
**Institute of Automation and Information Technologies**
**Department of Automation and Control**

# EDUCATIONAL PROGRAM
# 6B07103–AUTOMATION AND ROBOTIZATION

**code and name of the educational program**

Code and classification of the field of education: **6B07 Engineering, manufacturing and construction industries**
Code and classification of areas of study: **6B071 Engineering and Engineering**
Education Program Group: **B063–Electrical engineering and automation**
NQF level: **6**
ORC level: **6**
Duration of study: **4 years**
Volume of credits: **240 credits**

**Almaty 2022**

The educational program **"6B07103 - Automation and robotization"** was approved at a meeting of the Academic Council of KazNITU named after K.I.Satpaev.

**Protocol № 13 «28» 04 2022 y.**

It, was considered and proposed for approval at a meeting of the educational and methodological council of KazNITU named after. K.I. Satbaeva.

**Protocol № 7 «26» 04 2022 y.**

The educational program **"6B07103 - Automation and Robotization"** was developed by the Scientific Committee in the direction **"6B071 Engineering and Technology".**

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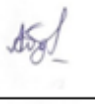
| Abdigaliyev Serik Kanaevich | | Chief | "HONEYWELL - AUTOMATIC CONTROL SYSTEM LLP" |  |
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# List of abbreviations and symbols

| | |
|---|---|
| EP | Educational program |
| APCS | Automated process control system |
| ACS | Automatic control systems |
| CAD | Computer-aided design system |
| DAC | D/A Converter |
| ADC | Analog to digital converter |

## 1 Description of the educational program

The educational program (hereinafter EP) is a set of documents developed by the Kazakh National Research Technical University named after K.I.Satpayev and approved by the Ministry of Education and Science of the Republic of Kazakhstan.

The educational program 6B07103 - Automation and robotics in the direction of personnel training 6B071- "Engineering and Engineering" involves the training of highly qualified specialists in the field of operation, maintenance, development and implementation of automated process control systems (APCS), robotic technological complexes (RTC) in various industries.

A bachelor who graduates from this program acquires the following competencies: operation and maintenance of automated process control systems and RTK in various industries, development and implementation of technical, information and software for industrial production process control systems and RTK, conducting scientific research in the field of integrated automation and robotization of production processes , using modern software for designing and modeling production processes.

The objects of professional activity of the bachelor are: subdivisions of industrial enterprises for the operation and maintenance of APCS and RTK of various industries, subdivisions of state institutions for the operation and maintenance of automated information and control systems for various purposes, subdivisions of design organizations for the development, implementation and technical support of APCS and RTK of various industries, subdivisions of scientific organizations for research in the field of automation of technological processes, robotization of technological operations.

The types of professional activity are:

In the field of organizational and managerial activities: to be the head of the group of the unit for the operation, maintenance of elements,APCS and RTK in various industries;

In the field of experimental research activities: to be a specialist in conducting experimental research on objects of automation and robotization of industrial production;

In the field of research activities: to be an engineer in a scientific laboratory for the research and development of modern APCS and RTK in various industries;

In the field of design and development: to be a development and design engineer APCS and RTK in various industries.

## 2. Purposes and objectives of the educational program

**Purpose of the EP:** The purpose of the educational program 6B07103–"Automation and robotization" is the creation of conditions for an effective educational process for the formation and development of personal, socio-cultural, general engineering and professional competencies in the field of automation and robotics, meeting the needs of students in intellectual, creative and professional development.

**Tasks of the OP:**

- providing social and humanitarian education based on knowledge of the laws of socio-economic development of society, the history of Kazakhstan, modern information technologies, the state language, foreign and Russian languages as a means of interethnic communication;
- providing in-depth knowledge of a natural-science, general technical nature, as the foundation of vocational education;
- providing deep theoretical knowledge and practical skills in the fieldautomation, robotization, artificial intelligence and automated control;
- ensuring the adaptation of professionally oriented skills to the changing needs of society.

## 3. Requirements for evaluating the learning outcomes of an educational program

OP 6B07103 - "Automation and robotization" ensures that all students achieve the learning outcomes necessary for professional activities. Upon completion of the program, students must:

- possess the knowledge, skills and abilities to implement a systematic approach to the development and implementation of automation systems and robotization of production processes.
- to be able to make a choice of measuring instruments and automation equipment, measure technological parameters, configure and operate automation elements and devices.
- demonstrate knowledge of sections of higher mathematics, physics and other natural sciences and apply them to solve engineering problems in the field of automation and control.
- own modern computer, information, communication technologies and software used in the creation and operation of automation systems.
- be able to put into practice knowledge on the main types of linear and non-linear automatic control systems, their mathematical description and modeling, perform calculations on the analysis and synthesis of control systems.
- have programming skills in high-level languages, tools and programming languages for microcontrollers, software for modeling and researching process control systems.
- be able to navigate the current economic, political and corruption situation.
- own methods of information processing and synthesis of automation systems, methods of designing and programming data management systems. Use in practice the functionality of Scada-systems.
- develop structural, functional and other automation schemes, analyze reference and regulatory literature, draw up technical documentation. Develop technical, software, mathematical, algorithmic, informational and other support for process control systems.
- use the technical capabilities of microprocessor technology, means of

receiving and transmitting information and software products to solve automation problems.

- analyze and evaluate the state of automation objects, technological processes and industries. Make qualified decisions on the use of automation elements and systems, their installation, commissioning and operation.

- use modern tools and information and communication technologies in the design and implementation of process and production control systems.

# 4. Passport of the educational program

## 4.1. General intelligence

| No. | Field name | Note |
|---|---|---|
| 1 | Code and classification of the field of education | 6B07 Engineering, manufacturing and construction industries |
| 2 | Code and classification of areas of study | 6B071 Engineering and engineering |
| 3 | Group of educational programs | B063–"Electrical Engineering and Automation" |
| 4 | Name of the educational program | 6B07103–Automation and robotization |
| 5 | Brief description of the educational program | The educational program 6B07103 - Automation and robotics in the direction of personnel training 6B071- "Engineering and engineering" involves the training of highly qualified specialists in the field of automation, robotics, artificial intelligence and automated control. |
| 6 | Purpose of the OP | The purpose of the educational program 6B07103–"Automation and robotization" is the creation of conditions for an effective educational process for the formation and development of personal, socio-cultural, general engineering and professional competencies in the field of automation and robotics, meeting the needs of students in intellectual, creative and professional development. |
| 7 | OP type | New OP |
| 8 | NQF level | 6 |
| 9 | ORC level | 6 |
| 10 | Distinctive features of the OP | Not |
| 11 | List of competencies of the educational program: | A bachelor who graduates from this program acquires the following competencies: operation and maintenance of automated process control systems and RTK in various industries, development and implementation of technical, information and software for industrial production process control systems and RTK, conducting scientific research in the field of integrated automation and robotization of production processes , using modern software for designing and modeling production processes. |
| 12 | Learning outcomes of the educational program: | PO1 Possess the knowledge, skills and abilities to implement a systematic approach to the development and implementation of automation systems and robotization of production processes.<br>PO2 Be able to select measuring instruments and automation equipment, measure technological parameters, configure and operate automation elements and devices.<br>PO3 Demonstrate knowledge of sections of higher mathematics, physics and other natural sciences and apply them to solve engineering problems in the field of automation and control.<br>PO4 Own modern computer, information, communication technologies and software used in the creation and operation of automation systems. |

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| | | RO5 To be able to put into practice knowledge on the main types of linear and non-linear automatic control systems, their mathematical description and modeling, perform calculations on the analysis and synthesis of control systems.<br>RO6 To have programming skills in high-level languages, programming tools and languages for microcontrollers, software for modeling and researching process control systems.<br>PO7 Be able to navigate the current economic, political and corruption situation.<br>RO8 Own methods of information processing and synthesis of automation systems, methods of designing and programming data management systems. Use in practice the functionality of Scada-systems.<br>RO9 Develop structural, functional and other automation schemes, analyze reference and regulatory literature, draw up technical documentation. Develop technical, software, mathematical, algorithmic, informational, etc. provision of process control systems.<br>RO10 Use the technical capabilities of microprocessor technology, means of receiving and transmitting information and software products to solve automation problems.<br>RO11 Analyze and evaluate the state of automation objects, technological processes and industries. Make qualified decisions on the use of automation elements and systems, their installation, commissioning and operation.<br>PO12 Use modern tools and information and communication technologies in the design and implementation of process and production control systems. |
| 13 | Form of study | full-time |
| 14 | Training period | 4 years |
| 12 | Volume of loans | 240 credits |
| 16 | Languages of instruction | Kazakh, Russian |
| 17 | Awarded Academic Degree | Bachelor of Engineering and Technology |
| 18 | Developer(s) and authors: | Aldiyarov N.U., Zhanabaeva E.Zh. |

## 4.2. The relationship between the achievability of the formed learning outcomes in the educational program and academic disciplines

| No. | Name of the discipline | Brief description of the discipline | Amount of credits | Formed learning outcomes (codes) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PO1 | PO2 | PO3 | PO4 | RO5 | RO6 | RO7 | RO8 | RO9 | RO10 | RO11 | RO12 |
| **Cycle of general education disciplines<br>Required Component** | | | | | | | | | | | | | | | |
| 1 | Foreign language | English is a discipline of the general education cycle. After determining the level (according to the results of diagnostic testing or IELTS results), students are divided into groups and disciplines. The name of the discipline corresponds to the level of English proficiency. When moving from level to level, prerequisites and postrequisites of disciplines are observed. | 10 | v | | | | | | | | | | | |
| 2 | Kazakh (Russian) language | The socio-political, socio-cultural spheres of communication and functional styles of the modern Kazakh (Russian) language are considered. The course covers the specifics of the scientific style in order to develop and activate the professional communication skills and abilities of students, allows students to practically master the basics of the scientific style and develop the ability to perform structural and semantic analysis of the text. | 10 | v | | | | | | | | | | | |
| 3 | Information and Communication Technologies (in English) | Required component. The task of studying the discipline is to acquire theoretical knowledge about information processes, new information technologies, local and global computer networks, methods of information protection; obtaining skills in the use of text editors and spreadsheet processors; creation of databases and various categories of application programs. | 5 | | | | | v | | | | | | | |
| 4 | Modern history of Kazakhstan | The course studies historical events, phenomena, facts, processes that took place on the territory of Kazakhstan from ancient times to the present day. The sections of the discipline include: the steppe empire of the Turks; early feudal states on the territory of Kazakhstan; Kazakhstan in the period of | 5 | | v | | | | | | | | | | |

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| | | the Mongol conquest (XIII century), medieval states in the XIV-XV centuries. The era of the Kazakh Khanate XV-XVIII centuries. Kazakhstan as part of the Russian Empire, Kazakhstan during the Great Patriotic War, in the period of independence and at the present stage. | | | | | | | | | | | | | |
| 5 | Philosophy | Philosophy forms and develops critical and creative thinking, worldview and culture, provides knowledge about the most general and fundamental problems of being and endows them with a methodology for solving various theoretical practical issues. Philosophy expands the horizon of vision of the modern world, forms citizenship and patriotism, contributes to the education of self-esteem, awareness of the value of human existence. It teaches to think and act correctly, develops the skills of practical and cognitive activity, helps to seek and find ways and means of life in harmony with oneself, society, and the world around. | 5 | | | | | | | v | | | | | |
| 6 | Module of socio-political knowledge (sociology, political science) | Studying the course contributes to the formation of students' theoretical knowledge about society as an integral system, provides the political aspect of training a highly qualified specialist on the basis of modern world and domestic political thought. The discipline is designed to improve the quality of both general humanitarian and professional training of students. Knowledge in the field of sociology and political science is necessary for understanding political processes, for forming a political culture, developing a personal position and a clearer understanding of the measure of one's responsibility. | 3 | v | | | | | | | | | | | |
| 7 | Module of socio-political knowledge (culturology, psychology) | The module of socio-political knowledge (culturology, psychology) is designed to acquaint students with the cultural achievements of mankind, for their understanding and assimilation of the main forms and universal patterns of the formation and development of culture. During the course of cultural studies, general problems of the theory of culture, leading cultural concepts, universal patterns and mechanisms for the formation and development of culture, the main historical stages of the formation | 5 | | v | | | | | | | | | | |

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| | | and development of Kazakhstani culture are considered. It also studies the laws of the emergence, development and functioning of mental processes, states, properties of a person engaged in a particular activity, the laws of development and functioning of the psyche as a special form of life. | | | | | | | | | | | | | | |
| **Cycle of general education disciplines<br>University component** | | | | | | | | | | | | | | | | |
| 8 | Fundamentals of anti-corruption culture | The discipline studies the essence, causes, causes of sustainable development of corruption from both historical and modern points of view. Considers the prerequisites and impacts for the development of an anti-corruption culture. Studies the development of countering corruption on the basis of social, economic, legal, cultural, moral and ethical norms. She studies the problems of forming an anti-corruption culture based on the relationship with various types of social relations and various manifestations. | 5 | | | | | | | v | | | | | | |
| 9 | Fundamentals of Entrepreneurship and Leadership | The discipline studies the foundations of entrepreneurial activity and leadership from the point of view of science and law; features, problematic aspects and development prospects; theory and practice of entrepreneurship as a system of economic, organizational and legal relations of business structures; readiness of entrepreneurs for innovative susceptibility. The discipline reveals the content of entrepreneurial activity, career stages, qualities, competencies and responsibilities of an entrepreneur, theoretical and practical business planning and economic expertise of business ideas, as well as risk analysis of innovative development, introduction of new technologies and technological solutions. | 5 | | | | | | | v | | | | | | |
| 10 | Ecology and life safety | The discipline studies the tasks of ecology as a science, types (out ecology, population and social ecology), environmental terms, the laws of the functioning of natural systems and aspects of environmental safety in the conditions of labor activity. Monitoring of the environment and management in the field of its safety. Sources of pollution of atmospheric air, surface, groundwater, | 5 | | | | | | | | | | | v | | |

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| | | soil and ways to solve environmental problems; life safety in the technosphere; natural and man-made emergencies. | | | | | | | | | | | | | |
| **Cycle of basic disciplines<br>University component** | | | | | | | | | | | | | | | |
| 11 | Mathematics I | The course is based on the study of mathematical analysis in a volume that allows you to explore elementary functions and solve the simplest geometric, physical and other applied problems. The main attention is paid to differential and integral calculus. The sections of the course include differential calculus of functions of one variable, derivative and differentials, study of the behavior of functions, complex numbers, polynomials. Indefinite integrals, their properties and methods of calculation. Definite integrals and their applications. Improper integrals. | 5 | | | V | | | | | | | | | |
| 12 | Mathematics II | The discipline is a continuation of Mathematics 1. The sections of the course include elements of linear algebra and analytic geometry. The main questions of linear algebra are considered: linear and self-adjoint operators, quadratic forms, linear programming. Differential calculus of a function of several variables and its applications. Multiple integrals. The theory of determinants and matrices, linear systems of equations, as well as elements of vector algebra. Includes elements of analytical geometry in the plane and in space. | 5 | | | V | | | | | | | | | |
| 13 | Physics I | The course studies the basic physical phenomena and laws of classical and modern physics; methods of physical research; the influence of physics as a science on the development of technology; connection of physics with other sciences and its role in solving scientific and technical problems of the specialty. The course covers the following sections: mechanics, dynamics of rotational motion of a solid body, mechanical harmonic waves, fundamentals of molecular kinetic theory and thermodynamics, transfer phenomena, continuum mechanics, electrostatics, direct current, magnetic field, Maxwell's equations. | 5 | | | V | | | | | | | | | |

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| 14 | Physics II | The course studies the laws of physics and their practical application in professional activities. Solution of theoretical and experimental-practical educational problems of physics for the formation of foundations in solving professional problems. Assessment of the degree of accuracy of the results of experimental or theoretical research methods, modeling of the physical state using a computer, studying modern measuring equipment, developing the skills of conducting test studies and processing their results, distributing the physical content of applied tasks of the future specialty. | 5 | | | v | | | | | | | | | |
| 15 | Engineering and computer graphics | The course develops the following skills for students: depict all possible combinations of geometric shapes on a plane, conduct research and measure them, allowing image transformations; create technical drawings, which are the main and reliable means of information providing communication between the designer and the designer, technologist, builder, in the AutoCAD environment. | 5 | | | v | v | | | | | | | | |
| 16 | Introduction to the specialty and engineering ethics | The objectives of the study of the discipline is the assimilation of theoretical foundations in the areas of: - ethics of business communication and the principles of ethics of business relations; - features and problems associated with professional and in particular engineering ethics; - features of the ethics of business relations and its connection with professional morality and generally accepted moral standards; - categories of the subject of regulation in engineering ethics, the engineer's code of ethics and the engineer's code of professional ethics; -applied aspects of ethical issues related to computing, waste disposal, air and water pollution, greenhouse effect and ozone holes, waste disposal and nuclear energy; - responsibility of engineers for their activities in foreign countries and ethical codes of engineering communities in different countries. | 4 | | | | | | | | | | | v | |
| 17 | Theoretical foundations of electrical engineering | The discipline deals with: basic concepts and definitions used in electrical engineering; modern methods of modeling electromagnetic processes; methods of analysis of electrical and magnetic | 5 | | v | | | | | | | | | | v |

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| | | circuits; numerical methods for the analysis of electrical circuits; basic laws and principles of electrical engineering, properties and characteristics of electrical circuits; methods for analyzing electrical circuits in steady state and transient modes; selection of the optimal calculation method, determine the main parameters and characteristics of electrical circuits. | | | | | | | | | | | | | | |
| 18 | Basics of electronics | Formation of students' knowledge on the basics of electronics, methods for designing and calculating electronic devices. Obtaining knowledge, skills and abilities to read structural and schematic diagrams of electronic devices, understand the principles of their operation and make the right choice of elements of electronic equipment. | 5 | | v | | | | | | | | | | | |
| 19 | Power electronic devices of automation | "Power Electronic Automation Devices" is one of the basic special courses for engineering specialties. The purpose of studying the discipline is to give students a fairly complete picture of power electronic devices of automation, their constituent elements, mathematical descriptions, basic methods of analysis, calculation and rational choice of elements. In automation, the basic principles for the construction and calculation of the most widely used circuits of electronic amplifiers, rectifiers and stabilizers, generator devices and electronic devices of discrete action on semiconductor devices are outlined. | 4 | | v | | | | | | | | | | | |
| 20 | Technological automation objects | The content of the discipline "Technological objects of automation" includes the study of mathematical methods of program control of robots, the basics of developing algorithms and cyclograms for controlling robots. The structure, composition of cyclic, positional and contour systems of program control of robots, systems of digital program control of machine tools and machines are considered. | 5 | | | | | | | | | | | | | v |
| 21 | Robotic production technology | The discipline "Technology of robotic production" aims to teach students the methodology of designing technological processes in the conditions of automated production, independent development of technological processes for assembling machines and manufacturing their parts. The issues of the scientific | 6 | v | | | | | | | | | | | | |

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| | | foundations of engineering technology, the preparation of robotic production, the choice of workpieces, the principles of designing technological processes under automation are considered. The objectives of the study of the discipline is the acquisition of knowledge to ensure the accuracy, control and testing of engineering products. As a result of studying the discipline, the trainee should know: the stages of designing the technology for the production of machines, typical technological processes for the manufacture of machine parts; used equipment and tooling in the conditions of robotic production. Be able to: set and solve problems of technical preparation of production; develop technological processes for the manufacture of machines and parts of the required quality in a robotic production environment. | | | | | | | | | | | | | | |
| 22 | Mathematical foundations of control theory | This discipline is designed to study methods for building models of objects, control systems. The following sections are studied: the concept of a set, operations on sets, correspondence and mapping of sets, the concept of graphs, adjacency and incidence matrices, operations on graphs, the concept of a logical variable, functions, operations on logical variables, elementary logical functions, forms of writing logical functions, the concept of a matrix , operations on matrices, types of matrices, characteristic numbers, Kelly-Hamilton theorem, matrix function, concept of a system, description of systems. This course is designed to instill in students the mathematical foundations of building models of control systems. As a result of mastering the discipline, the student will be able to set mathematical problems, build mathematical models, | 5 | | | v | | | | | | | | | | |
| 23 | Optimization methods | General formulation of the optimization problem. Optimization by methods of differential calculus. Method of Lagrange multipliers. geometric programming method. Nonlinear programming methods using derivatives. gradient method. The steepest descent method (greatest ascent). Gauss-Seidel method. Gradientless deterministic search | 5 | | | v | | v | | | | | | | | |

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| | | methods. Random search methods. Optimization under conditions of uncertainty and presence of noise. Multidimensional constrained optimization. Nonlinear programming methods. Multipurpose optimization problems. Methods of dynamic optimization. | | | | | | | | | | | | | | |
| 24 | Intelligent Process Control Systems | This course is designed to develop students' knowledge of the theoretical foundations and practical skills in building process control systems using intelligent technologies - fuzzy logic, neural and hybrid networks. | 5 | | | | | | | | | v | | | |
| 25 | Computer modeling and programming in the MatLab environment | MATLAB supports both numerical and symbolic modeling approaches and provides data fitting, statistics calculation, optimization, ordinary differential equations (ODE) and partial differential equations (PDE), differential and integral calculus, and other key mathematical tools. Simulink additionally provides an environment for modeling and simulating the behavior of multi-domain systems, as well as developing embedded systems. Using the MATLAB language, you can write programs and algorithms faster than in traditional programming languages, because there is no need for such low-level organizational operations as declaring variables, defining types, and allocating memory. In many cases, switching to vector and matrix operations eliminates the need for for loops. | 6 | | | | v | | | | | | | | |
| 26 | Programming and algorithmization | Students get acquainted with the basic structures of algorithms: linear, branched, cyclic, with the Visual Studio integrated development environment for applications; are engaged in the study of forms of representation of algorithms using a verbal description, flowcharts, pseudocode, the creation of console applications, the study of basic data types, counters, loops, arrays, as well as the development of a user interface; learn the principles of constructing flow diagrams, DFD data (Data Flow Diagram). | 5 | | | | v | | | | | | | | |
| 27 | Process measurements and instruments | Compensatory and direct conversion methods. Classification of measuring transducers: by purpose, the nature of the transformation of the input value, the principle of operation. Parametric transducers: | 5 | | v | | | | | | | | | | |

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| | | capacitive, thermal transducers. Meters of force and displacement. Turn angle meter. Gas analyzers. Rheostatic and inductive, strain gauges. Wire, foil, converters. Measurement of deformation, pressure. | | | | | | | | | | | | | |
| 28 | Educational practice | The tasks of educational practice are to obtain professional primary skills and abilities, prepare students for a conscious and in-depth study of basic and general educational disciplines, and familiarize themselves with the specifics of future professional activities.<br>Educational practice can be carried out on the basis of departments, laboratories, enterprises and institutions with various forms of ownership, the areas of activity of which are related to the future professional activities of bachelors.<br>The student can, at his own discretion, choose a task from the proposed block of tasks, which is agreed with the head of practice. In accordance with the tasks of practice, the student performs an individual task.<br>The student keeps records of the practice in the practice diary. At the end, students submit diaries and reports, the acceptance of final reports is carried out by a commission from among the teaching staff of the department. The final grade for the practice is defined as the assessment of the head of the practice from the department for the defense of the report.<br>Educational practice is a mandatory type of practice at the end of the graduating department. | 2 | v | | | | v | | | | | v | v | |
| **Cycle of basic disciplines Optional component** | | | | | | | | | | | | | | | |
| 29 | Microelectronics | The principles of operation, parameters, characteristics and features of the use of semiconductor devices are considered. Designing various circuits of electrical signal amplifiers and generators based on diodes, bipolar and field-effect transistors and working out the features of their functioning. operational amplifiers. differential amplifiers. Feedback. Influence of feedback on the main indicators and characteristics of amplifiers. Power amplifiers. Classification of filters and their composition. | 5 | | | | | | | | | | v | | |

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| 30 | digital electronics | The logical elements and functional units of digital automation devices and the principles of operation of integrated circuits have been studied; introduction and organization of working methods in connection with the peculiarities of semiconductor storage devices; familiarization with analog devices and analog-to-digital and digital-to-analog converters. Subject: circuitry of the main logical elements of digital devices, the design and principle of operation of parts of typical combinational and chain digital devices: encoder, decoder, multiplexer, demultiplexer, digital comparator, adder, trigger, register, digital counter; organizational techniques and features of the operation of semiconductor storage devices; operational amplifiers on the circuitry of analog devices; circuit engineering of analog-to-digital and digital-to-analog converters. As a result of studying the topic, students should know the logic elements and functional units of digital automation devices and the principles of operation of integrated circuits, work due to the features of semiconductor storage devices, analog devices and analog-to-digital and digital devices. -analog converters. | 5 | | | | | | | | | | v | | |
| 31 | Microcontroller programming | This course is intended for students to study the current state of microprocessor and microcontroller control systems. As a result of mastering the discipline, the student will be able to synthesize a program in any of the standard programming languages, to implement the relationship between the controller and the computer and the technological equipment in the most appropriate way. | 5 | | | | | | v | | | | | | |
| 32 | Programming microcontrollers for robotic systems | This course is designed to teach students how to use the methods of programming robotic systems. As a result of mastering the discipline, the student will be able to work in the environment for developing application software for RTS, connect peripheral devices to microcontrollers, perform remote control of the robot, and implement the terms of reference. | 5 | | | | | | | | | | v | | |
| 33 | Metrology and measurements | Fundamentals of representation of metrology. Elements of the measurement process. Classification | 5 | | v | | | | | | | | | | |

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| | | of measurements. Fundamentals of reproduction of units of physical quantities and transfer of their sizes. Measurement errors. Systematic and random errors. measuring signals. Quantization and discretization of measuring signals. Measuring instruments. Elementary measuring instruments. Complex measuring instruments. Measuring and computing complexes. Measurement of current and voltage. Power measurement in direct and alternating current circuits. Elementary analog instruments, digital measuring instruments. Temperature measurements. Thermoelectric thermometers. Flow meters for variable and constant differential pressure. Flow meters are electromagnetic, ultrasonic. Flow measurement of solid bulk materials. Measurement of the quality of raw materials and products of technological processes. Gas composition measurements. Measurements of the composition of liquids. Measuring and computing (microprocessor) means of system application. | | | | | | | | | | | | | | |
| 34 | Electrical measuring instruments | This course deals with tasks related to the measurement of process parameters in the field of automation and control. The course content provides a classification of methods for converting and converting non-electric and electrical, specific types of measuring instruments used to measure technological parameters in various areas of production. | 5 | | | | | | | v | | | | | | |
| 35 | Telecommunication networks of industrial enterprises | The discipline "Telecommunication networks of industrial enterprises" provides for the study of the main parameters and characteristics of telecommunication networks of industrial enterprises, the basics of their structural construction, taking into account modern trends in the development of communication networks, in an in-depth study of functional diagrams, design methods and integration of telecommunication networks and systems. | 5 | | | | | v | | | | | | | | |
| 36 | Fiber optic sensors and systems | The course "Fiber-optic sensors and systems" discusses the principle of operation, design and parameters of modern optoelectronic and fiber-optic sensors for various purposes, basic circuit and | 5 | | v | | | | | | | | | | v | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | technical solutions that determine the structure and functionality of modern sensors, features in industrial technologies. | | | | | | | | | | | | | | |
| 37 | Actuators of automation systems | The course deals with general issues of the theory of actuators of automation, outlines the principles of operation and classification of actuators, their main characteristics, as well as issues related to actuators as elements of an automation system. The actuator is a mandatory element of the control or regulation system, and the operability of the entire system and the possibility of obtaining the required quality indicators in it depend on the correctness of its calculation and selection. | 5 | | v | | | | | | | | | | | |
| 38 | Drives for industrial robots and manipulators | In the course of studying the discipline, students must master the principle of operation, the main components and elements, advantages and disadvantages, and the mathematical description of industrial robot drives. As a result of studying the discipline, students should know the basics of using a pneumatic drive, hydraulic drive and electric drive of industrial robots. Be able to analyze the operation of drive control systems for industrial robots. | 5 | v | | | | | | | | | | | | |
| **Cycle of major disciplines<br>University component** | | | | | | | | | | | | | | | | |
| 39 | Nonlinear automatic control systems | The discipline studies the fundamentals of the theory of nonlinear continuous and discrete automatic control systems, methods of mathematical description, studies of the stability and quality of nonlinear continuous and pulsed automatic control systems. Precise methods for studying stability and self-oscillations. Methods of phase trajectories. Lyapunov's second method. Criterion of absolute stability V.M. Popov. Approximate methods for studying stability and self-oscillations. The concept of impulse systems. Mathematical description of impulse systems. Study of the stability and quality of impulse ACS. Correction of impulse systems. | 5 | | | | | v | | | | | | | | |
| 40 | Linear automatic control systems | The discipline studies the fundamentals of the theory of linear automatic control systems, methods of mathematical description, research of stability and quality, synthesis of linear automatic control systems. | 5 | | | | | v | | | | | | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Basic principles and schemes of automatic control systems. Typical links of ATS. Time and frequency characteristics of links and systems. Rules for the transformation of block diagrams. Algebraic and frequency methods for analyzing the stability of linear ACS. Direct and indirect methods for assessing the quality of linear ACS. Methods and means of improving the properties of linear ACS. Synthesis of linear automatic control systems. | | | | | | | | | | | | | |
| 41 | Neural Network Automation Technologies | The goals of mastering the discipline are the formation of knowledge and competencies in the field of application of neural network technologies to solving problems of automation and control of technological processes and industries; acquisition of skills and abilities in the design and operation of technical means and automation systems built on the basis of the use of neural networks and neuro-fuzzy control systems. | 4 | | | | | | | | | | v | | |
| 42 | Fundamentals of design and development of distributed control systems (DCS) based on SIMATIC PCS 7 | The purpose of studying the discipline "Fundamentals of design and development of distributed control systems (DCS) based on SIMATIC PCS 7" is to train students to develop distributed control systems based on SIMATIC PCS7 software from Siemens. This course will cover the fundamental foundations and functional elements of the process of developing automated process control systems when creating a distributed enterprise management system. | 6 | | | | | | | | | v | | | |
| 43 | Field trip I | In order to consolidate and deepen the theoretical knowledge gained by students in the learning process, the acquisition of practical skills, competencies and professional experience in the educational program being taught, as well as the development of best practices, a bachelor's internship is carried out. Students have practical training at enterprises, working directly at the workplaces of students, performing specific production tasks, consolidating theoretical knowledge. In the process of practice, practice leaders and appointed specialists at the workplace provide students with the necessary assistance and monitor (control) the process of | 2 | v | | | | v | | | | | v | v | |

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| | | internship in terms of meeting deadlines and content. The student keeps personal records of the practice in the practice diary.<br>At the end, students submit diaries and reports, the acceptance of final reports is carried out by a commission from among the teaching staff of the department. The final grade for the practice is defined as the assessment of the head of the practice from the enterprise and the assessment of the head of the practice from the department for the defense of the report.<br>The result of the satisfaction of students, teaching staff and employers with places, conditions and content of practices, as well as the level of students and teachers is the opinion and feedback from organizations that provide bases for internships.<br>Industrial practice is a mandatory type of practice at the end of the course conducted by the graduating department. | | | | | | | | | | | | | |
| 44 | Field trip II | In order to consolidate and deepen the theoretical knowledge gained by students in the learning process, the acquisition of practical skills, competencies and professional experience in the educational program being taught, as well as the development of best practices, a bachelor's internship is carried out. Students have practical training at enterprises, working directly at the workplaces of students, performing specific production tasks, consolidating theoretical knowledge. In the process of practice, practice leaders and appointed specialists at the workplace provide students with the necessary assistance and monitor (control) the process of internship in terms of meeting deadlines and content. The student keeps personal records of the practice in the practice diary.<br>At the end, students submit diaries and reports, the acceptance of final reports is carried out by a commission from among the teaching staff of the department. The final grade for the practice is defined as the assessment of the head of the practice from the enterprise and the assessment of the head of the | 3 | v | | | | v | | | | | v | v | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | practice from the department for the defense of the report.<br>The result of the satisfaction of students, teaching staff and employers with places, conditions and content of practices, as well as the level of students and teachers is the opinion and feedback from organizations that provide bases for internships.<br>Industrial practice is a mandatory type of practice at the end of the course conducted by the graduating department. | | | | | | | | | | | | | | |
| **Cycle of major disciplines<br>Selectable Component** | | | | | | | | | | | | | | | | |
| 45 | Microprocessor complexes in control systems | This course is intended for students to build distributed and lumped control systems, the principles of building industrial controllers, programming tools and programming languages for industrial controllers. As a result of mastering the discipline, the student will be able to develop software for industrial controllers using modern development tools and programming languages. | 6 | | | | | | | | | | v | | |
| 46 | Capstone Research Project 1 | The Capstone Project is a project-based course that final year students take to demonstrate what they have learned from their first year to the final year of the 6B07103 - Automation and Robotics curriculum. Applying it in a specific idea to create something new and solve a specific problem. The Capstone Project aims to improve the quality of student graduate work through the formation and development of students' critical thinking skills, as well as planning, organizing and conducting scientific research. | 6 | v | | | | v | | | | | v | v | |
| 47 | Capstone research project 2 | The Capstone Project 2 course is a continuation of the Capstone Project 1 course. The course "Capstone Project 2" is a self-made development related to the solution of theoretical issues and experimental research or to the solution of applied problems that are part of the research work carried out by the department or enterprise. | 5 | v | | | | v | | | | | v | v | |
| 48 | SCADA systems | This course is intended for students to study the principles of building software and hardware complexes (STC), choosing hardware, learning the principles of building and choosing SCADA systems | 5 | | | | | | | | v | | | | |

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| | | when solving problems of automation of technological processes and industries. As a result of mastering the discipline, the student will be able to develop a justification and choice of automated tasks, to make the most appropriate choice of hardware and software. | | | | | | | | | | | | | |
| 49 | Theory and practice of project management | The discipline is aimed at studying the general trends in project management in market conditions in order to increase productivity in the professional industry. Essence, concept, composition, tasks and problems of management. Studying the scientific methodology of project management. The concept of organization, external and internal environment of the team, communication. Requirements for project management. The role of decision making in project management. The concept of anti-crisis programs in the performance of managerial functions. The concept of management culture and professional etiquette. | 5 | v | | | | | | | | | | v | |
| 50 | Software control systems for industrial robots | The discipline studies industrial programming languages for controllers STL, LAD, FBD and microprocessor programming languages C, Python. Methods for creating variables, working with logical, mathematical operators. Processing of discrete and analog signals and interfaces SPI, I2C, CAN, UART. Implementation of PID/PI/PD controllers. | 5 | | | | | | v | | | | | | |
| 51 | Robotization of production processes | "Robotization of production processes" is aimed at preparing students for independent theoretical, practical, design and implementation work in the field of robotics in various industries. Issues related to the technological process, equipment and purpose of robots and robotic technological complexes used in various technological processes of mechanical engineering are considered. The aim of the discipline is to develop the theoretical foundations and practical skills necessary for the development of robotic systems and complexes for robotics and technological processes in the field of mechanical engineering. As a result of studying the discipline, the student should know: the device of various types of robotic systems and complexes used in various | 5 | v | | | | | | | | | | v | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | industries and sectors; creation and operation of robotic technological complexes of various industries. Be able to: set and solve scientific and practical tasks on robotization, create systems and systems for robotization. | | | | | | | | | | | | | | |
| 52 | Industrial regulators | The discipline considers the basic concepts, goals and principles of building automation and control systems for technical systems, classification and characteristics of automation and control systems, as well as methods for modeling and synthesizing automation and control systems. The main task is to familiarize students with the basic methods of building automation and control systems and the means necessary for their implementation. | 5 | | | | | v | | | | | | | | |
| 53 | Design of robotic systems | The discipline studies the types and definition of robots, areas of expertise for robotic design. Design systems. Modeling tools in CAD. Elements of robotic structures. Actuators of robots. Types of control of robotic systems. Sensors. Features of designing a control system for intelligent robots. | 5 | | | | | | | | v | | | | | |
| 54 | Design of automation systems | The course is designed to instill in students the methods of designing automated control systems. The student will master practical skills in the field of designing automation systems, master state standards for designing automation systems. As a result of mastering the discipline, the student will be able to apply regulatory documents, state standards for the design of automation systems. | 5 | | | | | | | | v | | | | | |
| 55 | Reliability of technical systems | The discipline "Reliability of technical systems" includes the following main areas: Modern scientific ideas in the development of safety assessment of technical systems; Theory of reliability of devices, machines and structures; Reliability indicators, mathematical models of reliability and survivability. | 5 | | | | | | | | | v | | | | |
| 56 | Reliability of automation systems | The course deals with the issues of determining reliability indicators, the physical nature and causes of failures, their types and classification. Particular attention is paid to the issues of performance monitoring, search for defects and ensuring the operational reliability of automated systems. | 5 | | | | | | | | | v | | | | |
| 57 | Installation and adjustment of | The discipline studies general information about the | 4 | | | | | | | | | | | v | | |

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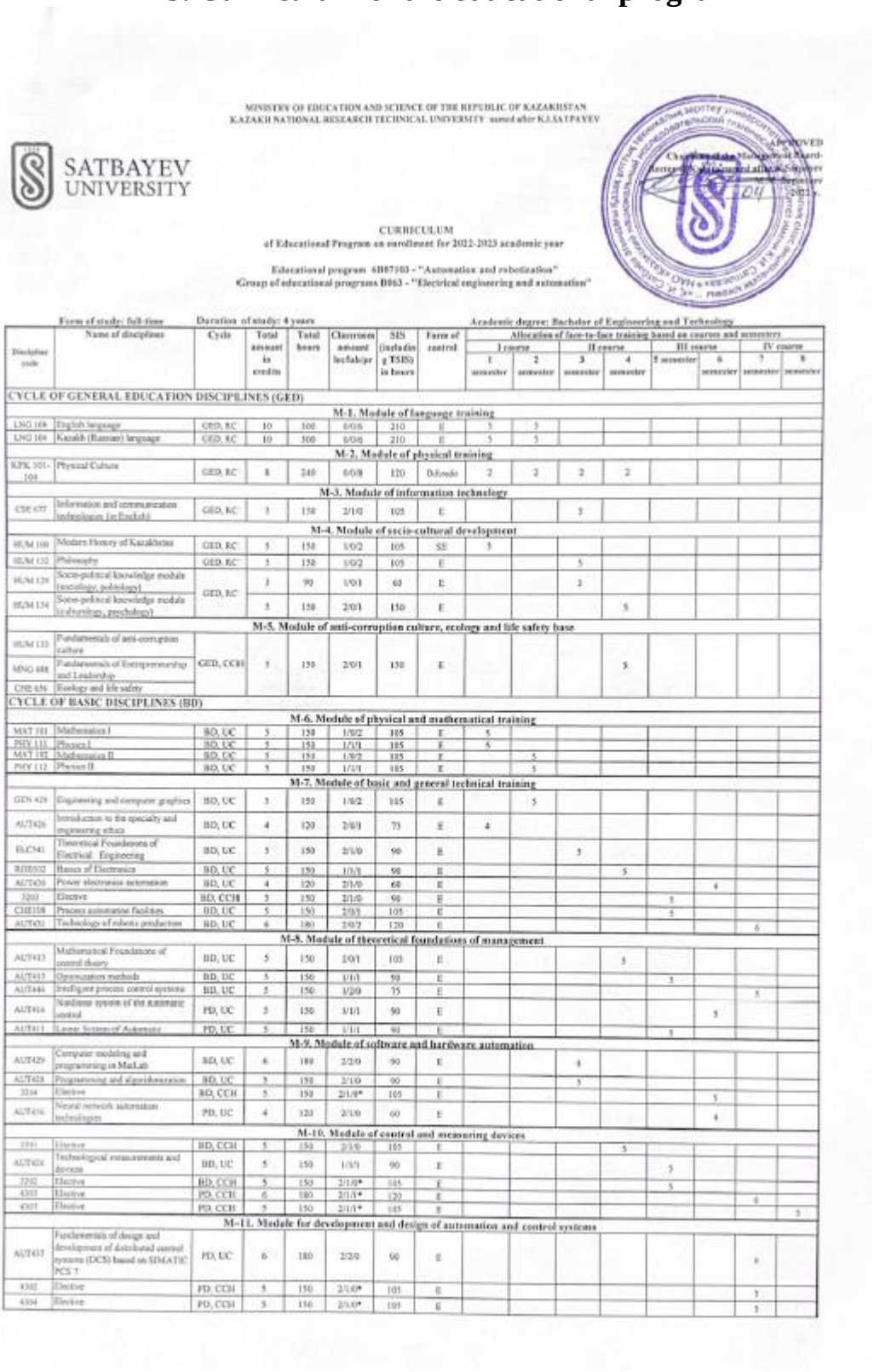
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | robotic complexes | procedure for organizing and carrying out installation work of robotic systems. Installation and commissioning and testing of mechatronic systems. Principal block diagrams, automation diagrams, connection diagrams and connections of mechatronic systems, control algorithms for mechatronic systems. Safety measures during installation and commissioning of mechatronic systems. Types of technical documentation in the production of installation work. | | | | | | | | | | | | | | |
| 58 | Installation and adjustment of electrical devices of control systems | Installation and adjustment of electrical devices of control systems - to teach students the rules and regulations of construction, installation, commissioning, safe operation of measuring instruments. As a result of mastering the discipline, students learn to draw diagrams in the AutoCAD program using repair technology. | 4 | | | | | | | | | | | | v | |
| 59 | Automation of typical technological processes and productions | The content of the discipline: the modern level of automation of technological processes. Concepts of APCS and OAS, integrated and distributed ACS. Processing of technological information, transformation of technological information. Types and forms of signals, information about the structure of technical means of automation and control of technological processes and complexes. Organization of communication between the UVM and the technological control object. Communication devices with the object (DAC, ADC). Methodology for the analysis of the technological process as a control object. Schemes of automation of typical technological processes. Real-time process control using a control computer. Basic information about the visual modeling system (Vissim) Tasks and algorithms for optimal automated control. As a result of studying the discipline, students should know: | 5 | | | | | | | | | | | | v | |

# 5. Curriculum of the educational program



MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I.SATPAYEV

SATBAYEV UNIVERSITY

APPROVED

CURRICULUM
of Educational Program on enrollment for 2022-2023 academic year

Educational program 6B07103 - "Automation and robotization"
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 | Allocation of face-to-face training based on courses and semesters | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | I course | | II course | | III course | | IV course | |
| | | | | | | | | 1 semester | 2 semester | 3 semester | 4 semester | 5 semester | 6 semester | 7 semester | 8 semester |
| CYCLE OF GENERAL EDUCATION DISCIPLINES (GED) | | | | | | | | | | | | | | | |
| M-1. Module of language training | | | | | | | | | | | | | | | |
| LNG 108 | English language | GED, RC | 10 | 300 | 0/0/6 | 210 | E | 5 | 5 | | | | | | |
| LNG 109 | Kazakh (Russian) language | GED, RC | 10 | 300 | 0/0/6 | 210 | E | 5 | 5 | | | | | | |
| M-2. Module of physical training | | | | | | | | | | | | | | | |
| KPK 101-104 | Physical Culture | GED, RC | 8 | 240 | 0/0/8 | 120 | D,Exam | 2 | 2 | 2 | 2 | | | | |
| M-3. Module of information technology | | | | | | | | | | | | | | | |
| CSE 677 | Information and communication technologies (in English) | GED, RC | 3 | 150 | 2/1/0 | 105 | E | | | 3 | | | | | |
| M-4. Module of socio-cultural development | | | | | | | | | | | | | | | |
| HUM 110 | Modern 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 133 | Fundamentals of anti-corruption culture | GED, CCH | 5 | 150 | 2/0/1 | 150 | E | | | | 5 | | | | |
| MNG 488 | Fundamentals of Entrepreneurship and Leadership | | | | | | | | | | | | | | |
| CHE 656 | Ecology and life safety | | | | | | | | | | | | | | |
| CYCLE OF BASIC DISCIPLINES (BD) | | | | | | | | | | | | | | | |
| M-6. Module of physical and mathematical training | | | | | | | | | | | | | | | |
| MAT 101 | Mathematics I | BD, UC | 5 | 150 | 1/0/2 | 105 | E | 5 | | | | | | | |
| PHY 111 | Physics I | BD, UC | 5 | 150 | 1/1/1 | 105 | E | 5 | | | | | | | |
| MAT 102 | Mathematics II | BD, UC | 5 | 150 | 1/0/2 | 105 | E | | 5 | | | | | | |
| PHY 112 | Physics II | BD, UC | 5 | 150 | 1/1/1 | 105 | E | | 5 | | | | | | |
| M-7. Module of basic and general technical training | | | | | | | | | | | | | | | |
| GEN 420 | Engineering and computer graphics | BD, UC | 3 | 150 | 1/0/2 | 105 | E | | 5 | | | | | | |
| AUT426 | Introduction to the specialty and engineering ethics | BD, UC | 4 | 120 | 2/0/1 | 75 | E | 4 | | | | | | | |
| ELC341 | Theoretical Foundations of Electrical Engineering | BD, UC | 5 | 150 | 2/1/0 | 90 | E | | | 5 | | | | | |
| ELE302 | Basics of Electronics | BD, UC | 5 | 150 | 1/1/1 | 90 | E | | | | 5 | | | | |
| AUT436 | Power electronics automation | BD, UC | 4 | 120 | 2/1/0 | 60 | E | | | | | | 4 | | |
| 3203 | Elective | BD, CCH | 5 | 150 | 2/1/0 | 90 | E | | | | | 5 | | | |
| CHE358 | Process automation facilities | BD, UC | 5 | 150 | 2/0/1 | 105 | E | | | | | 5 | | | |
| AUT431 | Technology of robotics production | BD, UC | 6 | 180 | 2/0/2 | 120 | E | | | | | | | 6 | |
| M-8. Module of theoretical foundations of management | | | | | | | | | | | | | | | |
| AUT433 | Mathematical Foundations of control theory | BD, UC | 5 | 150 | 2/0/1 | 105 | E | | | | 5 | | | | |
| AUT435 | Optimization methods | BD, UC | 5 | 150 | 1/1/1 | 90 | E | | | | | 5 | | | |
| AUT446 | Intelligent process control systems | BD, UC | 5 | 150 | 1/2/0 | 75 | E | | | | | | | 5 | |
| AUT416 | Nonlinear system of the automatic control | PD, UC | 5 | 150 | 1/1/1 | 90 | E | | | | | | 5 | | |
| AUT411 | Linear System of Automatic | PD, UC | 5 | 150 | 1/1/1 | 90 | E | | | | | 5 | | | |
| M-9. Module of software and hardware automation | | | | | | | | | | | | | | | |
| AUT429 | Computer modeling and programming in MatLab | BD, UC | 6 | 180 | 2/2/0 | 90 | E | | | 6 | | | | | |
| AUT428 | Programming and algorithmization | BD, UC | 5 | 150 | 2/1/0 | 90 | E | | | 5 | | | | | |
| 3204 | Elective | BD, CCH | 5 | 150 | 2/1/0* | 105 | E | | | | | | 5 | | |
| AUT416 | Neural network automation technologies | PD, UC | 4 | 120 | 2/1/0 | 60 | E | | | | | | 4 | | |
| M-10. Module of control and measuring devices | | | | | | | | | | | | | | | |
| 3201 | Elective | BD, CCH | 5 | 150 | 2/1/0 | 105 | E | | | | 5 | | | | |
| AUT426 | Technological measurements and devices | BD, UC | 5 | 150 | 1/1/1 | 90 | E | | | | | 5 | | | |
| 3202 | Elective | BD, CCH | 5 | 150 | 2/1/0* | 105 | E | | | | | 5 | | | |
| 4303 | Elective | PD, CCH | 6 | 180 | 2/1/1* | 120 | E | | | | | | | 6 | |
| 4305 | Elective | PD, CCH | 5 | 150 | 2/1/1* | 105 | E | | | | | | | | 5 |
| M-11. Module for development and design of automation and control systems | | | | | | | | | | | | | | | |
| AUT433 | Fundamentals of design and development of distributed control systems (DCS) based on SIMATIC PCS 7 | PD, UC | 6 | 180 | 2/2/0 | 90 | E | | | | | | | 6 | |
| 4302 | Elective | PD, CCH | 5 | 150 | 2/1/0* | 105 | E | | | | | | | 5 | |
| 4304 | Elective | PD, CCH | 5 | 150 | 2/1/0* | 105 | E | | | | | | | 5 | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4306 | Elective | PD, CCH | 5 | 150 | 2/1/0* | 105 | E | | | | | | | | 5 |
| **M-12. Module of professional disciplines** | | | | | | | | | | | | | | | |
| 3205 | Elective | BD, CCH | 3 | 150 | 2/1/0* | 105 | E | | | | | | 3 | | |
| 4303 | Elective | PD, CCH | 4 | 120 | 2/1/0* | 75 | E | | | | | | 4 | | |
| 4305 | Elective | PD, CCH | 5 | 150 | 2/1/0* | 105 | E | | | | | | | | 5 |
| **M-13. Practice-oriented module** | | | | | | | | | | | | | | | |
| AAP310 | Training Practice | BD, UC | 3 | | | | | | 3 | | | | | | |
| AAP(A) | Industrial internship I | PD, UC | 2 | | | | | | | | 2 | | | | |
| GDN501 | Industrial internship II | PD, UC | 3 | | | | | | | | | | 3 | | |
| **M-14. Module of final attestation** | | | | | | | | | | | | | | | |
| ECA800 | Preparation and writing of a thesis (project) | FA | 6 | | | | | | | | | | | | 6 |
| ECA810 | Defense of the thesis (project) | FA | 6 | | | | | | | | | | | | 6 |
| **M-15. Module of additional types of training** | | | | | | | | | | | | | | | |
| AAP500 | Military affairs | ATT | 0 | | | | | | | | | | | | |
| Total based on UNIVERSITY: | | | | | | | | 31 | 29 | 31 | 29 | 30 | 30 | 31 | 27 |
| | | | | | | | | 60 | | 60 | | 60 | | 60 | |

| Number of credits for the entire period of study | | | | | |
|---|---|---|---|---|---|
| Cycle code | Cycles of disciplines | Credits | | | |
| | | 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 | 35 | 112 |
| PD | Cycle of profile disciplines | | 75 | 33 | 60 |
| | *Total for theoretical training:* | *51* | *112* | *65* | *228* |
| FA | final attestation | 12 | | | 12 |
| | TOTAL: | 63 | 112 | 65 | 240 |

Decision of the Academic Council of Kazatu named after K.Satpayev, Protocol № 13 от "28" - 04 2022 г.

Decision of the Educational and Methodological Council of Kazatu named after K.Satpayev, Protocol № 7 от "26" - 04 2022 г.

Decision of the Academic Council of the Institute AaIT, Protocol № 6 от "27" - 01 2022 г.

| | |
|---|---|
| Vice-Rector for Academic Affairs | B.A. Zhautikov |
| Director of the Institute of AaIT | R.K. Uskenbayeva |
| Head of the Department of AuC | N.O. Abdiyeva |
| Representative of the Council from employers | S.K. Abdigaliyev |

# 5.1 Elective disciplines of the educational program

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN
KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I.SATPAYEV

SATBAYEV UNIVERSITY

APPROVED
Director of the Institute of Automation and Information Technology
R.K. Uskenbayeva
2022 y.

**ELECTIVE DISCIPLINES of the educational program for recruitment for the 2022-2023 academic year**
**Educational program 6B07103 - "Automation and robotization"**
**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

| Year of study | Elective code according to the curriculum | Discipline code | Name of disciplines | Semester | Cycle | Credits | lek/lab/pr |
|---|---|---|---|---|---|---|---|
| | | | **Module of basic and general technical training** | | | | |
| 3 | 3203 | ELC500 | Microelectronics | 5 | B | 5 | 2/1/0 |
| | | AUT142 | Digital electronics | | | | 2/1/0 |
| | | | **Module of software and hardware automation** | | | | |
| 3 | 3204 | AUT184 | Microcontroller programming | 6 | B | 5 | 2/1/0 |
| | | AUT183 | Microcontroller programming for robotic systems | | | | 2/1/0 |
| | | | **Module of control and measuring devices** | | | | |
| 2 | 2201 | AUT181 | Metrology and measurement | 4 | B | 5 | 2/1/0 |
| | | AUT193 | Electrical measuring instruments | | | | 1/1/1 |
| 3 | 3202 | ELC440 | Telecommunication networks of industrial enterprises | 5 | B | 5 | 2/0/1 |
| | | ELC428 | Fiber optic sensors and systems | | | | 2/1/0 |
| 4 | 4303 | AUT440 | Microprocessor-based systems in the control systems | 7 | P | 6 | 2/2/0 |
| | | AUT444 | Capstone research project 1 | | | | 0/0/4 |
| | 4307 | AUT162 | Industrial Regulators | 8 | P | 5 | 2/1/0 |
| | | AUT445 | Capstone research project 2 | | | | 0/0/3 |
| | | | **Module for development and design of automation and control systems** | | | | |
| 4 | 4302 | AUT404 | Reliability of automation systems | 7 | P | 5 | 2/0/1 |
| | | AUT405 | Reliability of technical systems | | | | 2/0/1 |
| | 4304 | AUT402 | SCADA-system | 7 | P | 5 | 2/1/0 |
| | | AUT167 | Robotic automation of production processes | | | | 1/1/1 |
| | | NSE185 | Theory and practice of project management | | | | 2/0/1 |
| | 4306 | AUT419 | Design of automation systems | 8 | P | 5 | 2/0/1 |
| | | AUT173 | Design of robotization systems | | | | 2/0/1 |
| | | | **Module of professional disciplines** | | | | |
| 4 | 3205 | AUT409 | Actuators of Automation Systems | 6 | B | 5 | 2/1/0 |
| | | AUT188 | Industrial robots and manipulator drives | | | | 1/1/1 |
| 3 | 4301 | AUT438 | Installation and adjustment of electrical devices of control systems | 6 | P | 4 | 1/1/1 |
| | | AUT439 | Installation and adjustment of robotic systems | | | | 2/0/1 |
| 4 | 4305 | AUT168 | Automation of typical technological processes and production | 8 | P | 5 | 1/1/1 |
| | | AUT180 | Industrial robot control systems | | | | 2/1/0 |
| | | | **The "R&D" module** | | | | |
| | 4303 | AUT444 | Capstone research project 1 | 7 | P | 6 | 0/0/4 |
| | 4307 | AUT445 | Capstone research project 2 | 8 | P | 5 | 0/0/3 |

| The number of credits in elective subjects for the entire period of study | |
|---|---|
| Cycles of disciplines | Credits |
| Cycle of basic disciplines (B) | 25 |
| Cycle of profile disciplines (P) | 35 |
| TOTAL: | 60 |

Decision of the Academic Council of the Institute AoIT, Protocol № 6 от "27" 01 2022 y.

Head of the Department "Automation and Control" N.U. Aldiyarov

Representative of the Council from employers S.K. Abdigaliyev

## 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 development additional educational programs (Minor) |
|---|---|---|---|
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