanta Pauk, prof. PB	2019-09-23	

Bialystok University of Technology									
Field of study	**Automatic Control and Robotics**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Programming in C++**							Course code	**MYARS03006**
								Course type	**obligatory**
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	Semester	**3**
	15	**0**	**0**	**30**	**0**	**0**	**0**	No. of ECTS credits	**3**
Entry requirements	Programming in C								
Course objectives	Gaining knowledge of object-oriented programming techniques in C++. Gaining practical skills in designing and implementing programs based on the object-oriented programming paradigm in C++.								
Course content	Lecture: Concepts: class, object, methods, fields. Creating and deleting objects. Interface and class implementation, hermetization. Static members. Composition and inheritance. Polymorphism. Internal classes. Containers in C++. Sequential containers. Container containers. Exceptions in C++. Project: Creating and deleting objects. Creating classes. The use of encapsulation. Use composition and inheritance to create new classes. Use of virtual methods. Use exceptions to handle runtime errors. Using interface types. Creating generic classes. Designing the program classes based on the description of the word system. Implementing larger programs.								
Teaching methods	Informative-problem lecture; Project classes;								
Assessment method	Lecture: one test Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes								

Symbol of learning outcome	Learning outcomes	Reference to the learning outcomes for the field of study
LO1	knows and understands object-oriented programming techniques	AR1_W04
LO2	knows and understands standard C ++ libraries	AR1_W04
LO3	is able to design and implement programs using object-oriented programming techniques in C++	AR1_U03
LO4	is able to detect different types of errors and neutralize them	AR1_U03

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	Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	P
LO4	Project: evaluation of project completion, current progress in project completion, discussion and activity during the classes;	P

	Student workload (in hours)	No. of hours
Calculation	Lecture attendance	15
	Project attendance	30
	Preparation for lecture test(s)	5
	Preparation for project classes	6
	Working on projects (including preparation of presentations)	12
	Preparation for projects completion	2
	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	55	2,2

Basic references	1. Schildt H., Programowanie C++. Wydaw. RM, Warszawa 2002.

	2. Eckel B., Thinking in C++. Helion, Gliwice 2002. 3. Allain A., C++: przewodnik dla początkujących. Helion, Gliwice 2014.	
Supplementary references	1. Jędrzejec B., Programowanie w języku C i C++: skrypt dla informatyków i automatyków. Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 2017. 2. Stroustrup B., Język C++: kompendium wiedzy. Helion, Gliwice 2014. 3. Josuttis N. M., C++ biblioteka standardowa. Helion, Gliwice 2014.	
Organisational unit conducting the course	Katedra Systemów Informacyjnych i Sieci Komputerowych	Date of issuing the programme
Author of the programme	dr inż. Tomasz Grześ	2019-09-23

Bialystok University of Technology									
Field of study	**Automatic Control and Robotics**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Programming of embedded systems**							Course code	**MYARS03007**
								Course type	**obligatory**
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	Semester	**3**
	15	**0**	**30**	**0**	**0**	**0**	**0**	No. of ECTS credits	**3**
Entry requirements	Electrotechnics and electronics, Programming in C								
Course objectives	Acquainting with embedded systems and to help them acquire practical skills in the configuration and programming of embedded systems based on Linux.								
Course content	Lecture: Commercial and technical reasons to use embedded systems. Generic architecture of embedded linux systems. Basic shell commands. Efficient tools to generate embedded Linux systems: crosstool-ng, busybox, buildroot. Configuring and compiling the kernel. Booting a Linux system. Examples of use of embedded systems. Creating applications for embedded systems. Laboratory classes: Learn how to build cross-compiling toolchain. Learn how to cross-compile a kernel for an embeded system. Learn how to create a minimalist system for embedded syatems. Leran how to work with the cross-compiler and how to configure Eclipse for running and debugging applications directly on the embedded device. Software development for embedded systems including: GPIO support, PWM signal generation, sensor support, communication interface support.								
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
LO1	has knowledge of the design and construction of embedded systems	AR1_W04
LO2	knows the tools for the installation and configuration of embedded systems,	AR1_W04 AR1_W08
LO3	is able to design and implement an embedded system using appropriate methods, techniques and tools,	AR1_U03 AR1_U06
LO4	is able to use available tools and develop their own tools and applications including procedures enabling: GPIO support, generation of PWM signals, sensor support, use of communication interfaces,	AR1_U03
LO5	can work individually and in a team and can estimate the time needed to complete the assigned task.	AR1_U11

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	Laboratory: evaluation of introductory tests, reports, discussion and activity during the classes;	L
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

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. Bis M., Linux w systemach embedded, Wydawnictwo BTC, Warszawa, 2011. 2. Bis M., Linux w systemach i.MX 6 series, Wydawnictwo BTC, Warszawa, 2015. 3. Skalski Ł., Linux embedded podstawy i aplikacje dla systemów embedded, Wydawnictwo BTC, Warszawa, 2012. 4. Monk S., Raspberry Pi: przewodnik dla programistów Pythona. Gliwice: Helion, 2014.		
Supplementary references	1. Abbott D., Linux for embedded and real-time applications, Burlington: Newnes, 2003. 2. Barry P., Python. Gliwice: Helion, 2011. 3. Love R., Jądro Linuksa: przewodnik programisty, Helion, Gliwice, 2014.		
Organisational unit conducting the course	Katedra Telekomunikacji i Aparatury Elektronicznej	Date of issuing the programme	
Author of the programme	dr inż. Krzysztof Konopko	2019-09-23	

Bialystok University of Technology									
Field of study	**Automatic Control and Robotics**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Foreign language II English**							Course code	**MYARS03008**
								Course type	**elective**
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	Semester	**3**
	0	**30**	**0**	**0**	**0**	**0**	**0**	No. of ECTS credits	**2**
Entry requirements	Foreign language I English								
Course objectives	Improving knowledge of English grammar in written work. Getting to know the vocabulary of English which enables communication in specific typical situations, including work environment. Ability to read technical documentation and interpretation of basic information from foreign literature concerning the studied field.								
Course content	Topics: Work / career. Security. Planning. Properties and features of materials used in technological processes, structure and operation of selected devices. Grammar: Present Continuous, Present Simple and structure be going to. The degree of the higher adjective and the ways of comparing items. Past Perfect and Past Simple. Modal verbs - active and passive. Forms of verbs after the terms: if / when / after / until / unless / without / before. Creating questions. Predicting the future: will + be able to, have to, need to; modal verbs must / can / can not, have to / do not have to.								
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
LO1	has knowledge and ability to apply the grammatical rules of English in written works	AR1_U10
LO2	reads with understanding and writes in English texts related to the studied direction	AR1_U10
LO3	knows basic vocabulary concerning selected materials, machines and devices	AR1_U10
LO4	speaks English sufficiently to communicate in specific situationsx	AR1_U10
LO5	can acquire and interpret basic information from the literature in English	AR1_U10

Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	Evaluation of inter-semester tests; mofular tests, written and oral statements, written and oral homeworks;	C
LO2	Evaluation of inter-semester tests; mofular tests, written and oral statements, written and oral homeworks;	C
LO3	Evaluation of inter-semester tests; mofular tests, written and oral statements, written and oral homeworks;	C
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

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. Bonamy D., Technical English 3. Pearson Longman, 2011. 2. Jacques Ch., Technical English 3.- Workbook. Pearson Longman, 2011. 3. Materiały własne lektora oraz materiały z Internetu.	
Supplementary references	1. Bonamy D., Technical English 2. Pearson Longman, 2008. 2. Bonamy D., Technical English 4. Pearson Longman, 2011. 3. Ibbotson M., Professional English in Use - Engineering, Cambridge University Press, 2009. 4. McCarthy M., O'Dell F., Academic Vocabulary in Use, Cambridge University Press, 2016. 5. Downes C., Cambridge English for Job Hunting, Cambridge University Press, 2008.	
Organisational unit conducting the course	Studium Języków Obcych	Date of issuing the programme
Author of the programme	mgr Wojciech Rogalski	2019-09-23

Bialystok University of Technology									
Field of study	**Automatic Control and Robotics**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Foreign language II Russian**							Course code	**MYARS03009**
								Course type	**elective**
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	Semester	**3**
	0	**30**	**0**	**0**	**0**	**0**	**0**	No. of ECTS credits	**2**
Entry requirements	Foreign language I Russian								
Course objectives	Improving knowledge of Russian grammar in written works. Getting to know the vocabulary of the Russian language that enables communication in specific typical situations, including the work environment. Ability to read technical documentation and interpretation of basic information from foreign literature concerning the studied field.								
Course content	Topics: Human characteristics. Feelings in interpersonal relations. Flat. Dream house. Ways of looking for a job. CV. Christmas customs. Specialist part: Properties and features of materials used in technological processes, structure and operation of selected devices. Grammatical issues: Plural forms of nouns. Gradation of irregular adjectives. Adverbs. Conjunctions of subordinate sentences.								
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
LO1	has knowledge and ability to apply grammatical principles of the Russian language in written works	AR1_U10
LO2	reads with understanding and writes in Russian texts related to the studied direction	AR1_U10
LO3	knows basic vocabulary concerning selected materials, machines and equipment	AR1_U10
LO4	speaks Russian sufficiently to communicate in specific situations	AR1_U10
LO5	can acquire and interpret basic information from the literature in Russian	AR1_U10

Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	Evaluation of inter-semester tests; mofular tests, written and oral statements, written and oral homeworks;	C
LO2	Evaluation of inter-semester tests; mofular tests, written and oral statements, written and oral homeworks;	C
LO3	Evaluation of inter-semester tests; mofular tests, written and oral statements, written and oral homeworks;	C
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

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. Cieplicka M.,Torzewska W., Русский язык. Kompendium tematyczno-leksykalne 1. Wagros, Poznań, 2007. 2. Pado A., Start.ru 2. WSiP, Warszawa, 2006. 3. Milczarek W., Język rosyjski od A do Z. Repetytorium. Kram, Warszawa, 2007	
Supplementary references	1. Kowalska N., Samek D., Praktyczna gramatyka języka rosyjskiego. REA, Warszawa, 2004. 2. Materiały z rosyjskojęzycznych portali internetowych, prasy i książek. 3. Samek D., Rozmówki polsko-rosyjskie. REA, Warszawa, 2009. 4. Słownik naukowo-techniczny rosyjsko-polski. Wydawnictwa Naukowo-Techniczne, Warszawa, 1999.	
Organisational unit conducting the course	Studium Języków Obcych	Date of issuing the programme
Author of the programme	mgr Irena Kamińska	2019-09-23

Bialystok University of Technology									
Field of study	**Automatic Control and Robotics**							Degree level and programme type	**full-time Bachelor's degree**
Specjalization / diploma path	**common subject**							Study profile	**general academic**
Course name	**Foreign language II German**							Course code	**MYARS03010**
								Course type	**elective**
Forms and number of hours of tuition	L	C	LC	P	SW	FW	S	Semester	**3**
	0	**30**	**0**	**0**	**0**	**0**	**0**	No. of ECTS credits	**2**
Entry requirements	Foreign language I German								
Course objectives	improving knowledge of German grammar in written work. Getting to know the vocabulary of the German language that enables communication in specific typical situations, including work environment. Ability to read technical documentation and interpretation of basic information from foreign literature concerning the studied field.								
Course content	Topics: German language in the work environment - recruitment process, job offers and candidates' files, interviews, areas of tasks in the company; communication at the workplace - assigning tasks; describing properties and characteristics. Specialist part: Properties and features of materials used in technological processes, structure and operation of selected devices. Grammar: the commanding and presuming mode (Konjunktiv II); reflexive and modal verbs (repetition); solid verbal-noun compounds.								
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
LO1	possesses knowledge and ability to apply grammatical principles of the German language in written works	AR1_U10
LO2	reads with understanding and writes in German texts related to the studied direction	AR1_U10
LO3	knows basic vocabulary concerning selected materials, machines and devices	AR1_U10
LO4	speaks German sufficiently to communicate in specific situations	AR1_U10
LO5	can acquire and interpret basic information from German literature	AR1_U10

Symbol of learning outcome	Methods of assessing the learning outcomes	Type of tuition during which the outcome is assessed
LO1	Evaluation of inter-semester tests; mofular tests, written and oral statements, written and oral homeworks;	C
LO2	Evaluation of inter-semester tests; mofular tests, written and oral statements, written and oral homeworks;	C
LO3	Evaluation of inter-semester tests; mofular tests, written and oral statements, written and oral homeworks;	C
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

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. Perlmann-Balme, Michaela/Schwalb, Susanne/Matussek, Magdalena: Sicher! Deutsch als Fremdsprache: Niveau B2: Kursbuch und Lektion 1-12, München, Hueber Verlag, 2014. 2. Maria Steinmetz, Heiner Dintera, Deutsch für Ingenieure, Springer Vieweg 2014. 3. Ch. Kuhn, R.M. Niemann, B. Winzer-Kiontke: studio d - Die Mittelstufe B2, Cornelsen Verlag 2010. 4. Valeska Hagner, Sabine Schlüter, Im Beruf Kurs- und Arbeitsbuch, Hueber Verlag 2014.		
Supplementary references	1. Wioletta Omelianiuk, Halina Ostapczuk: Sach- und Fachtexte auf Deutsch, Teil 2, Politechnika Białostocka, Białystok, 2010. 2. Zespół red. Małgorzata Sokołowska, Anna Bender, Krzysztof Żak, Słownik naukowo-techniczny niemiecko-polski, Wydawnictwa Naukowo-Techniczne 2007. 3. Materiały własne prowadzącego (adaptowane i opracowane teksty z literatury fachowej oraz z Internetu).		
Organisational unit conducting the course	Studium Języków Obcych	Date of issuing the programme	
Author of the programme	mgr Wioletta Omelianiuk	2019-09-23	