



“APPROVED BY”  
Chairman-Rector of the West  
Kazakhstan Agrarian and Technical  
University named after Zhangir  
Khan

\_\_\_\_\_ A.M. Nametov  
« \_\_\_\_ » \_\_\_\_\_ 2021



“APPROVED BY”  
Rector of PI “Kostanay Engineering  
and Economic University named  
after M. Dulatov”

\_\_\_\_\_ E.S. Abeldinov  
« \_\_\_\_ » \_\_\_\_\_ 2021



“APPROVED BY”  
First Vice-Rector of  
LLP “Innovative Eurasian  
University”

\_\_\_\_\_ A.V. Aliysova  
« \_\_\_\_ » \_\_\_\_\_ 2021

## EDUCATIONAL PROGRAM

**Robotic systems**

*educational program name*

**6B07 Engineering, manufacturing and construction industries**

*code and classification of the education area*

**6B071 Engineering**

*code and classification of the training area*

**B064 Mechanics and metalworking**

*number and name of the educational programs group*

**baccalaureate**

*training degree*

**DEVELOPED within the framework of the project 609757-EPP-1-2019-1-RS-EPPKA2-CBHE-JP «Dual education for industrial automation and robotics in Kazakhstan / DIARKAZ»:**

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minutes № \_\_ from « \_\_\_\_ » \_\_\_\_\_ 202\_\_

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minutes № \_\_ from « \_\_\_\_ » \_\_\_\_\_ 202\_\_

**Approved at a meeting of the Academic Council of INEU**

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## 1. Passport of the EP

<b>Training profile map within the educational program</b>		
Code and classification of the education area	6B07 Engineering, manufacturing and construction industries ( <b>Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 13, 2018 № 569</b> )	
Code and classification of the training area	6B071 Engineering ( <b>Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 13, 2018 № 569</b> )	
Name of the educational programs group	B064 Mechanics and metalworking	
Educational program name	WKATU	6B07107 - "Robotic systems"
	KEnEU	6B07138 - "Robotic systems"
	INEU	6B07109 - "Robotic systems"
EP type	Joint EP	
EP objective	Providing comprehensive and high-quality training of competitive highly qualified specialists in the field of robotic systems for the research, design, production and operation of robots, mechatronic and robotic systems for various automated and robotic industries	
ISCED level	6	
NQF level	6	
SQF level	6	
Distinguishing features of the EP	-	
Partner universities (JEP)	1) Non-public joint stock company “West Kazakhstan Agrarian and Technical University named after Zhangir Khan” 2) PI “Kostanay Engineering and Economics University named after M. Dulatov” 3) LLP “Innovative Eurasian University”	
Partner university (DDEP)	-	
Form of study	full-time	
Language of instruction	Kazakh, Russian	
Credits number	240 ECTS	
Awarded degree	bachelor	
Availability of an annex to the license for the direction of personnel training	WKATU	available (№KZ15LAA00007594)
	KEnEU	available (№17 from 03.04.2019 for license № 12020748 от 05.11.2012г.)
	INEU	available ( 0137472 от 16.10.2010 )
Availability of EP accreditation	-	
Accreditation body name	-	
Accreditation period		
<b>Qualification characteristics of the graduate</b>		
Degree / qualification	bachelor	
Specialist positions list	– Robotics engineer – Robotics service engineer – Design engineer	

Professional area	Industry, information and communication, professional, scientific and technical activities, education
Object of professional activity	<ul style="list-style-type: none"> <li>– robotic systems, including information-sensory, executive and control modules, their mathematical, algorithmic and software, methods and tools for their design, modeling, experimental research and design;</li> <li>– technical systems, units, machines and machine complexes for various applications based on mechatronic modules;</li> <li>– software and algorithms for robot system control, design and operation</li> </ul>
Functions of professional activity	<ul style="list-style-type: none"> <li>– modeling and selection of materials for robotic systems; organization and supervision of repair and maintenance work on robotic equipment;</li> <li>– conducting theoretical and experimental research in the field of developing new samples and improving existing robotic systems, their modules and subsystems, searching for new ways to control and process information using artificial intelligence methods;</li> <li>– conducting patent research accompanying the development of new robotic systems ;</li> <li>– development of experimental samples of robotic systems, their modules and subsystems for the purpose of testing and substantiating the main theoretical and technical solutions to be included in the terms of reference for the implementation of development work;</li> <li>– organizing and conducting experiments on operating robotic systems, processing the results of experimental research using modern information technologies; accounting and working documentation.</li> </ul>
Professional activities	<ul style="list-style-type: none"> <li>– design and engineering;</li> <li>– production and technological;</li> <li>– organizational and managerial;</li> <li>– operational;</li> <li>– calculation and design.</li> </ul>

## 2. Matrix for correlating learning outcomes in the educational program with the competencies being acquired

<b>Competencies / learning outcomes</b>	LO1. Formulate knowledge and understanding in the field of robotic systems, which are based on advanced knowledge on these issues with the ability to analyze and use the information obtained for the correct orientation of reality	LO2. Have a high level of professional culture, including the culture of professional communication, having a civil position	LO3. Differentiate information for further formation of judgments and considerations on social ethical and scientific issues	LO4. Use written and verbal communication to document the work and present obtained results, as well as have a high level of professionalism in Kazakh, English and Russian	LO5. Be competent in the relevant field of science and technology, have skills necessary for independent continuation of further education in the field of study	LO6. Is able to perform a professional function in the relevant field of science and technology, be able to analyze, perform calculations and describe the results obtained	LO7. Be able to develop innovative proposals and inventions for the modernization of equipment and technological tooling based on best practices and innovative approaches	LO8. Be able to work effectively in a team, understand the principles and values of academic integrity
GCC1 - be able to communicate freely in oral and written form in Kazakh, Russian and foreign languages as a means of interpersonal, intercultural and business communication	+	+		+	+			+

GCC2 - have the ability to scientifically analyze socially significant problems and processes, to use in practice the methods of social and polytechnic, legal sciences in various types of professional and social activities	+	+	+	+	+	+		
GCC3 - have an understanding of the objective causes of national and cultural processes and values, modern psychological theories, social interactions of the individual	+	+		+				+
GCC4 - know the economics of free enterprise formation of demand and market for products. The methodology of business plan preparation and the use of innovation in business planning	+					+		
GCC5 - have a detailed knowledge and understanding of the appropriate level of physical fitness and health promotion to ensure fulfilling social and professional activities	+							+
PC1 – be able to apply modern research methods, evaluate and present the results of work; compose algorithms and develop programs in	+		+	+		+	+	

accordance with the technology and structure of the programming languages used								
PC2 – be able to use existing software packages and, if necessary, develop new software required for information processing and control in robotic systems; have the ability to compose mathematical models of robotic systems	+		+			+	+	
PC3 – develop methods for conducting experiments and conduct experiments on existing models and samples of robotic systems and their subsystems; process the results using modern information technologies and technical means	+		+			+	+	
PC4 – be able to debug hardware and software systems and their interface with technical objects as part of robotic systems	+		+			+	+	
PC5 - have a knowledge in the field of construction materials, the basics of electrical engineering, heat exchange and heat power plants, the basics of hydraulics. Readiness to use the main methods of	+		+			+	+	



protecting production personnel and the population from the possible consequences of accidents, catastrophes, natural disasters								
PC6 - mastery of modern information technology, readiness to use modern CAD and computer graphics tools in the design of systems and their individual modules, as well as for the preparation of design and technological documentation, to comply with the basic requirements of information security	+		+			+	+	+
PC7 - ability to create mathematical models of mechatronic and robotics systems, their subsystems and individual elements and modules, including information, electromechanical, hydraulic, electrohydraulic, electronic devices and computational tools	+		+		+	+	+	+
PC8 - ability to calculate and design individual devices and subsystems of mechatronic and robotics systems using standard actuators and controls, automation,	+		+				+	+

measurement and computer technology according to the technical specification								
PC9 – have the opportunity to consolidate the knowledge gained in production, to implement the results of theoretical developments in the production of robots and robotic systems	+				+	+	+	+

### 3. Total credits by discipline cycle in the education program

№	Discipline name	Summary of discipline (30-50)	Number of credits	Формируемые компетенции (коды)
<b>Cycle of general education disciplines Mandatory component</b>				
1	Modern history of Kazakhstan	The course introduces historical events, processes, phenomena that reveal historical patterns that took place on the territory of Kazakhstan from the beginning of the twentieth century to the present day. The course is aimed at forming an understanding of the role of history and historical science, their branches and directions, social and political problems in the context of certain historical stages.	5	GCC2, GCC5
2	Philosophy	The study of the discipline is aimed at the formation of a modern culture of thinking and a methodological strategy of scientific research, critical thinking skills and a stable worldview, based on the principles of Kazakhstani patriotism, interethnic and interfaith harmony. The course is aimed at developing creative thinking skills, mastering the methods of philosophical analysis of theoretical problems and practical activities.	5	GCC2, GCC5
3	Foreign language	The discipline examines the requirement of society and the state for the competencies of modern specialists, the formation of foreign language communicative competence, the development of intercultural communicative competence, teaching a foreign language for special purposes, the development of the ability to communicate in a foreign language in a particular professional field.	10	GCC1, GCC5
4	Kazakh language	The discipline provides information on the justified functions of language, types and forms of speech, materials on functional and semantic types of speech, on functional styles of speech, information on the structural and semantic reading of texts, current problems of speech culture of practical stylistics. The course aims to develop communicative competence.	10	GCC1, GCC5
	Russian language	The content of the discipline is determined by the communicative needs of students in the educational and cognitive sphere, the goals and objectives of teaching the Russian language as a means of acquiring knowledge. The course		

		program is based on the linguistic and methodological achievements of recent years and on the established experience of teaching Russian as a non-native language, while maintaining, in general terms, continuity with previous programs.		
5	Psychology	The discipline introduces modern psychological theories, models, concepts of the formation, development and functioning of the human psyche as a whole, its structural components, the laws of the development and functioning of the human personality, personal individual properties, qualities and characteristics in the process of the development of human life, the structure and laws of the functioning of the activity of the individual.	2	GCC2, GCC5
6	Political science	This course is aimed at studying the history of political thought, the foundations of politics, the political system of society, the problems of power, state and international relations. Discipline contributes to the formation and development of civil and political culture, which is a prerequisite for building a rule of law and an active civil society.	2	GCC2, GCC5
7	Sociology	The course is designed to study the foundations of sociology, sociological concepts and categories, is aimed at mastering the complex of sociological knowledge necessary for the socialization of the individual in society; on the formation of skills for solving specific problems in the field of functioning and development of modern society. The discipline is aimed at fostering such qualities as tolerance, the ability to conduct a constructive discussion on socio-political issues.	2	GCC2, GCC5
8	Cultural science	This course introduces the objective laws of the world and national cultural heritage, the history of material and spiritual culture, the emergence, formation and development of cultural interests and needs of people in different historical epochs, their participation in the augmentation, preservation and transmission of cultural values.	2	GCC2, GCC5
9	Information - Communication Technologies (In English)	The course provides the formation of the ability to critically understand the role and significance of modern information and communication technologies in the era of digital globalization, the acquisition of knowledge and skills in the use of modern information and communication technologies in various activities. The discipline considers the stages of implementation and implementation of the State Program of the Republic of Kazakhstan "Digital	5	GCC1, GCC3, GCC5

		Kazakhstan", digital platforms for the provision of electronic services, ways of introducing and using digital technologies in various professional fields.		
<b>Cycle of general education disciplines</b> <b>University component / optional component</b>				
10	Basics of anti-corruption culture	The course studies the main directions of the state's anti-corruption policy, the foundations of the current anti-corruption legislation, as well as the activities of individual legal institutions that ensure the inevitability of punishment, legal guarantees of protection and rewards. The course is aimed at creating a culture of combating corruption and developing a civil position on this basis.	2	GCC2, GCC5
11	IT and Digital Culture	The course gives an idea of modern hardware and software for computer graphics. A significant part of the course is devoted to the mathematical apparatus used in algorithms for working with images. Methods for representing geometric information are described. Various types of projections of three-dimensional objects onto a plane are considered, as well as some special cartographic projections. The basic methods of working with color in visualization tasks, methods of painting geometric bodies are described.	3	GCC3, GCC5
12	Introduction to Mechatronics and Robotics	Introduces basic concepts, terms and definitions, the purpose of mechatronics and robotics; principles of operation and mathematical description of the components of robotic systems (information, electromechanical, electrohydraulic, electronic elements and computer technology). Teaches to analyze and use scientific and technical information about mechatronic and robotics systems; apply the knowledge of the principles of operation and the mathematical description of components and robotic systems necessary for building models.	5	PC6
13	Ecology and the basics of life safety	Ecology of individuals, populations, and communities. The biosphere and its stability. Socio-ecological problems of our time. Nature protection and sustainable development. Green economy. Legislative legal acts in the field of life safety. Tasks, principles of construction and functioning of civil defense in the Republic of Kazakhstan. Classification of emergency situations, principles and methods of protecting the population. Fundamentals of the organization and conduct of emergency rescue operations.	5	PC5
<b>Cycle of basic disciplines</b> <b>University component</b>				

1	Higher mathematics	Forms the personality of the student, the development of his intellect and abilities for logical and algorithmic thinking; teaching the basic mathematical methods necessary for the analysis and modeling of devices, processes in the search for optimal solutions for the implementation of scientific and technological progress and the choice of the best ways to implement these solutions, methods of processing and analyzing the results of numerical experiments.	5	PC2, GCC5
2	Discrete mathematics	Introduces students to the most important sections of discrete mathematics and its application in computer science. Provides an opportunity to acquire knowledge and skills in solving applied problems in a number of areas of modern mathematics, including: set theory and relations on sets, graph theory, algebra of logic.	4	PC2, GCC5
3	Physics	It forms the basis of general theoretical training, plays an important role in the preparation of the fundamental base of engineering and technical activities. The main goal of teaching physics is: to form an idea of the modern physical picture of the world and scientific worldview, knowledge and skills of using fundamental laws, theories of classical and modern physics, methods of physical research as the basis of a system of professional activity.	4	PC2, GCC5
4	Technosphere security	This course examines the basics of labor protection and prevention of man-made situations in production. Carrying out work on the disposal of industrial waste and ecological safety of the environment.	5	PC5
5	Descriptive geometry and engineering and computer graphics	The subject presents for study methods for accurately depicting spatial objects on a plane, as well as identifying geometric shapes of figures from given images. That is, this discipline is designed to give future engineers the knowledge and skills to build and read drawings.	5	PC6
6	Computer graphics	A special area of information technology that studies methods and tools for creating and editing images using software and computing systems. The discipline is divided into sections, each of which considers a specific component.	4	PC6
7	Theoretical and applied mechanics	The course is one of the divisions of mechanics in which the laws of motion of bodies and the general properties of these motions are studied. Based on these laws, methods and techniques of theoretical mechanics have been developed to enable the construction of structures, mechanisms and machines.	4	PC7

8	Materials science and technology of structural materials	Studies the relationship between the composition, structure and properties of materials used in technology. Regularities of the formation and change of the structure / structure and properties of metals and alloys. Studying the theory of strength. Technology of structural materials provides knowledge about modern methods of processing structural materials by plastic deformation, casting, welding, cutting and other methods of manufacturing workpieces and machine parts.	5	PC5
9	Algorithms and data structures, programming	Defines concepts about algorithms and methods of their presentation, types of algorithms, principles of their processing and analysis of their software implementation. The course material provides an understanding of the dynamic data structure, programming style, programming quality indicators, methods of forming and testing a program used in solving problems on a computer.	5	PC1
10	Object-oriented programming	The principles and features of object-oriented programming are considered. The main elements of object-oriented programming are covered - decomposition of a task into objects, encapsulation of the internal state and behavior of an object described by a class, building a class hierarchy, polymorphism, multiple inheritance, parametric polymorphism, an exception handling mechanism.	4	PC1
11	Calculation and design of machines and mechanisms	The objects of study in this course are calculations of machine parts and general units. Belt, chain, gear, worm, friction, shafts, bearings, gears, etc. The course contains the basics of structural analysis and synthesis of mechanisms; kinematic, power, dynamic analyzes of mechanisms; vibration activity and vibration protection of machines and mechanisms.	6	PC8, GCC5
12	Interchangeability, standardization, and technical measurements	The main elements of the product quality course, the legal basis for certification. Rules and procedures for product certification. Testing certification, certification types of services and quality systems. Legal basis for standardization of the Republic of Kazakhstan. International Organization for Standardization ISO. State standards of the Republic of Kazakhstan. Measurement classification, measurement and control methods. Metrological service of the enterprise. Varieties of measuring instruments.	3	PC4, GCC5
13	Technological processes of machine-building industries	Production technological processes, their development and mastering of new technologies, classification of enterprise elements according to management and execution, organization laws, fundamental principles of production	4	PC8, GCC5

		organization, production process and its components, calculation of the duration of the production cycle of a simple process, the procedure for drawing up flow charts for the manufacture of castings, forgings, welded workpiece.		
14	Basics of mechatronics and robotics	Collect, process, analyze and systematize scientific and technical information in the field of mechatronics and robotics independently; develop and test simple mechatronic systems. Use the achievements of domestic and foreign science, engineering and technology in their professional activities, skills in design, programming and debugging of simple mechatronic and robotic systems.	4	PC7, PC8
<b>Cycle of basic disciplines</b> <b>Optional component</b>				
15	Generating business ideas and obtaining a patent	Business idea; approaches to the generation of business ideas, the emergence of business ideas. Rules for choosing a business idea; sources of business ideas; typical errors in the search for ideas. The business model and its role in modern entrepreneurship. Business value, entrepreneurial process, business model template. Types of business models. Objects of intellectual property rights. Protection of intellectual property rights, legal aspects in the Republic of Kazakhstan, types of patents, the scheme of obtaining a patent. Pitching as a comprehensive tool for selling an idea. Development and presentation of a business model presentation. Types of goals, key tasks and presentation tools.	5	GCC5
16	Foreign language 2	The course examines the preparation of students for the study and mastery of competencies and communication skills in English in a business environment (Business Communication). Mastering with the student the necessary and sufficient level of proficiency in a foreign language for solving social and communicative problems in various fields of professional, scientific, cultural and everyday life, when communicating with foreign partners.	5	GCC1
17	Academic writing	Acquaintance with academic genres of analytical review (abstract, essays, theses, literature, presentation, correct compilation of bibliographic descriptions); define the goals of analytical word processing; analyze and write texts without using literature from Internet sources (plagiarism / academic honesty) on professional topics; master the linguistic norm (culture of speech); prepare speeches (reports); work with different genres of academic writing.	5	GCC1



18	Basics of economy and entrepreneurship	<p>The course examines the application of the scientific and practical foundations of the organization of entrepreneurial activity, methods of its planning in modern conditions.</p> <p>The development of the economy of the Republic of Kazakhstan is currently going on, first of all, as the development of the economy of free enterprise. The Government of the Republic of Kazakhstan pays great attention to the development of entrepreneurship. To become a successful entrepreneur, you need to know the basics of business organization.</p>	5	GCC4, PC9
19	Business planning	<p>The course provides the formation of competencies in the development and maintenance of a business plan, study of the basics of business design methods, analysis of the internal and external environment of the organization, familiarization with modern technologies for analysis and collection of information about the business environment of the organization; mastering professional skills in the development and implementation of a business plan.</p>	5	GCC4, PC9
20	Integral and microprocessor circuit design	<p>Introduces students to the basics of digital integrated circuitry and their practical application in instrument making, contains: logical functions and logic elements, series of microcircuits; microprocessor architecture, microprocessor software. Methods for automating circuit design of electronic components.</p>	3	PC6
21	Software for mechatronic and robotic systems	<p>The material related to the design and use of software products for mechatronic and robotic systems is presented. Provide the development of information about the development environment for program code for PLCs, programming languages supported by the environment, as well as debugging programs in emulation mode.</p>	3	PC1
22	Modern automation technologies	<p>Considers innovative projects and technologies in energy and mechanical engineering; information technology in science and education; information technology and automation in technical systems and management; technology and processing of organic and inorganic materials; innovative technologies and automation in the construction of buildings and structures; actual problems and trends in the socio-economic development of management and education.</p>	4	PC3
23	Information systems in robotics	<p>Introduces the principles of structuring information systems, general methods of developing algorithms and models for mechatronic, robotic and telecommunication systems.</p>	4	PC3

24	Analog and digital electronic devices	The subject introduces students to the basics of digital integrated circuitry and their practical application in instrument engineering, contains: logical functions and logic elements, series of microcircuits; microprocessor architecture, microprocessor software. Methods for automation of circuit design of electronic components.	3	PC3
25	Computer modeling of processes and systems in robotics	Develops students' ability to have skills of working with a computer as a means of information management, to use the basic laws of natural science disciplines in their professional activities, to apply methods of mathematical analysis and modeling; ability and readiness to apply the necessary knowledge of the principles of operation and mathematical description of the components of mechatronic and robotic systems, to implement models by means of computer technology; ability to conduct computational experiments using standard software packages to study mathematical models of mechatronic and robotic systems.	3	PC7
26	Electric drives of robotic system	Studies electrical and magnetic phenomena in nature, science and technology. Modern electric power industry, the device of electrical appliances, apparatus and installations, industrial electrical equipment and power supply systems, electric drive and much more. This discipline covers: perceiving elements or primary converters (sensors); Setting elements of automation (setting elements); Comparative automation elements; Transforming elements; Executive elements; Corrective elements and much more.	4	PC7
27	minor1 Fundamentals of leadership	The study of the discipline is aimed at creating conditions for organizing a variety of activities aimed at developing personal qualities in students, revealing the potential of freshmen, which allow them to become leaders in their chosen field of activity, creating human resources for public organizations at the university.	5	GCC1, GCC3
28	minor2 Data vizualization	Introduces the main methods of automating the processing of numerical information, presenting it in a graphical form, using it in promoting the results of professional activity through the Internet. Allows you to gain skills in creating technical specifications for a project related to infographics in your professional field. Search and structuring of information and data. Creation of a full-fledged project related to data visualization.	5	PC1
29	minor3	Provides for mastering all levels and directions of teaching common	5	GCC1

	English for everyday use	vocabulary in English and using it in situations of everyday communication. Full linguistic immersion and improvement of communication skills, using certain language cliches freely in certain situations is assumed. Particular emphasis is placed on practicing the skills of unprepared speech in a foreign language.		
30	minor1 Business activity	The study of the discipline will form students' instrumental, socio-personal, systemic and subject competences in the field of entrepreneurial activity. Students will form a holistic theoretical understanding of entrepreneurial activity, learn how to generate their business ideas and present them, study the peculiarities of using marketing methods and techniques, study the procedures for creating and liquidating business entities.	5	GCC4, PC9
31	minor2 Payment operations automation	Introduces methods of automating settlement operations, systems for processing economic information in order to use the results of analysis for decision-making; develops the skills of using information and software tools for data analysis and processing. Mastering the methods and tools for data analysis; study of settlement transactions in MSExcel spreadsheets; execution of works on processing, generalization and analysis of data.	5	GCC2, PC1
32	minor3 English in communicative situations	Improves communication skills and the use of common vocabulary in English in various situations of everyday communication. It is assumed that in the course of studying this discipline, students will develop the competencies necessary for the practical use of English in the future, including for studying the language of the specialty within the discipline "professionally oriented English".	5	GCC1
33	minor1 Business organization	Develops rational and practical skills and abilities to identify sources of financing and loans, implement the created business plans and projects. Teaches you how to use available state and non-state sources of project financing, to attract venture capital. Develops practical skills in the selection of government programs to subsidize SMEs, promote business plans through social networks, use online services and portals.	5	GCC4, PC9
34	minor2 Data Analysis and Business Planning	Develops competencies in the field of data processing, financial calculations, financial planning and investment modeling using Excel; skills in automating the modeling of organizations' cash flows. Focusing on the complex aspects of building models of securities portfolios and options pricing, using financial	5	GCC2, GCC4, PC9

		functions.		
35	minor3 English in situations of professional communication	The discipline will be studied by students of certain areas of study after or in parallel with the discipline "Professional-Oriented English" and is designed to improve the communication skills of students of the thesaurus, which is necessary for communication in the future professional field.	5	GCC1, PC9
36	minor1 Technological Entrepreneurship and Startups	The course is designed to help students develop their IT competencies, teamwork, and business skills. The training program covers the entire process of creating a startup, from finding an idea to launching a product on the market. The result of this course is the preparation of a real MVP, its launch by students and getting into a business incubator or acceleration program.	5	GCC4, PC9
37	minor2 E-business	Forms the ability to choose rational IP and ICT solutions for business management; the ability to prepare and maintain contract documentation for the development, purchase or supply of IP and ICT; the ability to manage the content of the enterprise and Internet resources, manage the processes of creating and using information services (content services); interact with consumers, organize sales on the Internet.	5	PC1, PC6
38	minor3 English for specific purpose	In the course of studying this discipline, it is envisaged that students master such a level of language competence in a foreign language, which will allow them to independently study literature in their specialty and communicate in the future with colleagues from foreign countries and get acquainted with their work experience. It is recommended to conduct classes in separate groups, divided according to the specialization of student education.	5	GCC1, PC9
39	Programmable microcontrollers	He studies methods of obtaining knowledge in the field of microprocessor technology as the main element base of modern information and control systems, forms skills for the design and operation of such systems based on microprocessors and microcontrollers.	3	PC2
40	Industrial programming	The course consists in mastering the methods and principles of using industrial programming based on programmable logic controllers, focused on working with process automation devices, and methods for developing automation projects within the framework of the SCADA system being studied.	3	PC2, PC4
41	Automation of typical technological processes and production	Studies the architecture of the automated control system, SCADA systems, the basic principles of operation of the components of the automated control system (collection, transformation, transmission and display of information).	4	PC6

		<p>Forms the ability to describe the functional units and devices of the automated process control system, the technology for creating control complexes. Allows you to acquire the skills of designing functional units of the computer controllers.</p> <p>Knowledge of the principles of building infocommunication networks, formation of basic technical requirements for infocommunication networks and systems, analysis of the main processes for forming, transmitting and receiving various signals.</p>		
42	3D modelling on CNC machines	Demonstrates to students the practical use of programmed machine tools in human professional activities. Teaches how to create and implement programs for machine tools with numerical control, using the example of programs ArtCamPro, ModelaPlayer and machine RolandMDX 15, Auto CAD.	4	PC2, PC6
43	Automation elements and devices	He studies physical principles used in electromagnetic and electrical machine converters, electrical micromachines as converters of mechanical quantities, electromagnetic automation devices, thermal conditions and the choice of electrical motors. The course teaches you to choose the optimal types of electric motors, electromagnetic relays and rectifiers in accordance with the specified parameters.	3	PC5
44	Robotics processes and systems	Forms knowledge and competence in the design of robotic actuators, selection of technological equipment, construction of RTS for various types of production; ability to solve problems of kinematics and dynamics of robots; possession of matrix methods for solving direct and inverse problems, methods of designing actuators for robots and robotic systems, skills in working with software packages "Matlab", "SimMechanics".	3	PC7, PC8
45	Intelligent robot group control systems	Studying the development of methods of self-organization in distributed technical systems, principles and methods of functioning of self-organizing systems of group control of intelligent robots; features of the synthesis of manipulation systems; generalized analysis of adaptive control systems.	4	PC8, PC9
46	Professionally oriented foreign language	To implement such aspects of professional activity as timely familiarization with the latest technologies, discoveries and trends in the development of science and technology, establishing professional contacts with foreign partners, improving the level of professional competence, providing active command of a foreign language as a means of "forming and formulating	5	GCC1

		thoughts" in socially conditioned and professionally		
47	Mobile application development	Study of mobile development (fundamentals of design and programming of mobile applications): study of the basic device of the Android platform and the capabilities that this platform provides for the development of mobile systems, obtaining practical skills in creating user interfaces, services, as well as using alarms, hardware sensors and standard information storage within this platform Mobile application development Study of mobile development (fundamentals of design and programming of mobile applications): study of the basic device of the Android platform and the capabilities that this platform provides for the development of mobile systems, obtaining practical skills in creating user interfaces, services, as well as using alarms, hardware sensors and standard information storage within this platform	3	PC1
48	minor1 Self-management and presentation techniques	The course examines the essence and concept of self-management. The art of setting goals as one of the components of successful self-management. Time and priority management. Positive thinking and stress tolerance. The strategy of success and personal growth. The study of the basic concepts, principles, and methods of self-management, methods of self-analysis and self-development, techniques for preparing and conducting presentations, including self-presentation, methods and stages of building a presentation, techniques for winning and retaining the attention of listeners	5	GCC4, PC9
49	minor2 Foreign language (B1) professional	The purpose of the course is: the formation of intercultural communicative competence at the level of B1; Main sections: Socio-political sphere of communication, general professional, special	5	GCC1
50	minor3 Computer-aided design systems	Levels, aspects and stages of design. Standard procedures. Mathematical models. Formulation and approaches to solving problems. Methods for obtaining models of technical systems. Automated processing of experimental data. Graphic programming and geometric modeling.	5	PC6
51	minor1 Web technologies	A brief excursion into the theory of networks. Fundamentals of web technologies. Introduction to web design. Graphics in web design. Maintenance of a web page. The first web page. Special features of HTML. Microsoft FrontPage. Cascading style sheets. Useful web design techniques.	5	GCC4, PC9

		Types of Internet business applications. Protection of information and Internet nodes.		
52	Minor2 Foreign language (B2)	Pedagogy of creativity. Video games for learning English. Actual problems of modern students. Individual image. How to become a successful student. Important people in our lives.	5	GCC1
53	minor3 Doing business	The history of the emergence and essence of entrepreneurship. The socio-economic significance of innovations. The essence and features of the venture business. Types of entrepreneurship. The main constituent and additional documents required for the registration of the company. The mechanism and principles of management. Organizational structures of the business. The essence of business planning, elements and stages of its implementation. Investment offer. The sequence of information submission. The value of the project.	5	PC4
54	Programmable microcontrollers	Study of the design and implementation of programmable microcontrollers in industry and the acquisition of skills for their practical application in industrial production. Drawing up a control program for an industrial logic controller; working with a programmable controller when solving professional tasks; performing maintenance, commissioning and checking of programmable controllers; performing technical control during operation of programmable controllers; programming basics and basic commands of the programming language	3	PC6
55	Development of mobile applications.	The purpose of mastering the discipline is to obtain in-depth knowledge in the field of mobile application development for operating systems. Tasks that need to be solved to achieve the goal: 1) Practical application of the main tools for developing mobile applications for the operating system ; 2) Introduction to advanced development tools.	3	PC1
56	Automation of technological processes and productions	Study of modern trends and problems of technological processes; basic automation schemes of standard and production objects in the field of robotics; structures and functions of automated control systems; analysis of technological processes as control objects with a choice of automation	4	PC3

		schemes; analysis and calculation of the ASR of a specific object		
57	Measuring instruments and automation devices	Study of the use of measuring systems and elements of automatic control and regulation of parameters of technological processes and production. Types of sensors. Methods and devices for measuring technological parameters. Methods and measurement schemes of devices. Application of automation devices. Basic concepts of the theory of automatic control. Automation schemes	3	PC3
58	Simulation of robot movement.	The study of methods for modeling the equations of dynamics of the manipulation mechanism; automation of mathematical models; the use of machine graphics to represent spatial scenes; features of modeling the movement of robots and robotic systems in real time; the use of mathematical models in computer-aided design, programming and control of robots	3	PC6
59	Drive systems of robotic systems	Studies electrical and magnetic phenomena in nature, science and technology. Modern electric power industry, the device of electrical devices, apparatuses and installations, industrial electrical equipment and power supply systems, electric drive and much more. In this discipline, the following are considered: perceiving elements or primary converters (sensors); Setting elements of automation (tuning elements); Comparing elements of automation; Transforming elements; Executive elements; Corrective elements and much more.	4	PC7
<b>Cycle of profile disciplines University component</b>				
1	Technology of production and repair of machines	The basic concepts of mechanical engineering technology are studied. Methods and methods of manufacturing mechanical engineering products, the foundations of the theory of cutting materials and the methodology of designing technological processes are explained in detail. In the second section, methods and methods of repairing machines, the design of equipment, fixtures and tools, as well as methods for developing technological processes for restoring machine parts are studied.	4	PC6
2	Programming for part processing on CNC	This subject studies the features of the processing procedure on machine tools with numerical control, models and algorithms for automation of the design of technological processes, automation of technological preparation of production, automation of the design of special technological equipment,	4	PC7



		control programs for technological machines, integrated systems of computer-aided design systems-computer-aided design of technological preparation of production.		
3	Industrial Controllers	Studying one of the most important elements in the field of industrial automation. Components that allow you to automate certain production processes. They study and design the details of which the process control process was carried out promptly and automatically.	4	PC7
4	Automated metal cutting equipment	An increase in the level of automation of the machining process by reducing operator intervention is achieved, along with other measures, by the use of a number of new, including special tool designs that meet the requirements for high efficiency of using CNC equipment. The criterion for assessing the need to use a new tool is the minimum cost of the operation.	5	PC7
5	Hydraulic and pneumatic automation tools	Structural and functional features of hydraulic drives, their place in the structures of technological machines and production systems; classification of hydraulic drives, circuit solutions of the main functional groups; methods of regulating hydraulic drives; hydraulic power amplifiers, tracking pneumatic hydraulic drives, elements of manual and automatic control; devices of hydraulic and pneumatic automation systems, hydraulic computing devices, auxiliary devices hydraulic drives.	4	PC7
<b>Cycle of profile disciplines</b> <b>Optional component</b>				
6	Programming of microcontrollers	The discipline contains the architecture and structure of microprocessors; main types of large integrated circuits for microprocessor (MP) sets; microprocessor cycle: addressing types and command system; organization of the interface of MP devices with external devices and memory; the use of microprocessors in the drives of mechatronic systems; examples of MP drives of modern systems; multiprocessor control systems.	4	PC8
7	Devices of basics of robotics and microprocessor technology	The course studies digital and analog devices of electronic technology, the basics of circuit modeling and design of electronic circuits, the basics of information presentation, the basics of discrete mathematics, the basic laws of designing digital systems used in electronic mechatronic modules. The process of computing a computer model on one or more computational nodes.	5	PC8

		Implements the representation of an object, system, concept in a form different from the real one, but close to the algorithmic description.		
8	Control of robotic systems	Robot control refers to the solution of a set of tasks related to the adaptation of the robot to the range of tasks it solves, programming of movements, synthesis of the control system and its software. Control types: biotechnical, automatic, and interactive controls.	4	PC7
9	Installation and operation of robotic devices	Studying robotic systems, developing and approving, in the prescribed manner, instructions for labor protection, which specify the duties of service personnel, safe techniques and methods of work during training, adjustment, repair and reprogramming of PR and RTK, forms of organizing control over measures and means of ensuring safety and personnel of safety requirements, rational modes of work and rest of personnel serving a specific PR or site.	4	PC9
10	Computer-aided design and construction systems	Studies the methodology and specifics of the design of mechatronic modules; arrangement of modules; the accuracy of the mechatronic module, the division of the error into individual elements; application of CAD methods and tools in design; examples of designing mechatronic modules.	5	PC8
11	Automation system design	Studying the principles of design; architecture and structure of APCS; electrical schematic diagrams; schemes; rules and requirements for the development of documents: specification of equipment, products and materials; list of signals / terminal fields; questionnaires; goals and objectives of creating CAD; classification; composition and structure of CAD: subsystems, components and support (technical, mathematical, software, informational, organizational, methodological, etc.).	4	PC8, PC9
12	Components of machine vision systems	Introduces the physical laws underlying computer vision systems, 1D, 2D, 3D measurements of geometry, surface defects of objects using diffraction, correlation, shadow methods; low-coherence interferometry and structural illumination methods; structural diagram of technical vision systems and optical information measuring systems; assign the blocks of the circuit and options for their implementation in relation to the problem being solved.	4	PC1, PC8
13	Adaptive control methods for robotic and mechatronic systems	Studies the planning of manipulator trajectories, trajectories in the space of generalized coordinates, smoothing of trajectories; planning trajectories in Cartesian coordinates of the manipulator workspace; dynamic control of the movement of the robot; compensation of manipulator dynamics in real time,	4	PC1, PC8

		control decomposition; decomposition of the equations of the dynamics of the manipulation mechanism and control signals; dynamic planning; planning movement along a given trajectory taking into account dynamic constraints.		
14	Interface device and communication protocol	Introduces students to channels with an open laser beam, data transmission protocols, data transmission networks, methods of accessing the network, principles of building network program interfaces, algorithms and their application in P2P networks.	5	PC2
15	Management and diagnostics of robotic systems	Robot control is understood as the solution of a set of tasks related to the adaptation of the robot to the range of tasks it solves, the programming of movements, the synthesis of the control system and its software. Control types: biotechnical, automatic and interactive controls.	4	PC 7
16	Robot control devices	Robot control is understood as the solution of a set of tasks related to the adaptation of the robot to the range of tasks it solves, the programming of movements, the synthesis of the control system and its software. Control types: biotechnical, automatic and interactive controls.	4	PC 7
17	Reliability of robotic systems	Study of engineering calculations in accordance with the reliability of robotic systems. Obtaining knowledge in the field of the structure and development of robotic systems; mastering the methods of ensuring reliability; studying existing models and structures; information (definitions, patterns, methods of solving problems) and training in their application	4	PC 8