A.Burkitbayev Institute of Power and Mechanical Engineering

Department of «Mechanical engineering»

EDUCATIONAL PROGRAM

6B07134 - Mechatronics and automation in mechanical engineering
(code and name of educational program)

Code and classification of the field of education:
6B07-Engineering, manufacturing and construction industries
Code and classification of training directions:
6B071-Engineering and Engineering
Group of educational programs:
B063-Electrical engineering and Automation
Level based on NQF: 6
Level based on IQF: 6
Study period: 4 years
Amount of credits: 240

Almaty 2025

Educational program 6B07134Mechatronics and Automation in mechanical
(code and name of educational program)
Engineering was approved at the meeting of K.I. Satbayev KazNRTU Academic Council

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

Protocol No. 6 of "18" 04 2025 r.

Educational program 6B07134 -Mechatronics and Automation in mechanical
(code and name of educational program)
engineering
was developed by Academic committee on direction "6B071- Engineering and Technology "

Full name	Academic degree/ academic title	Position	Workplace	Signature
Teaching staff:				
Nugman E.Z.	Doctor PhD, Associate Professor	Head of the Department of "Mechanical Engineering"	Institute of Energy and Mechanical Engineering named after A.Burkitbaev	
Kerimzhanova M.F.	Candidate of Technical Sciences, Docent	Professor	Department of Mechanical Engineering	
Uderbayeva A.E.	Doctor PhD	Assoc. Professor	Department of Mechanical Engineering	
Employers:				
Andreev V.I.		General Director	Kazecotech STE LLP	
Students				
Myrzakhan A.		1st year doctoral student	Department of "Mechanical Engineering"	

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List of abbreviations and symbols

ECTS	European Credit Transfer and Accumulation System
BD	Basic disciplines
HEI	Higher education institution
SMSE	State mandatory standard of education
KazNRTU	K. I. Satpayev Kazakh National Research Technical University
MEP	Modular educational program
NJSC	Non-profit joint stock Company
GED	General education disciplines
EP	Educational program
PD	Profile disciplines
WC	Working curriculum
IWS	Independent work of a student
EMC	Educational and Methodological Council
AC	Academic council
SDGs	Sustainable development goals

1 Description of the educational program

The professional activities of the program graduates are aimed at developing the mechanical engineering complex, automating the life cycle of mechanical engineering products, developing and implementing information technologies in the production of mechanical engineering products.

The direction of training in the educational program is Engineering and engineering.

The field of professional activity of bachelors includes sections of science and technology related to the creation, implementation and operation of automated and mechatronic systems in machine-building production. This activity covers a set of tools, methods and technologies aimed at improving the efficiency, reliability and competitiveness of production processes through the integration of digital technologies, control systems, sensors, actuators, robotics and intelligent components.

The subjects of professional activity of graduates are: mechatronic and robotic systems; automated technological equipment and production lines; sensor-actuating modules; numerical control systems (CNC); controllers and automatic control systems; technologies of digital design and modeling of automated technological systems; software and hardware automation of production processes; technologies of implementation of elements of the industrial Internet of things (IIoT) in machine-building production.

Bachelors can perform the following types of professional activities using modern software and hardware:

- production and technological;
- design and engineering;
- software engineering;
- organizational and managerial;
- experimental research.

The functions of graduates' professional activities include:

- Design and construction: development of mechatronic components, automated and robotic systems, control systems and actuators.
- Integration and implementation: installation, commissioning and integration of automated equipment, robotic complexes and CNC systems into production processes.
- Programming and configuration: writing and debugging control programs for CNC machines, industrial robots and other components of automated systems.
- Diagnostics and maintenance: maintenance, condition monitoring, fault diagnosis and repair of mechatronic and automated equipment.
- Optimization and modernization: improvement of production processes through the introduction of digital technologies, reengineering and adaptation of intelligent control systems.
- Research activities: conducting applied research in the field of mechatronics, automation, sensors and digital technologies; participating in the development of innovative solutions.
- Organizational and managerial activities: organization of work of production units, project management for automation and digitalization of production.

Graduates are prepared to solve the following types of tasks in their professional activities:

- organization and maintenance of automated production processes, coordination of the work of performers and technical personnel; setting goals and objectives for managing production and engineering projects in the field of mechatronics;
- development, implementation and maintenance of digital and intelligent control systems, including robotic complexes, CNC systems at machine-building enterprises;
- creation and implementation of highly efficient mechatronic modules, automated machine tools, robotic systems and industrial automation tools, taking into account environmental and energy-efficient requirements;
- engineering and design development of components of mechatronic systems, including controls, sensors, actuators and interaction interfaces;
- design and calculation of integrated mechatronic and automated systems, including engineering calculations on reliability, accuracy and stability of functioning;
- application of modern methods of modeling, 3D design and digital twins for the analysis and optimization of production processes and technical systems;
- research of promising areas in the field of automation and mechatronics, substantiation of methods for improving productivity, reliability and quality of mechanical engineering products based on digital and intelligent technologies.

Bachelor's key competencies:

- Professional (industry-specific) competencies;
- Managerial and organizational competencies;
- Research and analytical competencies;
- Digital and information and communication competencies;
- Communicative and social competencies.

2 Purpose and objectives of educational program

Purpose of EP:

The goal of OP 6B07134 -Mechatronics and Automation in mechanical engineering - Formation of highly qualified specialists capable of developing and implementing automated control systems in mechanical engineering based on modern mechatronic technologies, contributing to technological innovation, sustainable industrial development and environmentally responsible production.

Tasks of EP:

- Formation of students ' fundamental and applied knowledge in the field of mechatronics and automation, development of critical thinking, digital and professional competencies necessary for successful work in the context of rapidly changing technologies (SDG 4);
- PDevelop practical skills in the design, implementation and operation of mechatronic systems and equipment, and participate in researchaimed at the sustainable development of mechanical engineering (SDG 9);
- Training in the principles of rational use of resources, designing energy-efficient systems and applying environmentally friendly technologies in production (SDG 12).

- Creating conditions for continuous professional growth and inclusive education (SDG 4).
- preparation for working in an interdisciplinary team and in a digital production environment (Industry 4.0).
- Promoting the integration of graduates into the professional community (SDGs 9, 12).

3 Requirements for evaluating educational program learning outcomes

Description of mandatory standard requirements for graduating from a university and conferring an academic bachelor's degree: mastering at least 240 academic credits of theoretical training and final thesis.

4 Passport of the educational program

4.1 General information

№	Field name	Comments
1	Code and classification of the field of education	6B07-Engineering, manufacturing and construction fields
2	Code and classification of training directions	areas 6B071-Engineering and Engineering
3	Educational program group	B063-Electrical Engineering and automation
4	Educational program name	6B07134 - Mechatronics and automationз-building production
5	Short description of educational program	Professional activity the program focuses on the application of modern technologies for digitalization of machine-building production. In the educational program, students will gain professional knowledge of methods and technologies aimed at improving the efficiency, reliability and competitiveness of production processes through the integration of digital technologies, control systems, sensors, actuators, robotics and intelligent components.
6	Purpose of EP	Formation of highly qualified specialists capable of developing and implementing automated control systems in mechanical engineering based on modern mechatronic technologies, contributing to technological innovation, sustainable industrial development and environmentally responsible production.
7	Type of EP	Innovative
8	The level based on NQF	6
9	The level based on IQF	6
10	Distinctive features of EP	-
11	List of competencies of educational program	- Ability to apply general engineering knowledge, methods of mathematical analysis and modeling in professional activities; - Ability to develop and implement measures to improve production efficiency.

		- Ability to formulate and solve engineering and research tasks in the field of automation; - Readiness to apply digital modeling methods, CAD/CAM/CAE systems; - Willingness to apply innovative, eco-friendly and safe solutions in automated production; - Readiness for continuous learning and self-development in the context of rapid technological progress.
12	Learning outcomes of educational program	LO1 Apply communication and multicultural skills, creativity, strategic thinking, teamwork, a culture of academic integrity, knowledge of economic laws, life safety and ecology, elements of artificial intelligence, inclusive education skills. LO 2 Apply basic knowledge in the field of mathematical, natural, economic and environmental sciences in the field of machine building automation, taking into account the principles of sustainable development. LO 3 Demonstrate an understanding of legal, economic, financial knowledge, anti-corruption culture, principles of inclusive culture and sustainable development, necessary for making informed decisions in professional activities. LO 4 Apply knowledge of the professional field of mechatronics and automation, principles of engineering design, practical skills in performing technological operations and measurements. LO 5 Analyze and calculate the elements and mechanisms of machines, taking into account the laws of mechanics, the strength characteristics of materials, the requirements of interchangeability and design principles, using engineering methods and regulatory documentation. LO 6 Apply general engineering knowledge in the design of structures, technological processes, and the development of automated production management systems. LO 7 Perform engineering design of machine structures, design of cutting tools and accessories using modern computer, information technologies, software used in the creation and operation of automated and intelligent production management systems. LO 8 To choose and apply modern engineering materials, equipment and tooling in the design of technological processes and organization of machine-building production. LO 9 Demonstrate knowledge of the theoretical foundations of electrical engineering, power automation devices, the technical capabilities of

		microprocessor technology, design and machining skills on numerically controlled machines. LO 10 Master the basics of mechanics of liquid and gaseous media, thermodynamics, mass transfer and hydraulic pneumatic drives, apply this knowledge to the analysis and design of energy-physical and drive systems in mechatronics and automation. LO 11 Master the methods of information processing and synthesis of automation systems, methods of modeling and programming data management systems, the capabilities of SCADA systems and Internet of Things technologies. LO 12 Understand the principles of functioning of automatic control systems, engineering and electrical equipment of machine-building production, analyze and select elements of control systems and electric drive, focusing on the principles of sustainable development. LO 13 To use information and communication technologies in the design and implementation of control systems for technological processes and production, taking into account increased energy efficiency, resource optimization and minimization of environmental impact.
13	Education form	full-time
14	Period of training	4 years
15	Amount of credits	240
16	Languages of instruction	Kazakh, Russian
17	Academic degree awarded	Bachelor of Engineering and Technology
18	Developer(s) and authors	The educational program was developed by Academic committee on direction "6B071-Engineering and Technology"

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

№	Discipline name	Short description of the discipline	Amount of credits	Generated learning outcomes (codes)											
				RO1	RO2	RO3	RO4	RO5	RO6	RO7	RO8	RO9	RO10	RO11	RO12
Cycle of general education disciplines Component of Elective component															
1	Fundamentals of anti-corruption culture and law	The course introduces students to the improvement of socio-economic relations of Kazakhstan society, psychological features of corruption behavior. Special attention is paid to the formation of an anti-corruption culture, legal responsibility for corruption acts in various spheres. The purpose of studying the discipline "Fundamentals of anti-corruption culture and Law" is to increase the public and individual legal awareness and legal culture of students, as well as to form a system of knowledge and civic position on combating corruption as an anti-social phenomenon. Expected results: implement the values of moral consciousness and follow moral norms in everyday practice; work on improving the level of moral and legal culture; use spiritual and moral mechanisms to prevent corruption.	5	5/2											
2	Fundamentals of Economics and Entrepreneurship	The discipline examines the fundamentals of economics and entrepreneurship 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 receptivity. 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	5/3	/										
3	Ecology and life safety	The discipline studies the problems of ecology as a science, environmental terms, laws of functioning of natural systems and aspects of environmental	5	/											/

		safety in the conditions of work. Environmental monitoring and safety management. Sources of atmospheric air, surface, underground water, soil pollution and ways to solve environmental problems; safety of life in the technosphere; natural and man-made emergencies														
v v 4	Fundamentals of scientific research methods	The purpose of the discipline is to develop skills in organizing and planning scientific research, methods of conducting experimental research, methods of information processing. The discipline introduces students to the goals, tasks and stages of scientific research. Terms and concepts, experimental methods, and mathematical methods for processing research results are considered. The concept of engineering, laboratoryand industrial experiments, standx studies. The discipline introducesyou to the basics of the theory of inventive problem solving, c algorithmicми methodsами for finding technical solutions and their optimization. The main mathematical methods of optimization, application of the capabilities of artificial intelligence to solve optimization problems, search, accumulation and processing of scientific information are highlighted.	5	/	/											/
v v v 5	Fundamentalsиof financial literacy MNG564	Objective: formation of financial literacy of students on the basis of building a direct link between the acquired knowledge and its practical application. Content: practical use of various tools in the field of financial management, saving and increasing savings, competent budget planning, obtaining practical skills in calculating and paying taxes and correctly filling out tax reports, analyzing financial information and navigating financial products to choose an adequate investment strategy.	5		/											
v Cycle of basic disciplines University component																
6	Physics I	Objectives: study of basic physical phenomena and laws of classical and modern physics; methods of physical research; influence of physics on the development of technology; connection of physics with other sciences and its role in solving scientific and technical problems of the specialty. The following sections are considered: mechanics, dynamics of rotational motion of a solid, mechanical harmonic waves, fundamentals of	5		/											

		molecular kinetic theory and thermodynamics, transport phenomena, continuum mechanics, electrostatics, direct current, magnetic field, Maxwell's equations.														
7	7 Mathematics The first	course is based on the study of mathematical analysis to the extent that it allows you to study elementary functions and solve the simplest geometric, physical and other applied problems. The main focus is on differential and integral calculus. The course sections include differential calculus of functions of a single variable, derivatives and differentials, the study of the behavior of functions, complex numbers, and polynomials. Indefinite integrals, their properties and methods of calculation. Definite integrals and their applications. Improper integrals.	5		/											
8	8 Physics II	Course studies the laws of physics and their practical application in professional activities. Solving theoretical and experimental-practical educational problems of physics to form the basis for solving professional problems. Assessment of the degree of accuracy of the results of experimental or theoretical research methods, modeling the physical state using a computer, studying modern measuring equipment, developing skills in conducting test studies and processing their results, distributing the physical content of applied tasks of the future specialty.	5		5/9	/										
9	Mathematics II	The discipline is a continuation of Mathematics 1. The course sections include elements of linear algebra and analytic geometry. The main questions of linear algebra are considered: linear and self-adjoint operators, quadratic forms, and linear programming. Differential calculus of functions of several variables and its applications. Multiple integrals. Theory of determinants and matrices, linear systems of equations, and elements of vector algebra. Elements of analytical geometry on the plane and in space are included.	5		/	/										
v v 10	Fundamentals of professional activity	History and development of the industry.Stages of formation of mechatronics and automation.Contribution of domestic and foreign scientists and engineers. Current state and prospects. Current trends in mechanical engineering. The role of mechatronics in industrial automation. Industry 4.0 and digital manufacturing.														

		The main components of mechatronic systems. Electromechanical drives. Control systems and programmable controllers (PLCs). Sensors and actuators. Typical tasks and areas of application. Automation of production lines. Robotics in mechanical engineering. Modeling and design of mechatronic systems. ПрJob offers and career prospects.													
11	Engineering and digital graphics	General provisions of engineering design methodology. Stages of creating cars. Project procedures. Principles of engineering design. Methods of engineering design. Manufacturability of machine designs. Economic aspects of engineering design. Problems of design, ergonomics and ecology in engineering design Environmental aspects of engineering design. Optimization of design solutions Methods for solving problems of optimal engineering design. Basic concepts of reliability theory. Disadvantages of traditional engineering design. Goals and objectives of engineering design. Engineering design systems.	5				/				/				
v v 12	Engineering workshop	The purpose of the discipline is to develop knowledge about the technological processes of manufacturing machine parts and practical knowledge of metalworking. Workshops study a locksmith's workplace, locksmith and cutting tools, tool materials, and work on universal metal-cutting machines (lathes, drills, milling machines, and grinders). Introduction to the purpose and classification of machine tools. Processing of workpieces on sheet bending machines, numerical control laser machine, milling processing center.	5		/	/									
v v 13	Mechanics formechatronics engineers	The purpose of the discipline is to form the basics of engineering thinking among students by studying the basics of mechanics and mastering the basic principles and laws of theoretical mechanics Content of the discipline: basic laws of mechanical motion and mechanical interaction of material bodies; basic concepts of the law of mechanics, methods for studying the equilibria of motion of a material point, a solid systems	5			/			/						
v v 14	Mechanics of materials and structures	The aim of the discipline is to acquire theoretical knowledge of the basics of the science of strength,	5			/		/							

		rigidity and stability of materials and structures; practical skills in choosing calculation methods anddesigning various structures. Thezones and theoretical propositions underlying the mechanics of a deformable solid are studied. Methods for calculating structural elements for strength, rigidity, and stability under various types of rod deformation (tension, compression, shear, torsion, and bending), dynamic forces, and calculation of structural elements beyond elasticity.													
v v 15	Technical design	The aim of the discipline is to master the specifics of forming an industrial product and methods for solving design problems. Formation of theoretical and practical knowledge of the main stages of industrial product design and design analysis. Knowledge of elements of engineering support for industrial design and methodology for designing industrial products. As a result of the training, you will gain skills in using computer-aided design technologies to create virtual models, drawings, text documents, and files containing information necessary for the product life cycle.	5				/		/						
v v 16	Fundamentals of interchangeability and digital production standards	The aim of the discipline is to acquire knowledge and practical skills on the basics of interchangeability, technical measurements, and machine manufacturing accuracy. Basic concepts of interchangeability. Principles of building a system of tolerances and landings. Calculation and selection of landings. Main provisions of the Unified system of tolerances and fits for smooth cylindrical joints. Normalization, methods and tools for measuring and controlling deviations in shape, location, and surface roughness. Tolerances and fitments of rolling bearings; spline, keyway and threaded connections, gears. Measuring instruments, metrological characteristics and their normalization.	6							/		/			
v v 17	Modern structural materials	The aim of the discipline is to form knowledge about modern materials used in mechanical engineering, advanced technological methods of their application. The classification of engineering materials, basic properties of structural materials, and methods of their heat treatment are considered. Properties and characteristics of metal alloys, ceramic and composite materials, powder and synthetic superhard materials, multifunctional	5			/		/							

		coatings. Methods for studying the structure and composition of materials, iron-cementite diagram. Skills are being acquired for conducting analysis of the composition and structure of materials, selection of materials for specific structures of machine parts.													
v v 18	Digital design and machine elements	Purpose: to acquire knowledge of calculations and design of machine parts and assemblies, taking into account the criteria of strength, reliability and stability. Contents: general principles of design and construction, construction of models and algorithms for calculating typical machine parts, taking into account performance criteria, fundamentals of the theory and methodology for calculating typical machine parts, computer technologies for designing machine components and parts. Basic requirements for machine parts and assemblies.	5	/		/									
v v 19	Electrical engineering and electronics	The purpose of the discipline is to acquire theoretical and practical knowledge on the basics of electrical engineering and electronics. The main regularities of processes occurring in electromagnetic and electronic circuits and methods for determining electrical quantities that characterize these processes are studied. Methods for calculating DC electrical circuits, analysis and calculation of linear AC circuits, and analysis and calculation of magnetic circuits are studied. Electromagnetic devices and electrical machines. Fundamentals of electronics and electrical measurements. Element base of modern electronic devices. Fundamentals of digital and microelectronics, microprocessor tools.	5	/	/		/						/		
5/20 Dynamics and kinematics of	machines in automation	The aim of the discipline is theoretical and practical training in basic methods of designing and producing workpieces, ways to ensure the manufacturability and competitiveness of products in modern machine-building production, mastering the knowledge of technological design and modern calculation methods in the design of forging and stamping shops of machine-building production. Practical skills are acquired in the selection and design of workpieces and the basic principles of designing technological processes for the	5/21 Machine -						/		/				

		production of workpieces by casting and forging and stamping production methods.													
21	building equipment	The purpose of the discipline is to acquire theoretical and practical knowledge of the main types of industrial equipment for manufacturing parts, as well as information on the basics of designing and operating these types of equipment. The design of machines, machine tools and automata, as well as their most important components, kinematic analysis and synthesis of metal-cutting equipment are considered. Metal-cutting machines for processing bodies of rotation, processing holes, prismatic parts. Equipment for finishing and finishing surface treatment of machine parts. CNC machines, machining centers, advantages and technological opportunities.	5				/				/				
22	Technical design of machine-building equipment	The aim of the discipline is to form knowledge of modern machine-building production equipment for successful solution of professional tasks and for mastering subsequent professional training disciplines. Issues related to the study and analysis of kinematic schemes of equipment; methods for selecting the required equipment for performing the technological process, equipment of procurement workshops are considered. Technical design for blacksmithing- press equipment, rolling and drawing mills, molds. Calculation, design and modeling of equipment for welding production.	5								5/23		/		
23	Engineering Economics	The aim of the discipline is to acquire theoretical knowledge and practical skills in the economic assessment of a machine-building enterprise. The discipline studies the structure of a machine-building enterprise, fixed and current assets, production capacity of the enterprise, material and technical support of production, personnel, financial resources of production. The issues of forecasting and planning of production, calculation of production costs, production costs, economic efficiency, analysis and evaluation of the economic activity of the enterprise are studied. Practical skills are acquired in performing calculations of the main technical and economic parameters, evaluating the efficiency of the enterprise.	5		/							/			
24	Hydraulics and hydro	-pneumatic drive The aim of the discipline is to develop knowledge in the field of hydraulics, hydraulic and pneumatic machines for processing,	5				/								

		feeding and moving liquids and gases. The discipline deals with issues of hydrostatics: basic physical properties of liquids and gases; hydrodynamics: motion of liquids and gases, Euler and Bernoulli equations, modeling of hydrodynamic phenomena; hydraulic machines and hydraulic drives. Fundamentals of pneumatic drives, pneumatic motors, and equipment of pneumatic systems. The basics of operation of combined hydro-pneumatic drives are studied. Skills in designing and applying drives for machine-building equipment are acquired.													
25	Integrated design of cutting tools and technological equipment	The purpose of the discipline is to form knowledge of the main fundamental approaches to the design of cutting tools, algorithms for designing and constructing components, design features of cutting tools, the life cycle of cutting tools, modern scientific approaches to choosing geometric parameters of cutting tools. Methods of computer-aided design of cutting tools, questions of the theory of cutting materials, tool wear during various types of cutting processing, surface layer quality, mechanisms of deformation and stress occurrence; features of cutting tools operation in various production conditions are studied.	5	/			/								/
Cycle of basic disciplines Component of Elective component															
26	Programming and algorithmization	The purpose of studying the discipline is to get acquainted with the basics and methods of constructing mathematical models of design problems and technological processes of machine-building production, with methods of constructing and using mathematical models to determine the intensity of loading of parts by various environmental factors. The discipline studies the tools for composing mathematical models for determining the intensity of loading of parts by various environmental factors. Skills in using standard tools are acquired software packages and tools for computer-aided design of technical objects and technological processes, methodology of computational experiment.	5		/	/									
27	Fundamentals of artificial intelligence	Purpose: to introduce students to the main concepts, methods and technologies in the field of artificial intelligence: machine learning, computer vision, natural language processing, etc.	5	/		/									

		Contents: general definition of artificial intelligence, intelligent agents, information search and state space research, logical agents, architecture of artificial intelligence systems, expert systems, learning based on observations, statistical training methods, probabilistic processing of linguistic information, semantic models, natural language processing systems.													
28	Computer modeling and programming in the MatLab environment	The discipline is designed to develop students ' programming and mathematical modeling skills in the MATLAB environment. The purpose of the course consists of programming and standard MATLAB functions, such packages (applications)are studied как Control System Toolbox, Simulink, Stateflow, Deep Learning Toolbox и Fuzzy Logic Toolbox. As a result of mastering the discipline, students have complete tools for analyzing, synthesizing control systems and developing intelligent algorithms.	5		/			/							
29	Legal regulation of intellectual property	Objective: to form a holistic view of the system of legal regulation of intellectual property, including the basic principles, mechanisms for protecting intellectual property rights and features of their implementation. Content: The discipline covers the basics of IP law, including copyright, patents, trademarks, and industrial designs. Students learn how to protect and manage intellectual property rights, as well as consider legal disputes and how to resolve them.	5	/		/									
30	Power electronic devices of automation	The discipline is one of the basic special courses for the specialty of automation and robotics. The purpose of this course is to give students a fairly complete understanding of electrical energy converters, their components, topology, mathematical descriptions, and basic analysis methods. As a result, students master the assimilation of the principles of operation of power electronic automation devices; knowledge of the correct choice of automation elements and devices, calculate their characteristics.	5						/					/	
31	Fundamentals of Sustainable Development and ESG Projects in Kazakhstan	Objective: students will master the theoretical foundations and practical skills in the field of sustainable development and ESG, as well as develop an understanding of the role of these aspects in the modern economic and social development of Kazakhstan.	5										/		

		Content: introduces the principles of sustainable development and implementation of ESG practices in Kazakhstan, includes the study of national and international standards, analysis of successful ESG projects and strategies for their implementation in enterprises and organizations.														
32	Electric drive of typical industrial mechanisms	The purpose of the discipline is to acquire knowledge of automation systems for industrial equipment based on an electric drive. The discipline examines the state and prospects of development of industrial mechanisms; automated electric drive of standard industrial mechanisms. Features of cyclic mechanisms, static and dynamic loads of mechanisms, selection of engine power of typical mechanisms. Cranes, electric crane drive; classification and requirements for electric drive; electric drive systems of turbomechanisms are considered. Requirements for electric drive of elevators and lifts, automated electric drive of technological complexes.														
Cycle of profile disciplines University component																
33	Intelligent process control systems	The discipline is designed to form students ' knowledge of the theoretical foundations and practical skills of building process control systems using intelligent fuzzy logic technologies. The aim of the course is to train a specialist who is able to use in practice the theory, methods and means of synthesis of intelligent control systems. As a result of studying the discipline, the student should know the basics of fuzzy set theory; the basics of creating fuzzy inference systems for management purposes.	5				/				/					
34	Mechanical engineering technology	The purpose of the discipline is to form a set of knowledge, skills and abilities in the field of physical and chemical processes of mechanical processing of materials, study the development and manufacture of products using subtractive technologies, study the production technology of functional metal, ceramic, composite powder materials, and topical issues in subtractive production. The prospects of hybrid technologies, research of subtractive production technologies, fundamentals of reverse engineering and construction, CNC machining technology, study of	5			/		/								

		routing and electroerosion processing (EDM), multi-axis design, etc. are considered.													
35	Microprocessor complexes in control systems	This course is intended for students to build distributed and concentrated control systems, principles of building industrial controllers, programming tools and programming languages for industrial controllers. The following sections are studied: principles of organization and application of various classes of microprocessor systems, acquisition of embedded systems programming skills, at the stages of system, structural and logical design, a certain place is given to the design of hardware and software for microprocessor systems, methods for selecting microprocessor sets, features of developing and debugging hardware and software for systems.	5					/					/		
36	Theoretical foundations of automatic control	systems The purpose of the discipline is to develop knowledge and skills in designing technological processes for assembling machines and manufacturing machine parts. The discipline deals with the basics of mechanical engineering technology: terminology, theory of ensuring manufacturing accuracy, basing theory, calculation of allowances, processing modes, equipment selection. The basics of designing typical technological processes for manufacturing parts of the following classes are studied: shafts and axles, body parts, discs (gears), bushings, levers and brackets, fasteners. Skills in designing technological processes for the production of machines are acquired.	5						/			/			
v v Cycle of profile disciplines Component of Elective component															
37	Digital twins and modeling	The purpose of the discipline is to form knowledge of the concept of digital twins of processes in mechanical engineering, about methods of computer modeling to support technologies, the possibility of creating and repairing industrial products. Methods of constructing digital copies of processes of varying complexity are studied. creating digital and vector copies of products, working tools and fast-wearing parts without using design documentation; improving skills in working with modern CAD systems for developing 3D models of processes and objects.	5											/	

38	SCADA systems	This course is intended for students to study the principles of building software and hardware complexes (PTC), the choice of hardware, the principles of building and choosing SCADA systems when solving problems of automation of technological processes and production. As a result of mastering the discipline, the student will be able to develop the rationale and choice of automated tasks, make the most appropriate choice of hardware and software. Studying a SCADA system provides a visual representation of the process and provides, as a rule, a graphical interface to the operator for monitoring and managing.	5	/	/										
39	40 Designing automation systems	The course is designed to teach students the methods of designing automated control systems. The student will master practical skills in the field of automation system design; get acquainted with the trends in the development of science and technology and their impact on automation; study regulatory documents, state standards for the design of automation systems, the essence of the system approach to design, requirements for modern control systems; the structure and purpose of the state instrument system; various structural and functional aspects of functional schemes of control systems; basic algorithms that ensure the operation of standard industrial regulators; technical means of automation systems; modern technical and software tools of computer technology.	5				/	/							
40	Internet of Things (IoT) Technologies	The discipline of Internet of Things Technologies is designed to introduce students to the principles of building and operating digital devices for further application of the acquired knowledge in the development and design of automated systems based on IoT. Based on the results of the training, students will know • * the rules of safe operation and requirements for the organization of the workplace • * the basics of programming microcontrollers for controlled technical systems • * the basics of using sensors; • the basics of creating controlled systems. Based on the results of the training, students will be able to: • follow the rules of safe operation • * program microcontrollers for managed technical systems; • select, connect and configure sensors; •	5				/			/		/			

		develop managed systems using the Internet of Things technology.														
41	Organization and planning of machine-building production	The purpose of mastering the discipline is to study the basic principles of organization and planning of production and the formation of knowledge and skills used in making engineering decisions, the importance of scientific, technical and organizational preparation of production. The system of forecasts and plans of the enterprise, forms and methods of planning, basic methods of production management are studied. Skills of organization and planning of production, calculation are acquired the main technical and economic indicators of the main and auxiliary production of an industrial enterprise, methods of planning, ensuring, evaluating and managing quality at all stages of the product life cycle.	6									/	/		
42	Thermodynamics and fluid mechanics	The purpose of teaching the discipline to students is to learn the methods of obtaining, converting, transmitting and using thermal energy in thermal power plants and knowledge in the field of theory and practice of applying the basic laws of fluid mechanics, which will allow efficient operation of technological equipment in the development of solid minerals. When studying the discipline, you will be able to: study and learn how to apply in practice the basic laws of energy production and conversion in technical devices; study the laws of fluid or gas movement under the influence of various disturbances (external mechanical loads, temperature, etc.); learn how to determine and evaluate the efficiency of using thermal and hydraulic energy in technological processes using analytical and computational equipment.	6									/	/		
43	Thermodynamics and heat	transfer The aim of the discipline - теплотехническаяis to train future specialists in the field of mechanical engineering. The discipline studies methods of obtaining, converting, transmitting and using thermal energy; fundamental principles of operation and schemes of heat engineering installations; assessment and comparative analysis энергоэкономическихof energy-economic indicators of heat and power plants; efficiency of using production facilities in technological, energy and transport processes. The	6				/				/					

		laws of technical thermodynamics, the physical foundations of the theory of heat exchange, the operation and design of heat exchangers and heating devices are considered. Standard thermal engineering calculations of designs and modes of operation of thermal machines.													
44	Programming of processing on CNC	machines The purpose of the discipline is theoretical and practical knowledge on the development of control programs for processing on CNC machines. The issues of preparation for the development of control programs, technological documentation, calculation of elements of the cutting tool path, recording, monitoring and editing of the control program are considered. Basic principles of automation of the control program preparation process. Study of the automated workplace of a technologist-programmer, operator of a CNC machine. Various software products of SolidWorks, and Autodesk are considered.	6					/			/				
45	Automation of technological processes The	aim of the discipline is to acquire theoretical and practical knowledge and skills in the field of innovative technologies in mechanical engineering, technological processes of repair and restoration of worn parts and machine components. The discipline deals with innovative technologies in mechanical engineering, including modern methods of obtaining blanks by casting, pressure processing, powder metallurgy and cutting, processing methods, designs of metal-cutting machines, tools for manufacturing complex parts, methodological foundations for building modern technological processes of mechanical processing and assembly of machine-building products.	5						/					/	
46	Production technologies for obtaining blanks	The purpose of the discipline is to acquire knowledge of technological methods for obtaining and processing blanks and machine parts. In the discipline, students study the general characteristics of metals and alloys used in mechanical engineering, the technological foundations of metallurgical production, the technology of metal processing by pressure, the technology of foundry production, and the technology of welding production. The article deals with the production technology of blanks and machine parts made of non-metallic materials; welding features of various metals and alloys.	5					/					/		

47	Theory and practice of project management	The purpose of mastering the discipline is to expand and deepen knowledge about modern project management technology and study the principles of using project management in practical tasks. Mastering the discipline involves an introduction to the problems of project management and studying the methodology of project management, familiarization with the tools and methods of project management at all stages of the project life cycle, starting with project initialization, planning its work, organization of their use and control and ending with completion.	5										v		
48	Capstone project	The main goal of the discipline is to develop a set of theoretical knowledge and practical skills in managing, supporting and supporting the technical preparation of production.Practical opportunities are considered and professional skills of students to work in a team are formed. Students solve real engineering and technical problems in the production, formation and implementation of the life cycle of machine-building products based on information collection, critical assessment of the feasibility of the project, in-depth analysis and implementation of the project report.	5									/			/

5. Curriculum of the educational program

SATBAYEV UNIVERSITY

«APPROVED»
Decision of the Academic Council
NPJSC«KazNRTU
named after K.Satbayev»
dated 21.04.2025 Minutes № 13

WORKING CURRICULUM

Academic year: 2025-2026 (Autumn, Spring)
Group of educational programs: B063 - "Electrical engineering and automation"
Educational program: 6B07134 - "Mechatronics and automation in mechanical engineering"
The awarded academic degree: Bachelor of engineering and technology
Form and duration of study: full time - 4 years

Discipline code	Name of disciplines	Block	Cycle	Total ECTS credits	Total hours	lek/lab/pr Contact hours	in hours SIS (including TSIS)	Form of control	Allocation of face-to-face training based on courses and semesters								Prerequisites
									1 course		2 course		3 course		4 course		
									1 sem	2 sem	3 sem	4 sem	5 sem	6 sem	7 sem	8 sem	
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)																	
M-1. Module of language training																	
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E	5								
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E	5								
LNG108	Foreign language		GED, RC	5	150	0/0/45	105	E		5							
LNG104	Kazakh (russian) language		GED, RC	5	150	0/0/45	105	E		5							
M-2. Module of physical training																	
KFK101	Physical culture I		GED, RC	2	60	0/0/30	30	E	2								
KFK102	Physical culture II		GED, RC	2	60	0/0/30	30	E		2							
KFK103	Physical culture III		GED, RC	2	60	0/0/30	30	E			2						
KFK104	Physical culture IV		GED, RC	2	60	0/0/30	30	E				2					
M-3. Modult of information technology																	
CSE677	Information and communication technology		GED, RC	5	150	30/15/0	105	E				5					
M-5. Module of anti-corruption culture, ecology and life safety base																	
HUM159	Law basics	1	GED, CCH	5	150	30/0/15	105	E			5						
MNG489	Fundamentals of economics and entrepreneurship	1	GED, CCH	5	150	30/0/15	105	E			5						
MNG564	Basics of Financial Literacy	1	GED, CCH	5	150	30/0/15	105	E			5						
M-4. Module of socio-cultural development																	
HUM137	History of Kazakhstan		GED, RC	5	150	15/0/30	105	GE	5								
HUM132	Philosophy		GED, RC	5	150	15/0/30	105	E			5						
HUM120	Module of socio-political knowledge (sociology, political science)		GED, RC	3	90	15/0/15	60	E			3						
HUM134	Module of socio-political knowledge (cultural studies, psychology)		GED, RC	5	150	30/0/15	105	E				5					
CYCLE OF BASIC DISCIPLINES (BD)																	
M-7. General technical training module																	
MCH534	Fundamentals of professional activity		BD, UC	5	150	15/30/0	105	E	5								
MCH535	Engineering and digital graphics		BD, UC	5	150	0/0/45	105	E		5							
M-6. Module of physical and mathematical training																	
MAT101	Mathematics I		BD, UC	5	150	15/0/30	105	E	5								
PHY111	Physics I		BD, UC	5	150	15/15/15	105	E	5								

PHY112	Physics II		BD, UC	5	150	15/15/15	105	E		5							PHY111
MAT102	Mathematics II		BD, UC	5	150	15/0/30	105	E		5							MAT101
M-7. General technical training module																	
MCH536	Engineering workshop		BD, UC	5	150	15/30/0	105	E			5						
GEN463	Mechanics for mechatronics engineers		BD, UC	5	150	15/0/30	105	E			5						
ELC101	Electrical and Electronic Engineering		BD, UC	5	150	15/15/15	105	E			5						
GEN464	Mechanics of materials and structures		BD, UC	5	150	15/0/30	105	E				5					
GEN465	Kinematics and dynamics of mechatronic systems		BD, UC	5	150	15/0/30	105	E				5					
MCH512	Technical design of machine-building equipment		BD, UC	5	150	15/30/0	105	E				5					
MSM102	Basics of interchangeability		BD, UC	5	150	15/15/15	105	E					5				
MCH505	Modern construction materials		BD, UC	5	150	15/30/0	105	E					5				
GEN125	Bases of designing and details of cars		BD, UC	5	150	15/15/15	105	E					5				
AUT456	Technological Measurements and Instruments in Mechanical Engineering	1	BD, CCH	5	150	15/15/15	105	E					5				
MCH539	Fundamentals of scientific research	1	BD, CCH	5	150	30/0/15	105	E					5				
HUM158	The basics of anti-corruption culture	1	BD, CCH	5	150	30/0/15	105	E					5				
CHE950	ESG principles in inclusive culture	1	BD, CCH	5	150	30/0/15	105	E					5				
CSE880	Fundamentals of Artificial Intelligence	1	BD, CCH	5	150	30/0/15	105	E					5				
MCH537	Comprehensive design of cutting tools and technological equipment		BD, UC	5	150	15/15/15	105	E						5			
MCH510	Engineering equipment of machine-building production		BD, UC	5	150	15/0/30	105	E						5			
MSM149	Hydraulics and hydraulic pneumatic drive		BD, UC	5	150	15/0/30	105	E							5		
GEN404	Fluid Mechanics	1	BD, CCH	5	150	15/15/15	105	E							5		
GEN466	Thermodynamics and Mass Transfer	1	BD, CCH	5	150	15/0/30	105	E							5		
IDD427	Ecology and life safety	1	BD, CCH	5	150	30/0/15	105	E							5		
MNG563	Fundamentals of sustainable development and ESG projects in Kazakhstan	1	BD, CCH	5	150	30/0/15	105	E							5		
M-8. Module of software and hardware automation																	
AAP419	Educational practice		BD, UC	1				R		1							
AUT430	Power electronics automation		BD, UC	4	120	30/15/0	75	E					4				
AUT429	Computer modeling and programming in MatLab		BD, UC	6	180	30/30/0	120	E					6				
AUT428	Programming and algorithmization		BD, UC	5	150	30/15/0	105	E						5			
M-10. Module for the development and design of automation and control systems																	
AUT446	Intelligent process control systems		BD, UC	5	150	15/30/0	105	E							5		
CYCLE OF PROFILE DISCIPLINES (PD)																	
M-9. Module of production and technological training																	
AAP420	Industrial practice I		PD, UC	3				R				3					
MCH538	Mechanical engineering technology		PD, UC	4	120	15/0/30	75	E						4			
AAP421	Industrial practice II		PD, UC	5				R						5			
MSM129	Processes of machine-building production		PD, UC	5	150	30/15/0	105	E							5		
MSM155	Organization and planning of machine-building production		PD, UC	5	150	15/0/30	105	E							5		
MCH528	Programming of processing on CNC machines		PD, UC	6	180	30/30/0	120	E							6		
ERG688	Electric drive of production equipment		PD, UC	5	150	30/15/0	105	E								5	
M-10. Module for the development and design of automation and control systems																	
AUT457	Theoretical Foundations of Automatic Control Systems		PD, UC	6	180	30/15/15	120	E						6			
AUT440	Microprocessor-based systems in the control systems	1	PD, CCH	6	180	30/30/0	120	E								6	
AUT452	Internet of Things (IoT) technologies	1	PD, CCH	6	180	30/15/15	135	E								6	
AUT402	SCADA-system	2	PD, CCH	5	150	30/15/0	105	E								5	
AUT458	Digital Twins and Modeling	2	PD, CCH	5	150	15/30/0	105	E								5	
AUT419	Design of automation systems	3	PD, CCH	5	150	30/0/15	105	E								5	

MNG481	Theory and practice of project management	3	PD, CCH	5	150	30/0/15	105	E							5	
MSM418	Capstone Project	3	PD, CCH	5	150	15/30/0	105	E							5	
M-11. Module of final attestation																
ECA103	Final examination		FA	8											8	
Additional type of training (ATT)																
AAP500	Military training															
Total based on UNIVERSITY:									32	28	30	30	30	30	31	29
									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	0	5	56
BD	Cycle of basic disciplines	0	111	10	121
PD	Cycle of profile disciplines	0	39	16	55
Total for theoretical training:		51	150	31	232
FA	Final attestation				8
TOTAL:					240

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 6 dated 18.04.2025

Decision of the Academic Council of the Institute. Minutes № 8 dated 31.03.2025

Signed:

Governing Board member - Vice-Rector for Academic Affairs — Uskenbayeva R. K.

Approved:

Vice Provost on academic development — Kalpeyeva Z. S.

Head of Department - Department of Educational Program Management and Academic-Methodological Work — Zhumagaliyeva A. S.

Director of the Institute - A.Burkitbaev Institute of Energy and Mechanical Engineering — Yelemesov K. .

Department Chair - Mechanical Engineering — Nugman E. .

Representative of the Academic Committee from Employers ____Acknowledged____ — Andreev V. I.