SATBAYEV UNIVERSITY

**Institute of Automation and Information Technology
Department "Robotics and Engineering Tools of Automation"**

EDUCATIONAL PROGRAM
7M07107 Robotics and Mechatronics

Code and classification of the field of education:
7M07 Engineering, manufacturing and construction industries
Code and classification of training directions:
7M071 Engineering and engineering trades
Group of educational programs:
M102 Robotics and mechatronics
Level based on NQF: **7**
Level based on IQF: **7**
Study period: **2 year**
Amount of credits: **120**

Almaty 2022

Educational program <u>7M07107 Robotics and Mechatronics</u> was approved at the meeting of K.I. Satbayev KazNRTU Academic Council

Minutes #13 dated 28.04.2022

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

Minutes #7 dated 26.04.2022

Educational program <u>7M07107 Robotics and Mechatronics</u> was developed by Academic committee based on direction 7M071 Engineering and engineering trades

Full name	Academic degree/ academic title	Position	Workplace	Signature
Chairperson of Academic Committee:				
Baktybaev Murat Kyrgyzbaevich	Candidate of Physical and Mathematical Sciences	Associate Professor	Department of «Robotics and Engineering Tools of Automation», K.I. Satbayev KazNRTU	
Teaching staff:				
Ozhikenov Kassymbek Adılbekovıch	Candidate of Technical Sciences	Professor, Head of the Department	Department of «Robotics and Engineering Tools of Automation», K.I. Satbayev KazNRTU	
Employers:				
Dzhumagulov Arystanbek Kuyzembaevıch	-	General Director	LLP «MEDREMZAVOD HOLDING»	
Akzhanov Janat Koıshıbaevıch	-	Director	LLP «SAIMAN Corporation»	
Students				
Shylmyrza Usen Jumanuly	-	1st year Master's student	Department of «Robotics and Engineering Tools of Automation», K.I. Satbayev KazNRTU	

Table of contents

List of abbreviations and designations

EP - Educational program
BD - basic disciplines
PD - profile disciplines
ECTS - European Credit Transfer and Accumulation System
USEC - Universal, social and ethical competencies
S&MC - Special and managerial competencies
PC - Professional competence
EO - educational outcomes
FA - Final attestation

EP - Educational program

1. Description of educational program

Master's degree in the field of training "Robotics and mechatronics" should be prepared to solve professional tasks in accordance with the profile of the master's program and the types of professional activities:

research activities:

- analysis of scientific and technical information, domestic and foreign experience in the development and research of robotic and mechatronic systems; study of new methods of control theory, artificial intelligence technologies and other scientific areas that make up the theoretical base of robotics and mechatronics, preparation and publication of reviews and abstracts;

- conducting theoretical and experimental research in the field of developing new samples and improving existing robotic and mechatronic systems, their modules and subsystems, searching for new ways of managing and processing information using artificial intelligence, fuzzy logic, multi-agent control methods, artificial neural and neuro-fuzzy networks;

- conducting patent research supporting the development of new robotic and mechatronic systems in order to protect intellectual property objects, research and development results obtained;

- conducting the development of experimental samples of robotic and mechatronic systems, their modules and subsystems in order to verify and substantiate the main theoretical and technical solutions to be included in the terms of reference for the performance of development work;

- organizing and conducting experiments on existing robotic and mechatronic systems, their subsystems and individual modules in order to determine their effectiveness and determine ways to improve, processing the results of experimental studies using modern information technologies;

- preparation of reports, scientific publications and reports at scientific conferences and seminars, participation in the implementation of research and development results in practice;

design and development activities:

- preparation of a feasibility study of projects for new robotic and mechatronic systems, their individual subsystems and modules;

- calculation and research of robotic and mechatronic systems, control, information-sensory and Executive subsystems using mathematical modeling methods, layout and testing of existing systems, processing of experimental data with the use of modern information technologies;

- development of special software for solving problems of designing robotic and mechatronic systems, development of technical specifications and direct participation in the design of mechanical, mechatronic and robotic modules, design of mechatronic and robotic devices, control and information processing systems;

organizational and managerial activities:

- development of organizational and technical documentation (work schedules, instructions, plans, estimates) and established reporting in accordance with approved forms;

- organization of work of small groups of performers involved in research, design and experimental research;

- monitoring the implementation of measures to prevent industrial injuries, occupational diseases, and prevent environmental violations during the research and operation of robotic and mechatronic systems;

installation and commissioning activities:

- participation in verification, adjustment, adjustment, equipment condition assessment and configuration of robotic and mechatronic systems for various purposes, including both technical means and software control systems;

- participation in the interfacing of software and hardware complexes with technical objects as part of robotic and mechatronic systems, in conducting tests and commissioning prototypes of such systems;

service and maintenance activities:

- participation in the verification, adjustment, adjustment and evaluation of the state of robotic and mechatronic systems for various purposes, as well as their individual subsystems, in the setting up of control hardware and software complexes;

- preventive maintenance of technical condition and functional diagnostics of robotic and mechatronic systems for various purposes, as well as their individual subsystems;

- preparation of operating instructions for robotic and mechatronic systems and their hardware and software, development of routine testing programs;

- preparation of applications for equipment and components, preparation of technical documentation for equipment repair;

scientific and pedagogical activity:

- participation in the development of programs of academic disciplines and courses based on the study of pedagogical, scientific, technical and scientific-methodical literature, as well as the results of their own professional activities;

- participation in setting up and modernizing individual laboratory works and workshops in professional disciplines;

- conducting training sessions with students, participating in the organization and management of their practical and research work;

- application and development of new educational technologies, including computer and distance learning systems.

The term of study in the master's program is determined by the volume of academic credits mastered. When the established amount of academic credits is mastered and the expected learning outcomes for obtaining a master's degree are achieved, the master's degree program is considered fully mastered. In the scientific and pedagogical master's program, at least 120 academic credits are awarded for the entire period of study, including all types of educational and scientific activities of the master's student.

Planning of the content of education, the way of organizing and conducting the educational process is carried out by the University and scientific organization independently on the basis of credit technology of training.

The master's program in scientific and pedagogical direction implements educational programs of postgraduate education for the training of scientific and scientific and pedagogical personnel for Universities and scientific organizations with in-depth scientific and pedagogical and research training.

The content of the master's degree EP consists of:

1) theoretical training, including the study of cycles of basic and profile disciplines;

2) practical training of undergraduates: various types of internships, scientific or professional internships;

3) research work, including the execution of a master's thesis – - for the scientific and pedagogical master's program

4) final certification.

Final certification is carried out in the form of writing and defending a master's thesis.

2. Purpose and objectives of educational program

Purpose of EP: The purpose of the educational program is to train highly qualified, competitive and in-demand specialists in the field of robotics and mechatronics in the labor market, capable of performing design, production, technical, organizational work in professional activities

Tasks of EP: - development of students through research activities, critical thinking, development of professionally oriented skills and abilities;

- using highly professional training of undergraduates in various educational environments;

- training a new competitive generation of technical specialists for the labor market;

- developing an environment that supports people of different cultures, and creating an atmosphere of striving for knowledge, academic integration and intellectual motivation;

- conducting research and educational activities based on the world's best practices, developing their own methods and style of training specialists;

- development of cooperation "University-industry" to meet the requirements of the labor market for technical specialists, to improve the quality of educational programs for training specialists;

- development of additional educational and training programs using multimedia, new teaching technologies for organizing learning based on the principle of lifelong learning;
- establishing partnerships with other universities and organizations to improve the quality of education, to support technical and cultural ties.

Competencies for completing training

Universal, social and ethical competencies (USEC)	
U-1	Ability to communicate orally and in writing in the state, Russian and foreign languages to solve problems of interpersonal and intercultural interaction
U-2	The ability to assess the surrounding reality based on worldview positions formed by knowledge of the basics of philosophy, which provide scientific understanding and study of the natural and social world by methods of scientific and philosophical knowledge
U-3	Develop an environment that welcomes and supports people from different cultures, and create an atmosphere of striving for knowledge, academic integration, and intellectual motivation
U-4	Have the skills of social design and methods of forming and maintaining the socio-psychological climate in the organization
U-5	Ability to critically use the methods of modern science in practice
U-6	Awareness of the need and ability to learn and improve their skills independently throughout their working life
Special and managerial competencies (S&MC)	
S-1	Independently manage and control the processes of work and training activities within the

	framework of the strategy, policy and goals of the organization, discuss problems, argue conclusions and correctly operate with information
S-2	Organize the activities of the production team, make organizational and managerial decisions in the context of different opinions and evaluate the consequences of decisions
S-3	Organize work in the division to improve, modernize, and unify the manufactured robotic and mechatronic systems
S-4	Readiness to lead and participate in the preparation of a feasibility study of projects for the creation of robotic and mechatronic systems, their subsystems and individual modules
S-5	Ability to critically analyze, present, defend, discuss and disseminate the results of their professional activities
Professional competencies (PC)	
PC-1	The ability to analyze literature data and, based on the analysis, be able to determine and experimentally implement possible ways to improve the quality of robotic systems
PC-2	Ability to conduct professional written and oral communication with all stakeholders in the field of robotics and mechatronics
PC-3	The ability to demonstrate a sustained interest in self-study and training of both wards and colleagues, to guide and advise them throughout the entire period of professional activity
PC-4	Ability to demonstrate a high level of professional activity while solving industrial and / or scientific tasks, observing all the principles of legal and ethical standards
PC-5	Ability to conduct independent research in the field of robotics and mechatronics and modernize existing robotic and mechatronic systems, introduce new methods of digital signal processing with elements of artificial intelligence
PC-6	Ability to design modern and reliable blocks and devices, intelligently controlled Executive, information-sensor and navigation modules of robotic and mechatronic systems
PC-7	Ability to apply modern software products and the latest technologies to solve and manage interdisciplinary engineering problems in various fields of science and technology
PC-8	Ability to create adaptive and robust control systems for multi-agent robotic systems and special-purpose object systems in an unknown environment, taking into account their dynamic characteristics
PC-9	Ability to implement scientific results in the production of robotic and mechatronic systems, their subsystems and individual modules

3. Requirements for evaluating the educational program learning outcomes

EO1 - 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.

EO2 – Apply modern software products and the latest technologies to solve and manage interdisciplinary engineering problems in various fields of science and technology.

EO3 – Research in the field of development of new samples and improvement of existing mechatronic and robotic systems, search for new ways of information management and processing.

EO4 – 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.

EO5 – To determine the safety, environmental friendliness and economic efficiency of the implementation of the projected robotic and mechatronic systems, their individual modules and subsystems.

EO6 – 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.

EO7 – 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.

4. Passport of educational program

4.1. General information

№	Field name	Comments
1	Code and classification of the field of education	7M07 Manufacturing and processing industries
2	Code and classification of training directions	7M071 Engineering and engineering trades
3	Educational program group	M102 Robotics and mechatronics
4	Educational program name	7M07107 Robotics and Mechatronics
5	Short description of educational program	Training of highly qualified specialists in the field of development of new control methods, information processing and search for new design solutions for mechatronic and robotic systems of general purpose, their subsystems and individual modules, conducting research in the field of mechatronics, robotics, control theory and artificial intelligence methods.
6	Purpose of EP	The purpose of the educational program is to provide high–quality training of highly qualified specialists in the field of robotics and mechatronics, ready to solve scientific, pedagogical and production tasks of professional activity in modern conditions
7	Type of EP	New
8	The level based on NQF	7
9	The level based on IQF	7
10	Distinctive features of EP	-
11	List of competencies of educational program	In the field of research methodology; in the field of scientific and scientific-pedagogical activity in higher educational institutions; in matters of modern educational technologies; in the implementation of scientific projects and research in the professional field; in the field of information analysis.
12	Learning outcomes of educational program	EO1-EO07
13	Education form	full-time
14	Period of training	2 year
15	Amount of credits	120
16	Languages of instruction	russian, kazakh
17	Academic degree awarded	Master of Technical Sciences/Master of Engineering and Technology in the educational program «7M07107 Robotics and Mechatronics»
18	Developer(s) and authors	Ozhikenov K.A., Tasbolatova L.T.

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
Cycle of basic disciplines — University component										
1.	English (professional)	The course is designed for undergraduates of technical specialties to improve and develop foreign language communication skills in professional and academic fields. The course introduces students to the general principles of professional and academic intercultural oral and written communication using modern pedagogical technologies. The course ends with a final exam. Undergraduates also need to study independently (MIS).	5			v				
2.	Management Psychology	The course is aimed at teaching undergraduates the basics of management psychology. It will consider the specifics of management psychology, psychological patterns of managerial activity, personality and its potential in the management system; motivation and effectiveness in the organization, leadership and leadership in modern management of organizations, social group as an object of management, psychological foundations of managerial decision-making, business communication and managerial conflicts, psychology of responsibility, image creation, how an integral part of the culture of communication, the psychology of advertising.	3		v					
3.	History and philosophy of science	The subject of philosophy of science, dynamics of science, specifics of science, science and pre-science, antiquity and the formation of theoretical science, the main stages of the historical development of science, features of classical science, non-classical and post-non-classical science, philosophy of mathematics, physics, engineering and technology, specifics of engineering sciences, ethics of science, social and moral responsibility of a scientist and engineer.	3			v				
4.	Higher school pedagogy	The course is intended for undergraduates of the scientific and pedagogical magistracy of all specialties. Undergraduates will master the methodological and theoretical foundations of higher school pedagogy, plan and organize the processes of teaching and upbringing, master the communicative technologies of subject-subject interaction between a teacher and a master in the educational process of a university.	3		v					
Cycle of basic disciplines — Component of choice										
5.	Robot dynamics	The purpose of teaching the discipline "The dynamics of robots" is to study the basics of building kinematic and dynamic models of robots and motion control tasks, methods of constructing program trajectories of motion. The study of kinematics and dynamic properties of various actuators and the use of this information to obtain as simple and economical control as possible. The task of the dynamics of robot control, inextricably linked with the planning of the trajectory of its movement.	5	v		v				

№	Discipline	Description									
6.	Intelligent information management and processing systems	The discipline is aimed at studying the theoretical foundations and practical mastering of working with neural networks, genetic algorithms and expert systems. Formation of practical skills in the use of intelligent systems for management. Understanding the place of intelligent methods among all information technologies. The concept of basic intelligent technologies, their use in computer control systems and application for solving applied problems	5				v	v		
7.	Theory of inventive problem solving	The purpose of studying the discipline is to master the theoretical foundations of solving inventive tasks. Basic knowledge in the field of solving inventive tasks, as well as skills in working with normative documents of invention will be presented. After studying the course, a master's student must demonstrate the ability to analyze, synthesize and design solutions to inventive tasks, as well as assess their significance for society, biotechnology, biomedicine and medicine.	5				v	v		
8.	Application of methods of technical creativity in innovation	The purpose of studying the discipline is to master the basics of practical application of methods of technical creativity in innovation. The basic knowledge and skills of applying the methods of technical creativity in innovation are offered. After studying the course, a master's student must demonstrate the ability to analyze, synthesize and design methods of technical creativity in innovation, as well as assess their significance for biotechnology, biomedicine and medicine.	5				v			
9.	Mathematical modeling and optimization of the movement of multi-link systems	The purpose of studying the discipline is to study the principles of modeling the movement of multi-link systems, which are the majority of mechatronic systems that are multi-link, such as manipulators of industrial robots, etc., at the design stage. The study of the main elements of the SimMechanics library and the principles of forming models of spatial mechanisms and machines in the SimMechanics environment, visualization of the movements of spatial mechanisms and machines using the built-in SimMechanics tools	5				v		v	
10	Biotechnical control systems	The objectives of the development of the discipline: the formation of knowledge, skills, abilities and competences on the management systems of biotechnical systems; forming a belief about the need for the development of automatic biotechnical systems for human life support; use of information tools necessary for future professional activities	5	v		v				
	Cycle of profile disciplines **University component**									
11	Intelligent control technology	The purpose of the discipline is to study the theoretical foundations of artificial intelligence, neural network technologies of intelligent systems, technologies for building control systems with fuzzy logic, rules of fuzzy logic, technologies for creating a knowledge base, expert control systems, adaptive control systems, problems of theory and technology of intelligent systems, etc. This knowledge is necessary for further understanding of the principles of building robotic systems.	5				v	v	v	
	Cycle of profile disciplines **Component of choice**									
12	Managing mobile robots in an unknown environment	The purpose of teaching the discipline is to form masters' knowledge about automatic and automated control of mobile robots, methods and methods of designing, debugging and operating mobile robots using computer–aided design and production systems, taking into	5			v	v			

		account unknown, random, non-deterministic influences. The issues of mathematical description of static and dynamic objects, development and design of mechanical and electrical components of robotic and mechatronic systems with their subsequent automated control are considered.								
13	Intelligent management in conditions of uncertainty	The discipline "Intellectual management in conditions of uncertainty" is aimed at studying the problems of managing continuous dynamic objects under uncertainty. The tools of sensitivity theory, interval model representations, generalized modal control, Lyapunov function method and adaptive control are studied. Designing control laws that deliver robustness to systems in the sense of the main indicators of the quality of their functioning. Non-adaptive and adaptive management methods.	5		v	v				
14	Robot navigation systems	The purpose of the discipline is to study the types, purpose, general principles of operation of robot navigation systems, as well as the mathematical apparatus of modern navigation. To teach to understand the purpose of robot navigation systems and to apply modern robot navigation systems and tools. Inertial orientation and navigation system (IONS) for manipulative and mobile robots. Structure and purpose and sleep. Orientation and navigation algorithms for determining the kinematic parameters of a moving object using IONS.	5		v	v				
15	Biomedical measurement information systems	The purpose of studying the discipline is the formation of students' knowledge in the field of information and measurement systems: components, algorithms, structures, characteristics, varieties and purposes of modern information and measurement systems and their parts; features of the use of computers and computer technology in information and measurement systems; organization of human interaction and technology in information and measurement systems; metrological providing systems; sources, types and performance indicators of information and measurement systems	5		v					
16	Multi-agent robotic systems	The purpose of studying the discipline is the study of multi-agent systems, which are one of the new promising areas of artificial intelligence, which was formed on the basis of research results in the field of distributed computer systems, network technologies for solving problems in parallel computing, in which the principle of autonomy of individual parts of the program, jointly functioning in a distributed system, where many interconnected computing processes are simultaneously taking place programs called multiagents.	5		v	v				
17	Intelligent control technology	The purpose of the discipline is to study the theoretical foundations of artificial intelligence, neural network technologies of intelligent systems, technologies for building control systems with fuzzy logic, rules of fuzzy logic, technologies for creating a knowledge base, expert control systems, adaptive control systems, problems of theory and technology of intelligent systems, etc. This knowledge is necessary for further understanding of the principles of building robotic systems.	5			v	v	v		
18	Diagnostics and reliability of technical systems and devices	The purpose of studying the discipline is to study methods for assessing the reliability of technical systems at the design stage, to study methods for assessing the reliability of technical systems in operation, to apply probability theory to predict and prevent equipment failures, to study methods for diagnosing existing equipment. Accordingly, the teaching of the discipline "Diagnostics and reliability of technical systems and devices" is aimed at arming future specialists with knowledge of the basic provisions of the theory of reliability	5							v

№	Discipline	Description	Credits								
		and survivability of technical systems.									
19	Assessment of reliability and survivability of technical systems	The discipline is aimed at studying methods for assessing the reliability of technical systems at the design stage, studying methods for assessing the reliability of technical systems in operation, applying probability theory to predict and prevent equipment failures. The basic concepts of reliability theory, such as the quality and reliability of the object, the causes and types of failures. Methods for assessing the reliability of recoverable systems without limitation and with a limited recovery time	5								v
20	Digital processing of measurement information	The purpose of the discipline is to study the role and significance of digital signal processing in the reception and transmission of information, the features and advantages of digital representation of signals, the study of digital transformation algorithms, the implementation of digital processing in telecommunications, information-measuring and radiophysical systems and its application in various fields of science, technology and production.	5			v	v				
21	Neuro fuzzy and hybrid controlenterprises	The purpose of studying the discipline is to familiarize with the principles and methods of building systems of neural fuzzy and hybrid control of a technical object based on the methods of the theory of artificial intelligence and modern software and hardware. Study of the structure, characteristics and functionality of the NeuralNetworksToolbox module of the MatLab software package for modeling neural networks; study of the structure, characteristics and functionality of the FuzzyLogicToolbox module of the MatLab software package for modeling fuzzy and hybrid control systems	5				v		v		
22	Design of special purpose robotic systems	The purpose of teaching the discipline is to systematize and integrate previously acquired knowledge in the disciplines of bachelor's and master's training in the field of study. Definition and formalization of tasks facing robotics; drawing up requirements for components of robotic systems; the concept of problems of designing highly efficient mechatronic modules and systems of special-purpose objects; obtaining methodological foundations of system design of multicomponent integrated systems, taking into account the specifics of automated production.	5						v		
23	Design of microprocessor and microcontroller systems	The discipline is aimed at forming students' knowledge of the general methodology and specific design methods of the main varieties of modern microprocessor tools, as well as knowledge and skills in the field of architecture, principles of functioning and programming of microprocessor systems. Studies the architecture and functionality of modern microprocessors and microcontrollers; methods and technical means of debugging, diagnostics, modeling and design of microprocessor systems and microcontrollers.	5						v		
24	Organization and planning of mechatronic equipment production	The purpose of studying the discipline is to study the methods of planning and production of medical equipment and the principles of the organization of the production process in the production of medical equipment. Scientific foundations of the organization of the production of medical equipment. Organization of auxiliary workshops and service farms of the enterprise for the production of medical equipment. Organization of research, design and technological preparation of medical equipment production. Organization and planning of management of the enterprise for the production of medical equipment. Organization of mastering the production of new equipment.	5	v							v
25	Information topologies and	The purpose of studying the discipline is to provide undergraduates with systematized	5						v		

	networks	knowledge about information topologies and networks in computer control systems of robotic systems. Formation of in-depth knowledge in the field of modern information and communication technologies, information culture. Mastering the skills of designing and practical implementation of various automated control systems for robotic systems.										
26	Deep learning of robots	The purpose of studying the discipline is to develop undergraduates' skills in solving applied problems using deep neural networks. The course is dedicated to the methods of "deep learning" - a new generation of neural network methods of machine learning, which caused rapid development in a number of applied areas. Over the past few years, deep learning methods have become firmly entrenched in the applied fields of computer vision: visual image recognition, segmentation, color restoration using images, image description with tags, text processing, speech processing.	5					v		v		
27	Robust systems and adaptive control	The purpose of studying the discipline is to familiarize undergraduates with the technical characteristics of adaptive, robust and robust–suboptimal control systems for single-connected, multi-connected and network linear and nonlinear objects. To study mathematical methods used in the synthesis of adaptive and robust control systems for dynamic objects. To teach how to use the studied methods to solve specific adaptation problems in stochastic dynamical systems	5				v	v				
28	Project management	After the successful completion of the discipline, undergraduates will gain knowledge about the key components of project management, with an emphasis on modern behavioral models of project-oriented business development management. The course program, built on recognized by business communities international PMI PMBOK, IPMA ICB standards and Kazakhstan standards in the field of project management. The peculiarity of organizational management of business development through projects in relationship to strategic, project and operational management is discussed. The system of practitioners, methods and procedures used in the innovative activities of organizations is considered considering the psychological aspects of team building, communication and stakeholder interaction.	5				v					

5. Curriculum of educational program
KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY NAMED AFTER K.I. SATBAYEV

APPROVED

**Chairman of the Management Board-
Rector of Kazntu named after K.Satpayev
_____ M.M. Begentaev
«_____» _____ 2022 y.**

CURRICULUM
**of Educational Program on enrollment for 2022-2023 academic year
Educational program 7M07107 - Robotics and mechatronics
Group of educational programs M102 - "Robotics and mechatronics"**

Form of study: full-time   **Duration of study: 2 year**   **Academic degree: Master of Technical Sciences**

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	Allocation of face-to-face training based on courses and semesters			
								I course		2 course	
								1 semester	2 semester	3 semester	4 semester
M-1. Module of basic training (university component)												
LNG210	English (professional)	BD UC	5	150	0/0/3	105	E	5			
HUM214	Management Psychology	BD UC	3	90	1/0/1	60	E		3		
HUM212	History and philosophy of science	BD UC	3	90	1/0/1	60	E		3		
HUM213	Higher school pedagogy	BD UC	3	90	1/0/1	60	E	3			
M-2. Module of theoretical foundations of management (optional component)												
1201	Elective	БД КВ	5	150	2/0/1	105	E	5			
1202	Elective	БД КВ	5	150	2/0/1	105	E	5			
ROB284	Intelligent control technology	ПД ВК	5	150	2/0/1	105	E	5			
1302	Elective	ПД КВ	5	150	2/0/1	105	E		5		
2307	Elective	ПД КВ	5	150	2/0/1	105	E			5	
M-3. Control Design Module (optional component)												
1203	Elective	БД КВ	5	150	2/0/1	105	E		5		
1301	Elective	ПД КВ	5	150	2/0/1	105	E	5			
1303	Elective	ПД КВ	5	150	2/0/1	105	E		5		
2304	Elective	ПД КВ	5	150	2/0/1	105	E			5	
2305	Elective	ПД КВ	5	150	2/0/1	105	E			5	
2306	Elective	ПД КВ	5	150	2/0/1	105	E			5	
2308	Elective	ПД КВ	5	150	2/0/1	105	E			5	
M-4. Practice-oriented module												
AAP229	Pedagogical practice	BD UC	6						6		
AAP256	Research practice	PD, CCH	4								4
M-5. Experimental research module												
AAP251	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	2						2		

AAP241	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	3						3		
AAP254	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	5							5	
AAP255	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	14								14
M-6. Module of final attestation											
ECA205	Preparation and defense of a master's thesis	FA	12								12
Total based on UNIVERSITY:				30	30	30				30	
				60				**60**			

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

SATBAYEV UNIVERSITY
1934

APPROVED
Director of the Institute of Automation and Information Technology
_____ **R.K. Uskenbayeva**
«____» _____ **2022 y.**

Educational program 7M07107 - Robotics and mechatronics
Group of educational programs M102 - ''Robotics and mechatronics''

Form of study: full-time   **Duration of study: 2 year**   **Academic degree: Master of Technical Sciences**

Elective code according to the curriculum	Discipline code	Name of disciplines	Semester	Cycle	Credits	lek/lab/pr
Module of theoretical foundations of management						
1201	ROB256	Robot dynamics	1	B	5	2/0/1
	ROB204	Intelligent information management and processing systems				2/0/1
1202	ROB263	Theory of inventive problem solving	1	B	5	2/0/1
	ROB262	Application of methods of technical creativity in innovation				2/0/1
1302	ROB555	Managing mobile robots in an unknown environment	2	P	5	2/0/1
	ROB203	Intelligent management in conditions of uncertainty				2/0/1
2307	ROB283	Robot navigation systems	3	P	5	2/0/1
	ROB224	Biomedical measurement information systems				2/0/1
	MNG705	Project management				2/0/1
Control system design module						
1203	ROB275	Mathematical modeling and optimization of the movement of multi-link systems	2	B	5	2/0/1
	ROB257	Biotechnical control systems				2/0/1
1301	ROB265	Multi-agent robotic systems	1	P	5	2/0/1
	ROB225	Intelligent control technology				2/0/1

1303	ROB277	Diagnostics and reliability of technical systems and devices	2	P	5	2/0/1
	ROB216	Assessment of reliability and survivability of technical systems				2/0/1
2304	ROB279	Digital processing of measurement information	3	P	5	2/0/1
	ROB285	Neuro fuzzy and hybrid controlenterprises				2/0/1
2305	ROB281	Design of special purpose robotic systems	3	P	5	2/0/1
	ROB239	Design of microprocessor and microcontroller systems				2/0/1
2306	ROB280	Organization and planning of mechatronic equipment production	3	P	5	2/0/1
	ROB288	Information topologies and networks				2/0/1
2308	ROB274	Deep learning of robots	3	P	5	2/0/1
	ROB286	Robust systems and adaptive control				2/0/1
The "R&D" module						
2307	MNG705	Project management	3	P	5	2/0/1

The number of credits in elective subjects for the entire period of study

Cycles of disciplines	Credits
Cycle of basic disciplines (B)	15
Cycle of profile disciplines (P)	40
TOTAL:	**55**

Number of credits for the entire period of study

Cycle code	Cycles of disciplines	Credits		
		university component (UC)	component of choice (CCH)	Total
BD	Cycle of basic disciplines	20	15	35
PD	Cycle of profile disciplines	24	25	49
	Total for theoretical training:	*0*	*44*	*40*	*84*
	RWMS			*24*
FA	Final attestation	12		12
	TOTAL:	**12**	**44**	**40**	**120**

Remark:

1. The names and amount of modules related to Module of basic training and professional activity are prescribed by departments themselves

2. * - Division into types of work is at the department's discretion

3. If necessary, the disciplines: Physics II, Mathematics III, General Chemistry of the department include, at the expense of credits, the department's component of BD, UC from the basic training module

4. The full academic load of one academic year should be 60 academic credits

5. The application of elective disciplines catalog in the same way as Curriculum is divided into modules, with the inclusion of "R&D" module

Decision of the Academic Council of Kazntu named after K.Satpayev. Protocol № __ от "____" _____20___ y.
Decision of the Educational and Methodological Council of Kazntu named after K.Satpayev. Protocol № __ от "____" _____20___ y.
Decision of the Academic Council of the Institute of A&IT. Protocol № __ от "____" _____20___ y.

Vice-Rector for Academic Affairs	_____	**B.A. Zhautikov**
Director of the Institute of Automation and Information Technology	_____	**R.K. Uskenbayeva**
Head of the Department of Robotics and Automation Equipment	_____	**K.A. Ozhikenov**
Specialty Council representative from employers	_____	**A.K. Dzhumagulov**

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6. Additional educational programs (Minor)

Name of additional educational programs (Minor) with disciplines	Total number of credits	Recommended semesters of study	Documents on the results of mastering the additional educational programs (Minor)