SATBAYEV UNIVERSITY

Institute of «Automation and Information Technology»
Department «Robotics and Engineering Tools of Automation»

EDUCATIONAL PROGRAM
6B07113 «Robotics and Mechatronics»

Code and classification of the field of education:
6B07 «Engineering, manufacturing and construction industries»
Code and classification of training directions:
6B071 «Engineering and engineering trades»
Group of educational programs:
B063 «Electrical engineering and automation»
Level based on NQF: **6**
Level based on IQF: **6**
Study period: **4 year**
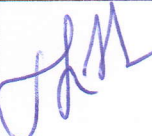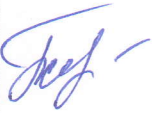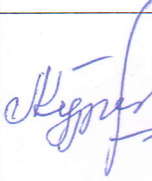Amount of credits: **240**

Almaty 2025

Educational program 6B07113 «Robotics and Mechatronics» was approved at the meeting of K.I. Satbayev KazNRTU Academic Council

Minutes #10 dated 06.03.2025

was reviewed and recommended for approval at the meeting of K.I. Satbayev KazNRTU Educational and Methodological Council

Minutes #3 dated 20.12.2024

Educational program 6B07113 «Robotics and Mechatronics» was developed by Academic committee based on direction 6B071 Engineering and engineering trades.

Full name	Academic degree/ academic title	Position	Workplace	Signature
Chairperson of Academic Committee:				
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Teaching staff:				
Ozhikenov Kassymbek Adilbekovich	Candidate of Technical Sciences	Professor, Head of the Department	Department of «Robotics and Engineering Tools of Automation», K.I. Satbayev KazNRTU	
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Bigaliyeva Zhanar Serykhanovna	Master of Technical Sciences	Senior lecturer of the department	Department of «Robotics and Engineering Tools of	
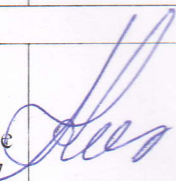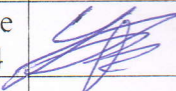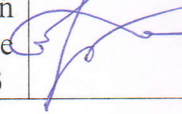
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Students				
Meiram Adil Zeynelkabidenovich	3rd year student	6B07113 «Robotics and mechatronics»	KazNRTU named after K. I. Satpayev	

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List of abbreviations and designations

EP - Educational program
GEP - general education disciplines
BD - basic disciplines
PD - profile disciplines
MSHE RK - Ministry of Science and Higher Education of the Republic of Kazakhstan
AC - attestation commission
ECTS - European Credit Transfer and Accumulation System
GC – General cultural competences
GPC - General professional competencies
PC - Professional competence
EO - educational outcomes
FA – final attestation

1. Description of educational program

The professional activities of the graduates of the program are directed to the field of robotics and mechatronics.

Educational program «Robotics and mechatronics» is aimed at training professional bachelors in the field of design and construction of robots, robotic and mechatronic systems for industrial and non-industrial purposes.

The objects of professional activity of graduates who have completed the undergraduate program are robotic and mechatronic systems, including information and sensory, Executive and control units, their mathematical, algorithmic and software methods and tools for design, modeling, experimental studies, debugging and exploitation, research and production testing of robotic and mechatronic systems having different applications.

Educational program "Robotics and mechatronics" contains a complete list of academic disciplines, grouped in cycles: general education disciplines (GED), basic disciplines (BD) and profile disciplines (PD) as mandatory components, and components for selection, indicating the complexity of each subject in academic credits and hours established by the State obligatory standards of higher and postgraduate education, approved by order of MSHE RK №2 dated July 20, 2022.

The disciplines of the mandatory component of the GED cycle are aimed at forming the worldview, civic and moral positions of a future specialist who is competitive on the basis of knowledge of information and communication technologies, building communication programs in the state, Russian and foreign languages, focusing on a healthy lifestyle, self-improvement and professional success. The BD cycle includes studying academic subjects and passing professional practice. The PD cycle includes academic disciplines and types of professional practices. The programs of disciplines and modules of the BD and PD cycles are interdisciplinary and multidisciplinary in nature, providing training at the junction of a number of areas of knowledge.

Final certification is carried out in the form of writing and defending a thesis (project) or preparing and passing a comprehensive exam.

The requirements for the level of training of students are determined based on the Dublin descriptors of the first level of higher education (bachelor's degree) and reflect the development of competence, expressed as outcomes of learning. Learning outcomes are formed both at the level of the entire educational program of higher education, and at the level of individual modules or academic disciplines.

Description compulsory standard requirements for graduation and assignment of the academic degree bachelor: on the volume of the educational program of bachelor degree is 240 credits, regardless of the form of education, applied educational technologies, the implementation of bachelor programs using a network form of realization of the program of bachelor in the individual curriculum, including accelerated learning.

Special requirements for University graduation in this program: Students who have passed the final certification, and who have confirmed the assimilation of the professional curriculum in the EP "Robotics and mechatronics", the decision of the

SAC confers the academic degree "Bachelor of engineering and technology" in the educational programRobotics and mechatronics and a state-issued diploma with an Appendix is issued.

Issuance of a state-issued diploma with an Appendix is carried out on the basis of an order of the head of the University on graduation.

The diploma Supplement is filled out on the basis of a certificate of completion of the student's (student's) individual curriculum in accordance with the received grades in all disciplines in the amount provided for by the state mandatory standard of education and the working curriculum, completed course papers (projects), types of practices and the results of final certification.

In the diploma Supplement, the latest grades for each academic discipline are recorded according to the point-rating letter system of knowledge assessments, indicating its volume in credits and in the ECTS scale.

2. Purpose and objectives of educational program

Purpose of EP: Training highly qualified, competitive, and in-demand specialists in robotics and mechatronics, capable of operating, maintaining, and adapting intelligent and energy-efficient robotic systems, ensuring the digitalization of production and sustainable development.

Tasks of EP:
- developing competencies in the operation and maintenance of energy-efficient and environmentally safe robotic systems;
- enhancing programming skills and working with autonomous system models;
- strengthening knowledge in digital technologies and artificial intelligence;
- implementing international standards for environmental and industrial safety.

Competencies at the end of studing

	Generalcultural competences (GC)
GC 1	The ability to communicate in oral and written forms in the state, Russian and foreign languages for solving problems of interpersonal and intercultural interaction
GC 2	Understanding and practical use of the norms of a healthy lifestyle, including issues of prevention, the ability to use physical culture to optimize performance
GC 3	The ability to analyze the main stages and patterns of the historical development of society for the formation of civic position
GC 4	Ability to use the foundations of philosophical knowledge to form a worldview
GC 5	The ability to critically use the methods of modern science in practice
GC 6	Awareness of the need and the acquisition of the ability to independently study and improve their qualifications throughout their working life
GC 7	Knowledge and understanding of professional ethical standards, mastery of professional communication techniques
GC 8	Ability to work in a team, tolerantly perceiving social, ethnic, confessional and cultural differences
GC 9	Ability to use the basics of economic knowledge in various fields of activity
	General professional competencies (GPC)
GPC 1	Knowledge of design methods for robotic and mechatronic systems, their individual subsystems and modules
GPC 2	Possession of modern software products for solving problems of system design, design of mechanical and mechatronic modules, control and information processing
GPC 3	Knowledge of mathematical models of robots, robotic and mechatronic systems, their individual subsystems and modules, carrying out their research using mathematical modeling, using both special and universal software tools, in order to substantiate the theoretical and design decisions
GPC 4	Understanding the physical processes and phenomena underlying the principles of operation of devices, equipment and systems
GPC 5	Knowledge of standards, methodological and regulatory materials accompanying the operation, installation and adjustment of modern mechatronic systems with digital control
	Professional competence (PC)
PC -1	Collection and analysis of scientific and technical information, taking into account modern trends in the development and use of the achievements of science, technology and technology in professional activities

PC -2	Assessment of the economic efficiency of the implementation of projected robotic and mechatronic systems, their individual modules and subsystems
PC -3	Application of modern software products and the latest technologies for solving and managing interdisciplinary engineering problems in various fields of science and technology
PC -4	Evaluation of the surrounding reality on the basis of worldview positions formed by knowledge of the foundations of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical knowledge
PC -5	Calculation and design of individual blocks and devices of robotic and mechatronic systems, control, information-sensor and executive subsystems and mechatronic modules in accordance with the terms of reference
PC -6	Planning tests of modules and subsystems of robotic and mechatronic systems, participation in the organization and conduct of experiments at existing facilities and experimental models, processing the results of experimental studies using modern information technologies
PC -7	Monitoring the compliance of technical documentation of developed projects with standards and technological conditions
PC -8	Implementation of the results of theoretical developments in the production of robotic and mechatronic systems, their subsystems and individual modules
PC -9	Organization of work on operation, installation and commissioning of modern mechatronic systems
PC -10	Organization of the activities of the production team, making organizational and managerial decisions in the context of different opinions and assessing the consequences of decisions made

3. Requirements for evaluating the educational program learning outcomes

Assessment of learning outcomes is a procedure for determining the compliance of individual educational achievements, students and graduates of professional education with the requirements of consumers of educational services. Such an assessment according to the credit technology of training can be carried out in three stages:

- assessment in the classroom (current and boundary control);
- exams in disciplines providing separate subject and instrumental professional competencies;
- final certification (thesis (project) defense), showing the level of competence in solving a specific scientific problem (task);

The exam as a form of control should facilitate an accurate assessment of learning outcomes, therefore, examination questions in disciplines within the competence of the graduate model should meet the following requirements: - compliance with the goals, objectives and thematic content of the course; - compliance with the claimed competencies; - the possibility of an accurate, specific assessment of the results of the trained.

4. Passport of educational program

4.1. General information

№	Field name	Comments
1	Code and classification of the field of education	6B07 «Manufacturing and processing industries»
2	Code and classification of training directions	6B071 «Engineering and engineering trades»
3	Educational program group	B063 «Electrical engineering and automation»
4	Educational program name	6B07113 «Robotics and Mechatronics»
5	Short description of educational program	Educational program «Robotics and mechatronics» is aimed at training professional bachelors in the field of design and construction of robots, robotic and mechatronic systems for industrial and non-industrial purposes.
6	Purpose of EP	The purpose of the educational program is training highly qualified, competitive, and in-demand specialists in robotics and mechatronics, capable of operating, maintaining, and adapting intelligent and energy-efficient robotic systems, ensuring the digitalization of production and sustainable development
7	Type of EP	New
8	The level based on NQF	6
9	The level based on IQF	6
10	Distinctive features of EP	No
11	List of competencies of educational program	Providing a wide range of theoretical and practical knowledge in the professional field; the ability to develop methodological and regulatory documents, technical documentation, as well as the implementation of measures to implement the developed projects and programs; the ability to make decisions based on the results of calculations for projects and the results of the technical-economic and functional-cost analysis of the effectiveness of the designed mechatronic systems; master the organization of work on operation, installation and adjustment of modern machines and equipment
12	Learning outcomes of educational program	EO1 - To assess the compliance of the technical documentation of the developed projects with standards and technological conditions. EO2 – Plan tests of modules and subsystems of robotic and mechatronic systems, organize and conduct experiments on existing objects and experimental models, processing the results of experimental research, using modern information technologies. EO3 – Organize the activities of the team, make organizational and managerial decisions in the context of different opinions and assess the consequences of the decisions taken. EO4 – Determine the safety, environmental friendliness, and economic efficiency of implementing the designed robotic and mechatronic systems, their

		individual modules, and subsystems, considering the principles of sustainable development. EO5 – Calculate and design individual blocks and devices of robotic and mechatronic systems, intelligent control, information-sensor and executive subsystems and mechatronic modules, in accordance with the terms of reference. EO6 – Apply modern software products and the latest technologies to solve and manage interdisciplinary engineering problems in various fields of science and technology. EO7 – Organize the operation, installation and commissioning of modern mechatronic systems. EO8 – Collect and analyze scientific and technical information, taking into account current trends in the development and use of achievements of science, technology and technology in professional activities. EO9 – Conduct research to improve the operation of robotic and mechatronic solutions using digital technologies. EO10 - Demonstrate knowledge of the branches of higher mathematics, physics and other natural sciences and apply them to solve problems that have arisen in the course of professional activity.
13	Education form	full-time
14	Period of training	4 year
15	Amount of credits	240
16	Languages of instruction	English, russian, kazakh,
17	Academic degree awarded	Bachelor of Engineering and Technology
18	Develop and author	Ozhikenov K.A.

4.2. Relationship between the achievability of the formed learning outcomes based on educational program and academic disciplines

№	Discipline name	Short description of discipline	Amount of credits	Generated learning outcomes (codes)									
				EO1	EO2	EO3	EO4	EO5	EO6	EO7	EO8	EO9	EO10
	Cycle of general education disciplines **Main component**												
1.	English language	English is a compulsary subject. According to the results of placement test or IELTS score, students are placed into groups and disciplines. The name of the discipline corresponds to the level of English. When passing from level to level, prerequisites and postrequisites are respected.	5										
2.	Kazakh (Russian) language	Kazakh (Russian) language In this course author considers socio-political, socio-cultural spheres of communication and functional styles of the modern kazakh (russian) language. The course covers the specifics of the scientific style to develop and activate professional communication skills and abilities of students. Also it allows students to leavn the basics of scientific style practically and develop the ability of production structural and semantic text analysis	5										
3.	Physical Culture	The purpose of the discipline is to master the forms and methods of forming a healthy lifestyle within the framework of the professional education system. Familiarization with the natural-scientific basics of physical education, knowledge of modern health-improving technologies, basic methods of independent physical education and sports. As part of the course, the student will master the rules of judging in all sports.	8										
4.	Information and communication technologies (in English)	The aim of the course is to gain theoretical knowledge in information processing, the latest information technologies, local and global networks, the methods of information protection; Getting the right use of text editor editors and tabulators; creation of base and different categories of applications.	5										
5.	History of Kazakhstan	The purpose of the discipline is to provide objective historical knowledge about the main stages of the history of Kazakhstan from ancient times to the present day; introduce students to the problems of the formation and development of statehood and historical and cultural processes; contribute to the formation of humanistic values and patriotic feelings in the student; teach the student to use the acquired historical knowledge in educational, professional and everyday life; evaluate the role of Kazakhstan in world history.	5										
6.	Philosophy	The purpose of the discipline is to teach students the theoretical foundations of philosophy as a way of knowing and spiritually mastering the world; developing their interest in fundamental knowledge, stimulating the need for philosophical assessments of historical events and facts of reality, assimilating the idea of the unity	5										

		of the world historical and cultural process while recognizing the diversity of their skills in applying philosophical and general scientific methods in professional activities.														
7.	Socio-political knowledge module (sociology, politology)	The objectives of the disciplines are to provide students with explanations on the sociological analysis of society, about social communities and personality, factors and patterns of social development, forms of interaction, types and directions of social processes, forms of regulation of social behavior, as well as primary political knowledge that will serve as a theoretical basis for understanding social -political processes, for the formation of political culture, development of a personal position and a clearer understanding of the extent of one's responsibility; help to master the political, legal, moral, ethical and socio-cultural norms necessary to act in the interests of society, form personal responsibility and achieve personal success.	3													
8.	Socio-political knowledge module (culturology, psychology)	The purpose of the disciplines is to study the real processes of cultural creative activity of people who create material and spiritual values, identify the main trends and patterns of cultural development, changes in cultural eras, methods and styles, their role in the formation of man and the development of society, as well as master psychological knowledge for the effective organization of interpersonal interaction, social adaptation in the field of their professional activities.	5													

Cycle of general education disciplines
Component of choice

9.	Fundamentals of anti-corruption culture and law	Purpose: to increase the public and individual legal awareness and legal culture of students, as well as the formation of a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Contents: improvement of socio-economic relations of the Kazakh society, psychological features of corrupt behavior, formation of an anti-corruption culture, legal responsibility for acts of corruption in various fields.	5		v			v								
10.	Fundamentals of economics and entrepreneurship	Purpose: To develop basic knowledge of economic processes and skills in entrepreneurial activities. Content: The course aims to develop skills in analyzing economic concepts such as supply and demand, and market equilibrium. It includes the basics of creating and managing a business, developing business plans, risk assessment, and strategic decision-making	5		v			v								
11.	Ecology and life safety	Purpose: formation of ecological knowledge and consciousness, obtaining theoretical and practical knowledge on modern methods of rational use of natural resources and environmental protection. Contents: the study of the tasks of ecology as a science, the laws of the functioning of natural systems and aspects of environmental safety in working conditions, environmental monitoring and management in the field of its safety, ways to solve environmental problems; life safety in the technosphere, emergencies of a natural and man-made nature.	5			v										
12.	Fundamentals of scientific research methods	Purpose: to form knowledge about scientific research, methods and methodology of scientific research, methods of collecting and processing scientific data in modern	5										v	v	

№	Discipline	Description	Credits												
		science. Contents: fundamentals of the theory of solving inventive problems, with algorithmic methods of searching for technical solutions and their optimization, basic mathematical optimization methods, the use of artificial intelligence capabilities to solve optimization problems, issues of search, accumulation and processing of scientific information.													
13.	Basics of Financial Literacy	Purpose: formation of financial literacy of students on the basis of building a direct link between the acquired knowledge and their practical application. Contents: using in practice all kinds of tools in the field of financial management, saving and increasing savings, competent budget planning, obtaining practical skills in calculating, paying taxes and correctly filling out tax reports, analyzing financial information, orienting in financial products to choose adequate investment strategies.	5					v							

<table>
<tr><td colspan="16" align="center">Cycle of basic disciplines
University component</td></tr>
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№	Discipline	Description	Credits												
14.	Engineering and computer graphics	Purpose: To develop students' knowledge of drawing construction and skills in developing graphical and textual design documentation in accordance with standards. Content: Students will study ESKD standards, graphic primitives, geometric constructions, methods and properties of orthogonal projection, Monge's projection, axonometric projections, metric tasks, types and features of connections, creating part sketches and assembly drawings, detailing, and creating complex 3D solid objects in AutoCAD.	5					v							
15.	Mathematics I	Purpose: to introduce students to the fundamental concepts of linear algebra, analytical geometry and mathematical analysis. To form the ability to solve typical and applied problems of the discipline. Contents_ Elements of linear algebra, vector algebra and analytical geometry. Introduction to the analysis. Differential calculus of a function of one variable. The study of functions using derivatives. Functions of several variables. Partial derivatives. The extremum of a function of two variables.	5												v
16.	Mathematics II	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the primitive. To teach how to apply a certain integral to solve practical problems. Contents_ integral calculus of the function of one and two variables, series theory. Indefinite integrals, methods of their calculation. Certain integrals and applications of certain integrals. Improper integrals. Theory of numerical and functional series, Taylor and Maclaurin series, application of series to approximate calculations.	5					v							v
17.	Mathematics III	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the primitive.The discipline is a continuation of Mathematics II. The course includes sections: ordinary differential equations and elements of probability theory and mathematical statistics. Differential equations with separable variables, homogeneous, in full differentials, linear inhomogeneous differential equations with constant coefficients, systems of linear differential equations with constant coefficients, finding the probability of events, calculating the	5		v										v

#	Discipline	Description	Credits													
		numerical characteristics of random variables, using statistical methods for processing experimental data are studied.														
18.	Physics I	Purpose: to form students' knowledge and skills in using fundamental laws, theories of classical and modern physics, as well as methods of physical research as the basis of a system of professional activity. Contents: harmonic oscillations, damped oscillations, alternating current, wave motion, laws of refraction and reflection of light, quantum optics, laws of thermal radiation, photons, their characteristics, wave function, electrical conductivity of metals, atomic nucleus, its structure and properties, binding energy, radioactivity.	5										v		v	
19.	General Chemistry	The purpose of the discipline is to study the basic concepts and laws of chemistry; fundamental laws of chemical thermodynamics and kinetics; quantum mechanical theory of atomic structure and chemical bonding. Solutions and their types, redox processes, coordination compounds: formation, stability and properties. The structure of matter and the chemistry of elements.	4												v	
20.	Physics II	The course studies the laws of physics and their practical application in professional activity. Solving theoretical and experimental-practical educational problems of physics for the formation of the foundations in solving professional problems. Assessment of the degree of accuracy of the results of experimental or theoretical research methods, modeling of physical condition using a computer, study of modern measuring equipment, development of skills for conducting test studies and processing their results, distribution of the physical content of applied tasks of the future specialty.	5	v											v	
21.	Fundamentals of electromechanics and electronics	The discipline is aimed at studying a variety of electromechanical and electronic devices existing on the market, and related phenomena; the study of a single-phase transformer, a DC motor and generator, synchronous and asynchronous motors, semiconductor devices, analog electronic devices, the basics of digital technology	6					v								
22.	Electronics	The course is aimed at developing students' knowledge of the basics of electronics, methods of calculation and design of electronic devices. In the process of studying the course, the student will master the principles of the physical foundations of operation and devices of semiconductor devices, study their characteristics and indications, as well as the basic principles of constructing analog electronic circuits, signal generators, the principles of operation of integrated circuits, the functions and construction of integrated logic elements, and study methods for the synthesis of logic devices combination and chain types	5												v	
23.	Integral and microprocessor circuit design	The discipline is aimed at familiarizing students with the basics of digital integrated circuitry and their practical application in robotics, getting an idea of the development of integrated digital circuitry, architecture and programming of typical microprocessor systems, methods of automated modeling and design of electronic circuits	5										v			
24.	Mechanics of robots	The discipline studies the main types of mechanisms of robots and manipulators: articulated-lever, cam and gear mechanisms. The structural, kinematic and dynamic	5												v	

		analysis and synthesis of various mechanisms of robots and manipulators, and their kinematic and dynamic properties are considered. Practical methods for solving problems of analysis and synthesis of mechanisms of robots and manipulators are studied.																
25.	Mechanic manipulators	The purpose of the discipline is to study by students the features of designing and calculating manipulators of industrial robots and technological equipment, modern designs of robotic complexes, their location and structure, characteristics and requirements, conditions for the use of various manipulators in production. The main task of students is to acquire the necessary set of knowledge on modern production automation tools, be able to determine the optimal combination of the main technical and economic indicators, instill the necessary practical skills in the study, calculation and assembly of industrial robots and manipulators	5															v
26.	Mechanics of controlled machines	The course is aimed at studying methods for controlling dynamic systems and estimating their state; mastering the methods of designing optimal control systems; application of the studied methods and algorithms for solving problems related to the control of mechatronic machines; study of various drive elements and structures in the overall system for constructing controlled mechatronic machines.	5															v
27.	The theory of automatic control	Purpose: disciplines mastering the principles of object management, methods of building models of automatic control systems and research of processes in these systems. Content: the course "Theory of automatic control" examines the processes of automatic control of objects and the use of software tools for the analysis of automatic control systems. At the same time, using mathematical tools, the properties of automatic control systems are identified and recommendations for their design are developed.	5														v	v
28.	Basics of information-measuring technology	The purpose of the discipline is to study general information about the measurement of physical quantities, methods and means of measurement, measurement and information systems. The study of the main methods and means of measuring electrical, magnetic and non-electrical quantities, methods for evaluating the accuracy of measurement results, familiarization of students with modern measuring technologies and their application.	5	v															v
29.	Database in robotics	The discipline "Database in robotics" is aimed at studying general concepts of database systems within the framework of mastering disciplinary competencies for the development and design of control systems in robotics: architecture of database systems; concepts of relational model, basic elements of the standard relational SQL language; the ability to create a real database; the ability to work in a network or local database, the study of the principles of building basic data models and their use in modern database management systems (DBMS).	5																v
30.	Educational practice	Formation of students' basic professional skills in the field of robotics and mechatronics, mastering the basics of designing, assembling and programming simple robotic systems.																	
	Cycle of basic disciplines																		

		Component of choice														
31.	Manufacturing robototechnics	The discipline is aimed at mastering disciplinary competencies in the use of information technology, technology, application software in the construction and diagnosis of industrial robots and robotic systems, including the use of modern methods for developing energy-efficient technologies and controls; to study the structure and arrangement of industrial robots, the basic principles of control implemented in robot drives, the principles of designing and assessing the state of industrial robots.	5										v		
32.	Socially oriented service robotics	The discipline aims to develop a comprehensive understanding of the role of service robotics in creating an accessible and convenient technological environment that meets modern ethical and social requirements. Students will study the mechanisms of designing and developing mobile robots considering the principles of inclusivity, learn about the practical aspects of adapting robotic solutions for various social groups, and explore case studies of successful implementation of such technologies.	5			v									
33.	Biomorphic and anthropomorphic robotic	The course is aimed at the formation of basic knowledge about biomorphic and anthropomorphic robotic systems, their applications and design designs, as well as training in methods of calculating the parameters of manipulators, the acquisition by students of the skills of calculating kinematic and dynamic variables of movement of manipulation systems; knowledge about robotic devices of bionic and anthropomorphic design designs	5												v
34.	Autonomous mobile robots	In the process of studying the discipline "Autonomous mobile robots" a student forms a knowledge base on the basics of organizing the design process, on the principles of parallelization of design work, on how to achieve optimal technical and economic parameters of the developed products of mobile robotic systems	5					v							
35.	Fundamentals of sustainable development and ESG projects in Kazakhstan	Purpose: the goal is for students to master the theoretical foundations and practical skills in the field of sustainable development and ESG, as well as to develop an understanding of the role of these aspects in the modern economic and social development of Kazakhstan. Contents: introduces the principles of sustainable development and the implementation of ESG practices in Kazakhstan, includes the study of national and international standards, analysis of successful ESG projects and strategies for their implementation in enterprises and organizations.	5			v									
36.	Programming for microcontrollers	Purpose: train students in programming microcontrollers, connecting sensors and devices, as well as developing robot control algorithms for students in mechatronics and robotics. Content: The discipline "Programming for microcontrollers" is a fundamental discipline for the study of microcontroller control of robots. The course is intended for students of the field of mechatronics and robotics.	5							v				
37.	Programming in a high level language	Purpose: The aim of the discipline is to develop a free and creative approach to programming in modern high-level languages, and an interest in observing trends and news in the field of software development tools. Contents: the basic principles of programming in high-level languages and their application in solving applied problems. The study of the discipline should contribute to the formation of the	5							v				

№	Name	Description	Cr.	1	2	3	4	5	6	7	8	9	10	11
		foundations of scientific thinking among students.												
38.	Legal regulation of intellectual property	Purpose: the goal is to form a holistic understanding of the system of legal regulation of intellectual property, including basic principles, mechanisms for protecting intellectual property rights and features of their implementation. Contents: The discipline covers the basics of IP law, including copyright, patents, trademarks, and industrial designs. Students learn how to protect and manage intellectual property rights, and consider legal disputes and methods for resolving them.	5	v										
39.	Fundamentals of Artificial Intelligence	Purpose: to familiarize students with the basic concepts, methods and technologies in the field of artificial intelligence: machine learning, computer vision, natural language processing, etc. Contents: general definition of artificial intelligence, intelligent agents, information retrieval and state space exploration, logical agents, architecture of artificial intelligence systems, expert systems, observational learning, statistical learning methods, probabilistic processing of linguistic information, semantic models, natural language processing systems.	5					v						
40.	Microprocessor control devices for robots	The discipline is aimed at studying structural diagrams of microprocessor systems in mechatronics and robotics, the basics for developing hardware for microprocessor devices and controlling robots; acquisition of skills in building control devices for various objects of mechatronic and robotic systems.	4										v	
41.	Microcontroller control systems	The discipline is aimed at studying the basic principles of building microprocessor systems and modern architectures of microcontrollers; mastering methods and tools for the development of microcontroller systems for collecting and processing information; acquisition of skills in managing various sensors and solving the problem of microprocessor control.	4											v
42.	Robot control	Basic concepts of mechatronics and robotics, device robots, principles of design, design and management of robotic systems, principles and methodological bases for the construction of mechatronic devices, modules, systems, device and principle of operation of industrial robots, manipulators, tongs PR, individual modules PR, classification of mechatronic modules, robots and manipulators, their main technical characteristics	6									v		v
43.	Control and dynamic systems	The discipline is aimed at the formation of competencies necessary for the acquisition of knowledge and skills of construction, as well as qualitative and quantitative research of mathematical models of controlled complex dynamic systems operating in continuous or discrete time, as well as evaluation of raw materials and data for the development of mathematical models of a real process or phenomenon.	6									v		v

Cycle of profile disciplines
University component

№	Name	Description	Cr.											
44.	Power sources	The study of the material of this course allows you to get some knowledge of the device power sources, skills using these devices as a tool in their professional activities. Sources of primary power. Electromagnetic elements of power devices.	4											v

№	Discipline	Description	Credits										
		Transformers. Smoothing filters. Switching power supplies. Control of the regulating element in the switching power supplies. AC-DC converters											
45.	Engineering thermodynamics and electrodynamics	The discipline is aimed at developing the student's theoretical and practical base for carrying out heat engineering calculations of heat and power equipment and assessing its thermodynamic efficiency. The course studies the basic laws and fundamental principles of technical thermodynamics, the properties and processes of changing the states of working bodies, the principles of energy conversion in heat and refrigeration machines, thermodynamic cycles.	5									v	
46.	Embedded systems in robotics	The discipline aims to give students an idea of modern technologies for building embedded control systems, theoretical and practical aspects of the development of microcontroller systems and to promote the development of system thinking. The course covers the main issues of building embedded systems for controlling robots based on microcontrollers, focusing on a promising high-performance and energy-efficient family of microcontrollers.	6					v			v		
47.	ICT - Programming for engineers with MATLAB	The discipline is aimed at studying typical mathematical schemes for modeling systems, familiarizing with the main approaches to simulating systems, studying modern methods of simulating physical control processes in devices, in technical means of automation and technological processes in the MATLAB environment.	4					v				v	
48.	Reception and transmission of data	Purpose: To equip students with the basics of transmitting and receiving data in computer systems, data networks and various devices to ensure effective communication and exchange of information. Contents: Fundamentals of digital communication: concepts and terms, modulation, demodulation. Types of data transmission media: wired and wireless networks, local and global networks, Internet. Data transfer protocols: TCP/IP, UDP, HTTP, FTP and others.	5								v	v	
49.	Production practice I	Consolidation of theoretical knowledge and obtaining primary production experience in a real or educational laboratory enterprise, familiarization with the operation of equipment, automation systems and basic maintenance processes.											
50.	Production practice II	Acquisition of practical skills in independent engineering, work on an applied project in an enterprise or laboratory, preparation for final qualifying work.											
	Cycle of profile disciplines Component of choice													
51.	Accuracy of measuring instruments	The discipline is aimed at preparing students for solving practical problems of assessing the accuracy of measuring instruments. As a result of studying the discipline, the student knows the definition of accuracy, the causes and types of errors in the functioning of devices, methods for assessing various types of errors and their influence on the resulting accuracy of the functioning of devices.	5	v									
52.	Test and Measurement	The discipline is aimed at studying the fundamentals of the construction of instruments and general methods of measuring technology, as well as the features of measurements of various non-electrical quantities. Familiarization with devices, switching circuits and errors of measuring instruments, and measuring transducers. Study with the basic principles and types of instruments and measuring systems used	5		v							v	

№	Discipline	Description	Credits													
		to measure physical quantities most commonly found in research and production														
53.	Modeling of dynamic systems	The discipline is aimed at studying the principles of constructing simulation modeling of dynamic systems on MATLAB/SIMULINK and analyzing the flow of dynamic processes in robot drives and evaluating the positioning process indicators, as well as simulation methods for building control systems of mechatronic and robotic systems.	4							v			v			
54.	Standardization and technical measurements	The discipline is aimed at students' acquisition of scientific knowledge, as well as skills in applying methods and practical fundamentals of standardization, and technical measurements in the design of equipment, devices, mechatronic and robotic complexes, the development of standards, as well as the calculation of errors of electronic equipment.	4	v	v											
55.	Sensor systems in robotics	The discipline is aimed at acquiring students' knowledge about sensors designed for robotic and mechatronic systems and complexes, such as load cells, flex sensors, infrared and optical sensors, and others. In this course, the student will learn how to program and receive, process data from these sensors.	5													v
56.	Sensor electronics, sensors	The discipline is aimed at acquiring students' knowledge about the principles of operation, basic parameters, designs of sensors, measuring transducers based on them and sensors for various purposes. Studies the basics of physical phenomena and processes underlying the principles of sensors and measuring transducers.	5													v
57.	Robot drives	The discipline is aimed at studying the main and modern types of drives used in industrial and domestic robots, functional diagrams included in its composition, drives of robots and elements, static and dynamic characteristics; ways to improve the dynamics with the help of corrective feedbacks; microprocessor control devices for robot drives.	6													v
58.	Hydropneumatic drives of robots	The discipline "Hydropneumoprivod" studies the following main issues: the principle of operation; classification; basic parameters of volumetric and paddle hydraulic machines; examples of designs; features of working processes, designs and calculation methods of hydraulic machines; the principle of operation of volumetric and hydrodynamic gears. The knowledge gained by students while studying the materials of the theoretical and laboratory part of the discipline is used in the study of subsequent disciplines and final qualifying work.	6													v
59.	Machine learning and neural networks	This discipline includes the study of the foundations of Machine learning and neural networks and their practical applications. There will be considered types of neural networks, methods and algorithms used in machine learning and neural networks	5								v			v			
60.	Design of electronic circuits	The purpose of the discipline is to study the principles of organization and methods of designing electronic circuits, including computer-aided design methods, mathematical models and software, that is, what allows modern specialists to set and solve complex problems of designing devices and electronic equipment complexes	5						v							
61.	Fundamentals of engineering creativity	Purpose: teaching students the basics of the theory of technical creativity, methods for solving engineering problems in design developments, as well as studying patent science and innovation strategies to stimulate engineering creativity. Content: The	5										v			v

№	Discipline	Description	Cr.												
		discipline is aimed at studying the basics of the theory of technical creativity and methods of solving engineering problems that arise in the process of design development during the technical development of new products, during their operation and repair													
62.	Industrial robot design	Purpose: To train students in the basics of design and development of industrial robots for their effective use in automated production processes. Contents: Fundamentals of robotics: classification of robots, principles of design and operation. Kinematics and dynamics of robots: motion modeling, solving direct and inverse kinematics and dynamics problems. Mechanical components of robots: manipulators, drives, gears, sensors. Robot programming: programming languages, control methods, integration with industrial systems.	5		v		v								
63.	Designing service robots	Purpose: To train students in the fundamentals of designing and developing service robots for use in a wide range of service tasks such as customer service, medical assistance, cleaning and others. Contents: Basics of service robotics: classification, characteristics, design requirements. Kinematics and dynamics of service robots: motion modeling, operating principles of manipulators. Sensory and perception of the environment: vision, hearing, tactile sensors, lidars and other sensors.	5		v		v								
64.	Statistical methods in engineering research	Purpose: formation of logical and algorithmic thinking of students, which allows them to apply statistical methods in engineering research. Content: The discipline is aimed at studying the basic methods of modeling processes and systems in solving problems of processing and interpretation of experimental data and problems of system engineering and circuit design, the formation of logical and algorithmic thinking of students, allowing the use of statistical methods in engineering research.	5				v								
65.	Primary processing and mathematical elements of statistics	Purpose: To provide students with basic knowledge and skills in primary data processing and basic mathematical elements of statistics for the analysis and interpretation of data in scientific research and industrial applications. Contents: Basics of data collection: methods of observation, surveys, experiments, etc. Processing and preliminary analysis of data: data cleaning, data transformation, visualization. Descriptive statistics: measures of central tendency, measures of variability, graphical presentation of data. Probability and random variables: basic concepts, probability distributions. Mathematical statistics: estimation of distribution parameters, testing of statistical hypotheses, interval estimates	5		v										v

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5. Curriculum of educational program

KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I. SATPAYEV

CURRICULUM
of Educational Program on enrollment for 2025-2026 academic year
Educational program 6B07113 - "Robotics and mechatronics"
Group of educational programs B063 - "Electrical engineering and automation"

Form of study: full-time   **Duration of study:** 4 years   **Academic degree: Bachelor of Engineering and Technology**

Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	Classroom amount lec/lab/pr	SIS (including TSIS) in hours	Form of control	1 semester	2 semester	3 semester	4 semester	5 semester	6 semester	7 semester	8 semester
								I course		II course		III course		IV course	
M-1. Module of language training															
LNG 108	Foreign language	GED, RC	10	300	0/0/6	210	E	5	5						
LNG 104	Kazakh (Russian) language	GED, RC	10	300	0/0/6	210	E	5	5						
M-2. Module of physical training															
KFK 101-104	Physical Culture	GED, RC	8	240	0/0/8	120	Difc redit	2	2	2	2				
M-3. Module of information technology															
CSE 677	Information and communication technologies	GED, RC	5	150	2/1/0	105	E			5					
GEN 429	Engineering and computer graphics	BD, UC	5	150	1/0/2	105	Э		5						
M-4. Module of socio-cultural development															
HUM 137	History of Kazakhstan	GED, RC	5	150	1/0/2	105	SE	5							
HUM 132	Philosophy	GED, RC	5	150	1/0/2	105	E			5					
HUM 120	Socio-political knowledge module (sociology, politology)	GED, RC	3	90	1/0/1	60	E			3					
HUM 134	Socio-political knowledge module (culturology, psychology)		5	150	2/0/1	150	E				5				
M-5. Module of anti-corruption culture, ecology and life safety base															
HUM 136	Fundamentals of anti-corruption	GE	5	150	2/0/1	150	E				5				

	culture and law	D, C C H													
MNG 489	Fundamentals of Economics and Entrepreneurship														
ELC 577	Fundamentals of scientific research methods														
CHE 656	Ecology and life safety														
MNG 564	Basics of Financial Literacy														
M-6. Module of physical and mathematical training															
MAT 101	Mathematics I	B D, U C	5	15 0	1/0/2	105	E	5							
MAT 102	Mathematics II	B D, U C	5	15 0	1/0/2	105	E		5						
MAT 103	Математика III	B D, U C	5	15 0	1/0/2	105	Э			5					
M-7. Module of physical and chemical preparation															
PHY 111	Physics I	B D, U C	5	15 0	1/1/1	105	E	5							
CHE8 46	General chemistry	B D, U C	4	12 0	1/1/1	75	E	4							
PHY 112	Physics II	B D, U C	5	15 0	1/1/1	105	E		5						
M-8. Robotics Module															
ROB 185	Industrial Robotics	B D, C C H	5	15 0	2/0/1	105	E		5						
ROB 430	Socially oriented service robotics														
ROB 523	Phytomorphic and anthropomorphic robotics	B D, C C H	5	15 0	2/0/1	105	E				5				
ROB 511	Autonomous mobile robots														
MNG 563	Fundamentals of sustainable development and ESG projects in Kazakhstan														
M-9. Electronics and Circuit Engineering module															
ROB 538	Fundamentals of Electromechanics and electronics	B D, U C	6	18 0	2/1/1	120	E			6					
ROB 154	Electronics	B D, U C	5	15 0	1/1/1	105	E				5				
ROB 573	Integrated and microprocessor circuitry	B D, U C	5	15 0	2/1/0	105	E					5			
M-10. Robot Mechanics Module															
ROB 503	Robot mechanics	B D, U C	5	15 0	2/0/1	105	E				5				
ROB 173	Mechanics of manipulators	B D, U C	5	15 0	2/0/1	105	E					5			
ROB 534	Mechanics of controlled	B D,	5	15 0	2/0/1	105	E						5		

	machines	U C														
M-11. Robot Control System Module

ROB 622	Basics of automation	B D, U C	5	15 0	2/1/0	105	E					5				
ROB 650	Programming for microcontrollers	B D, C C H	5	15 0	1/1/1	105	E					5				
ROB 615	Programming in a high-level language															
MNG 562	Legal regulation of intellectual property				2/0/1											
CSE 831	The basics of artificial intelligence				1/0/2											
ROB 544	Microprocessor control devices of robots	B D, C C H	4	12 0	1/1/1	75	E						4			
ROB 545	Microcontroller control systems															
ROB 570	Robot management	B D, C C H	6	18 0	1/1/2	120	E							6		
ROB 571	Control and dynamic systems															
M-12. Measurement and power supply module
ROB 187	Fundamentals of information and measurement technologies	B D, U C	5	15 0	2/1/0	105	E					5				
ROB 574	Power sources	P D, U C	4	12 0	1/1/1	75	E						4			
ROB 577	Measuring instrument accuracy	P D, C C H	5	15 0	2/1/0	105	E							5		
ROB 189	Control and measuring Instrumentation															
ROB 607	Modeling of dynamic systems	P D, C C H	4	12 0	2/0/1	75	E									4
ROB 608	Standardization and technical measurements															
M-13. Module of robotic systems
ROB 535	Engineering thermodynamics and electrodynamics	P D, U C	5	15 0	2/0/1	105	E						5			
ROB 552	Embedded systems in robotics	P D, U C	6	18 0	1/1/2	120	E							6		
ROB 139	Sensor systems in robotics	P D, C C H	5	15 0	2/1/0	105	E							5		
ROB 138	Touch electronics, sensors															
ROB 548	Robot drives	P D, C C H	6	18 0	1/1/2	120	E							6		
ROB 549	Hydropneumatic drives of robots															
M-14. Data and modeling module
ROB 579	Databases in robotics	B D, U C	5	15 0	2/1/0	105	E					5				
ROB 550	Programming for engineers with MATLAB	P D, U C	4	12 0	1/1/1	75	E						4			
ROB 659	Reception and transmission of data	P D,	5	15 0	2/1/0	105	E									5

Code	Discipline															
		UC														
ROB 144	Machine Learning Theory and Neural Networks	PD, C	5	150	2/1/0	105	E									5
ROB 126	Fuzzy logic and neural networks	CCH														
M-15. R&D module																
ROB 520	Design of electronic circuits	PD, C	5	150	2/1/0	105	E						5			
ROB 662	Fundamentals of engineering creativity	CCH			1/0/2											
ROB 663	Design of industrial robots	PD, C	5	150	0/0/3	105	course project							5		
ROB 664	Designing service robots	CH														
ROB 633	Statistical methods in engineering research	PD, C	5	150	0/0/3	105	course project									5
ROB 665	Primary processing and mathematical elements of statistics	CH														
M-16. Practice-oriented module																
AAP 173	Educational practice	BD, UC	2						2							
AAP 102	Industrial practice I	PD, UC	2									2				
AAP 183	Industrial practice II	PD, UC	3											3		
M-17. Module of final certification																
ECA 109	Writing and defending a thesis (project)	FC	8													8
M-18. Module of additional types of training																
AAP500	Military affairs	ATT	0													
								31	29	31	29	30	30	33	27
Total based on UNIVERSITY:								**60**		**60**		**60**		**60**	

Number of credits for the entire period of study					
		Credits			
Cycle code	**Cycles of disciplines**	required component (RC)	university component (UC)	component of choice (CCH)	Total
GED	Cycle of general education disciplines	51		5	56
BD	Cycle of basic disciplines		82	25	176
PD	Cycle of profile disciplines		24	45	
	Total for theoretical training:	*51*			*232*
FA	Final attestation	8			8
	TOTAL:	**59**	**0**	**0**	**240**

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Decision of the Academic Council of KazNRTU named after K.Satpayev. Protocol №   from "____" _____ 2025 y.
Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Protocol №   from "____" _____ 2025 y.
Decision of the Academic Council of the Institute of A&IT. Protocol   №   from "____" _____ 2025 y.
Vice-Rector for Academic Affairs   _____   **R.K. Uskenbayeva**

Acting Directors of the Institute of Automation and   **E.G.**
Information Technology   _____   **Chinibayev**
Head of the Department of Robotics and Automation   **K.A.**
Equipment   _____   **Ozhikenov**

Specialty Council representative from employers   _____   **A.K. Dzhumagulov**

F KazNRTU 703-05 Educational program