



Institute of Energy and mechanical named after A. Burkitbayev
Department of Power Engineering

EDUCATIONAL PROGRAM

6B07128 - «Digital Power Engineering»
code and title of the 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: **Level 6**

Level based on IQF: **Level 6**

Study period: **4 years**

Amount of credits: **240**

Almaty 2025

Educational program **6B07128 - «Digital Power Engineering»**

code and name of educational program

was approved at the meeting of K.I. Satbayev KazNRTU Academic Council

Minutes №10 dated «06» 03 2025.

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

Minutes №3 dated «20» 12 2024.

Educational program **6B07128 - «Digital Power Engineering»**

code and name of educational program

was developed by Academic committee based on direction «Engineering and Engineering»

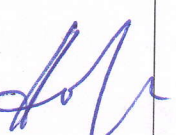
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List of abbreviations and designations

EP – educational program
BC – basic competencies
PC – professional competencies
LO – learning outcomes
MOOC – massive open online courses
NQF – National Qualifications Framework
IQF – Industry Qualifications Framework
SDG - Sustainable Development Goals

1. Description of educational program

The educational program is designed to train personnel for the production and engineering departments of power plants and substations, industrial production enterprises in the energy, construction, transport, metallurgical, mining, oil and gas industries and in the housing and communal services industry, as well as in secondary specialized educational institutions.

The specialty and specialization program area covers engineering and engineering.

In case of successful completion of the full bachelor's degree course, the graduate is awarded the academic degree "Bachelor of Engineering and Technology in the field of electrical engineering and energy".

The educational program has increased the volume of mathematical, natural science, basic and language disciplines. Specialized disciplines have been added, which can be divided into three groups: disciplines in the electric power industry, disciplines in digital management and disciplines in programming. As a result, we have an educational program that has innovative and practical content and is aimed at implementing the Digital Kazakhstan program.

The educational program provides for the study of the following innovative disciplines:

- Intelligent control systems of electrical networks;
- Identification of control objects in the power system;
- - Diagnostics of power system equipment;
- Digital control systems for electric drives;
- Computerized protection and safety of electrical systems;
- Energy-saving and resource-saving technologies;
- Means of optimizing electricity consumption;
- Programming logic controllers using Unity Pro;
- SCADA in the power supply system.

In the process of mastering the educational program, a Bachelor of Engineering and Technology in the field of (production, transformation, transmission and consumption) of energy (electricity) must possess the following key competencies.

The bachelor must:

have an idea:

- about modern energy facilities, about autonomous power sources and renewable energy facilities, about promising areas of energy development;
- on modern approaches to the calculation and design of energy systems, as well as to the use of software tools for the management and evaluation of energy systems;
- about modern elements and installations of electric power systems (devices, apparatuses, equipment, etc.);
- about modern applications used in energy systems;

To know:

- theoretical and experimental research methods in order to create new promising areas in the field of energy;
 - principles of operation, technical characteristics and design features of the energy facilities being developed and used;
 - standards, methodological and regulatory materials, fundamentals of design, installation and operation of electrical installations in the energy industry;
 - modern and promising directions for the development of energy and electrical systems, principles of operation, technical characteristics and design features of energy and electrical installations and systems being developed and used;
 - fundamentals of programming for the creation of control systems for electrical systems;
- be able to:
- to develop the principles of organization and design of the electrical part of enterprises;
 - use application programs for calculations, modeling and automation of energy systems design;
 - use theoretical information on the organization of the technological process of electricity generation;
 - develop programs for managing technological processes of energy systems;
 - to solve the main issues of power supply systems; issues related to the design features of internal power supply systems, electrical networks, substation equipment;
 - use energy supply calculation methods.
 - apply methods and measuring instruments used in the production, transmission and consumption of electric energy;
 - to use energy- and resource-saving technologies, to carry out a preliminary feasibility study of design calculations;
 - to carry out calculations on electricity consumption of electric power plants.

have skills:

- formulate the main technical and economic requirements for the designed power systems;
- organization of work on the operation, installation and commissioning of electrical and energy equipment;
- development and design on the modern element and technical basis of energy systems and individual devices.
- possess modern methods and devices for monitoring and accounting of energy resources.
- Calculate energy losses in various electrical equipment.

During the training, production practices are provided at such enterprises as: NC "KEGOC", JSC "AZHK", JSC "AIES", LLP "Elcos", JSC "Kazatomprom", LLP "Kazzinc", "Karachaganak Petroleum Operating", "Kazminerals". Kazakhmys and others.

2. Purpose and objectives of educational program

The purpose of EP: The purpose of the educational program is to teach students general education, basic and profile disciplines with the achievement of relevant competencies. Training of bachelors with professional knowledge in the design, installation, operation and repair of power plant equipment, power supply sources for industrial enterprises, cities and agriculture, with an understanding of the classical and new areas of modern energy and environmental technologies, and able to apply the knowledge gained in scientific, practical and production activity.

SDG 7 – Affordable and Clean Energy: Design of heat exchangers that use energy efficiently and can work with renewable energy sources;

Tasks of EP: Theoretical and practical training of highly qualified bachelors of electricians, capable of performing the tasks of the entire complex of engineering issues of power supply, using modern computer technology and introducing new technologies in design.

3. Requirements for the evaluation of learning outcomes of the educational program

Admission to the university is carried out according to the applications of an applicant who has completed secondary, secondary special education in full on a competitive basis in accordance with the points of the certificate issued according to the results of the unified national testing with a minimum score of at least 65 points. Special requirements for admission to the program apply to graduates of 12 summer schools, colleges, applied bachelor's degree programs, niches, etc. Such applicants must pass diagnostic testing in English, mathematics, physics and special disciplines. Rules for credit transfer for accelerated (reduced) education based on 12-year secondary, secondary technical and higher education

Code	Competence type	Description	Competence result	Responsible
Shared (Includes full training with possible additional, depending on the level of knowledge)				
G1	Communication	- Fugitive monolingual oral, written and communication skills - The ability not to communi-cate fluently with a second language	Full 4-year study with a minimum of 240 academic loans (of which 120 contact classroom academic credits) with a possible re-recording of loans in the second language where students have an advanced level.	Department of Kazakh and Russian, Department of English

		- The ability to use communi-cative communication in different situations - There are basics to acade-mic writing in their native language - Diagnostic language test	The level of language is determined by passing the diagnostic test	
G2	Mathematical Literacy	- Basic mathematical thinking at the communication level - the ability to solve situational problems on the basis of the mathematical apparatus of algebra and began mathematical analysis - Diagnostic test for mathe-matical literacy in algebra	Full 4-year study with a minimum of 240 academic loans (of which 120 are contact auditory academic loans). With a positive test of diagnostic test, the level of mathematics 1, the negative - the level of algebra and the beginning of the analysis	Mathematics Department
G3	Basic literacy in science disciplines	- A basic understanding of the scientific picture of the world with an understanding of the basic laws of science - Understanding basic hypotheses, laws, methods, drawing conclusions and assessing errors	Full 4-year study with a minimum of 240 academic loans (of which 120 are contact auditory academic loans). With a positive test of diagnostic test level Physics 1, General Chemistry, at negative - the level of the Beginning of Physics and basic basics of chemistry	Departments in the fields of natural sciences
Specific (includes reduced tuition by re-counting credits depending on the level of competence knowledge for graduates of 12-year schools, colleges, universities, including humanitarian and economic areas)				
S1	Communication	- Fugitive bilingual oral, written and communication skills - The ability not to communi-cate fluently with a third language	Full re-repayment of credits by language (Kazakh and Russian)	Department of Kazakh and Russian

		- writing skills of different styles and genres - skills of deep understanding and interpretation of one's own work of a certain level of complexity (essay) - basic aesthetic and theoretical literacy as a condition of full perception, interpretation of the original text		
S2	Mathematical Literacy	- Special mathematical thinking using induction and deduction, generalization and specification, analysis and synthesis, classification and systematization, abstraction and analogy - The ability to formulate, substantiate and prove positions - Application of common mathematical concepts, formulas and extended spatial perception for mathematical tasks - Full understanding of the basics of mathematical analysis	Re-credit for The Discipline of Mathematics (Calculus) I	Mathematics Department
S3	Special literacy in science disciplines (Physics, Chemistry, Biology and Geography)	- A broad scientific perception of the world that suggests an understanding of natural phenomena - Critical perception to understand the	Re-credits for Physics I, General Chemistry, General Biology, Introduction to Geology, Introduction to Geodesy; Training practice, etc.	Departments in the fields of natural sciences

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		phenomena of the world around - cognitive ability to formulate a scientific understanding of the forms of existence of matter, its interaction in nature		
S4	English language	- Readiness for further self-learning in English in various fields - Ready to gain experience in design and research using English	Refilort English credits above academic to professional level (up to 15 credits)	Department of English
S5	Computer skills	- Basic programming skills in one modern language - Use software and applications to teach different disciplines	Reset Credits on Discipline Introduction to Information and Communication Technologies, Information and Communication Technologies	Department of Software Engineering
S6	Social and humanitarian competencies and behaviour	- Understanding and understanding the responsibility of every citizen for the development of the country and the world - The ability to discuss ethical and moral aspects in society, culture and science	Re-credit for Kazakhstan's Modern History (excluding state exam)	Department of Public Discipline
		- Critical understanding and the ability to debate on modern scientific hypotheses and theories	Re-credit credits for philosophy and other humanities	
PROFESSIONAL (includes reduced education by re-counting credits depending on the level of knowledge on competences for college graduates, AV schools, universities)				
P1	Professional competencies	- Critical perception and a deep understanding of professional competencies at level 5 or 6	Re-credits for basic professional disciplines, including introduction to specialty, engineering ethics, robotic technology, automation technology,	Releasing chair

		- The ability to discuss and debate professional issues within the framework of the mastered program	theoretical basics of electrical engineering, technological measurements and instruments, mathematical basics of control theory, electronic automation devices.	
P2	General Engineering Competencies	- Basic general engineering skills and knowledge, the ability to solve general engineering problems and problems - be able to use application packages to process experimental data, solve algebraic and differential equation systems	Re-credit for general engineering disciplines (engineering graphics, outline geometry, electrical engineering basics, microelectronics basics.)	Releasing chair
P3	Engineering and computer competencies	- Basic skills in using computer programs and software systems to solve general engineering problems	Re-credit for computer graphics discipline, computer modeling and programming in the MatLab environment.	Releasing chair
P4	Socio-economic competences	- Critical understanding and cognitive ability to reason on contemporary social and economic issues - A basic understanding of the economic assessment of research sites and the profitability of projects.	Re-transfer credits for socio-humanitarian and technical and economic disciplines in the set-off of the electorate cycle	Releasing chair

The university may refuse to transfer loans if the low diagnostic level is confirmed or the final grades in completed disciplines were below A and B.

4. Passport of educational program

4.1. General information

№	Field name	Note
1	Code and classification of the field of education	6B07 Engineering, manufacturing and construction industries
2	Code and classification of training directions	6B071 Engineering and Engineering
3	Educational program group	B063 Electrical engineering and automation
4	Educational program name	Digital Power Engineering
5	Short description of educational program	The educational program is designed to train personnel for the production and engineering departments of power plants and substations, industrial production enterprises in the energy, construction, transport, metallurgical, mining, oil and gas industries and in the housing and communal services industry, as well as in secondary specialized educational institutions. The specialty and specialization program area covers engineering and engineering. In case of successful completion of the full bachelor's degree course, the graduate is awarded the academic degree "Bachelor of Engineering and Technology in the field of energy". The educational program has increased the volume of mathematical, natural science, basic and language disciplines. Specialized disciplines have been added, which can be divided into three groups: disciplines in the electric power industry, disciplines in digital management and disciplines in programming. As a result, we have an educational program that has innovative and practical content and is aimed at implementing the Digital Kazakhstan program.
6	Purpose of EP	The purpose of the educational program is to teach students general education, basic and profile disciplines with the achievement of relevant competencies. Training of bachelors with professional knowledge in the design, installation, operation and repair of power plant equipment, power supply sources for industrial enterprises, cities and agriculture, with an understanding of the classical and new areas of modern energy and environmental technologies, and able to apply the knowledge gained in scientific, practical and production activity. SDG 7 – Affordable and Clean Energy: Design of heat exchangers that use energy efficiently and can work with renewable energy sources;
7	Type of EP	Innovative
8	The level based on NQF	6 level
9	The level based on IQF	6 level
10	Distinctive features of EP	No
11	List of competencies of educational program	A - knowledge and understanding: A1 - methods for constructing electrical, technological and functional diagrams for the design of electric power systems; A2 - modern trends in the development of technical and technological systems of energy facilities;

	A3 - standards, methodological and regulatory materials accompanying the operation, installation and commissioning of electric power facilities; A4 - the basics of programming, to create control systems for electrical systems. B - application of knowledge and understanding: B1 - independent work and the proposal of various options for solving professional problems using theoretical and practical knowledge; B2 - for organizing work on the installation, commissioning and operation of electric power systems; B3 - for the organization of work on the collection, storage and processing of information used in the field of professional activity. C - the formation of judgments: C1 - about modern facilities of the energy industry and process control systems; C2 - on the use of modern systems of autonomous energy supply for various categories of consumers; C3 - on modern technical devices and technological equipment of energy facilities (devices, apparatus, equipment, actuators, etc.); C4 - about modern application programs used in energy systems; D - personal abilities: D1 - to be an energy engineer, an electrical engineer of the production unit for the operation of energy systems; D2 - to be a specialist in maintenance of electrical networks and systems; D3 - to be an engineer of the production unit for the repair of electrical and electrical installations; D4 - to be able to organize work on the adjustment of energy and electromechanical installations of industrial enterprises. <i>Competencies upon completion of training</i> B - Basic knowledge, skills and abilities: B1 - capable of philosophical analysis of social phenomena, behavior of the individual and other phenomena. Ready to conduct a philosophical assessment of social phenomena; B2 - know and apply in practice the basics of engineering professional ethics; B3 - be able to analyze the actual problems of the modern history of Kazakhstan. P - Professional competencies, including in accordance with the requirements of industry professional standards: P1 - a wide range of theoretical and practical knowledge in the professional field; P2 - able to analyze and solve problems on the basics of electrical engineering and automatic control;
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		P3 - is able to analyze electrical, electrical and wiring diagrams of technological production. Ready to install, adjust and operate electrical installations and systems. M - Universal, social and ethical competencies: O1 - is able to use English fluently as a means of business communication, a source of new knowledge in the field of electrical engineering and energy. Ready to use English in professional activities in the field of energy; O2 - is able to speak Kazakh (Russian) fluently as a means of business communication, a source of new knowledge in the field of electrical engineering and energy. Ready to use the Kazakh (Russian) language in professional activities in the field of energy; O3 - to know and apply in work and life the basics of applied ethics and ethics of business communication; O4 - know and apply the basic concepts of professional ethics; O5 - know and apply in practice the "engineer's code of ethics"; O6 - to know and solve the problems of human impact on the environment. C - Special and managerial competencies: C1 - independent management and control of the processes of labor and educational activities within the framework of the strategy, policy and goals of the organization, discussion of the problem, argumentation of conclusions and competent handling of information; C2 - in the field of organizational and managerial activities: to be the head of the group of the unit for the operation, installation and repair of power plants in various industries; C3 - in the field of experimental research activities: to be a specialist in conducting experimental research of electric power facilities; C4 - in the field of research activities: to be an engineer in a scientific laboratory for research and development of modern power plants and systems in various industries; C5 - in the field of design and development: to be an engineer for the development and design of electric power plants and systems in various industries.
12	Learning outcomes of educational program	Obligatory standard requirements for graduation from a university and awarding an academic degree of a bachelor: mastering at least 240 academic credits of theoretical training and a final thesis or a state exam in a specialty. Special requirements for graduation from this program <i>the graduate should know:</i> Shows knowledge about society as an integral system and a person. He knows about the role of spiritual processes in modern society, about the legal interests of the parties in the field of protecting the rights of individuals and legal entities. Has an understanding of the economic and social conditions of entrepreneurial activity, the impact of harmful and dangerous factors on humans and the natural environment.

	Possesses basic knowledge in natural sciences that contribute to solving professional tasks in the field of energy and the formation of a highly educated personality with a broad worldview, in accordance with the goals of sustainable development, aimed at ensuring inclusive and equitable quality education and promoting lifelong learning opportunities. Able to use tables and charts. Has knowledge of modern methods and devices for control and metering of electricity. Knows modern and future directions of development of power systems, principles of operation, technical characteristics and design features of developed and used power plants. Expands and systematizes the acquired knowledge in the course of studying the disciplines of the module. Gains experience in reading and constructing various types of diagrams. Manage the Iot system at the physical, network and application level. Configure and install sensors and readers to transmit information for verification and analysis of the transmitted data. Applies methods for calculating electrical systems. Conducts electrical calculations of industrial electrical equipment. Analyzes the modes of operation of electrical systems, applies methods for their study. Implements innovative approaches in practical activities to achieve specific results in the field of energy, contributing to the development of sustainable industrialization, supporting innovation, and creating reliable infrastructure. Independently processes information and makes informed decisions when developing or mastering new technologies and materials, taking into account the principles of sustainable development. Uses knowledge of basic disciplines to understand the physical essence of the processes occurring in the objects of the main and auxiliary equipment of objects of electric power systems. Possesses knowledge and skills of installation, repair and adjustment of electrical equipment. Demonstrates the ability to design systems, system components, or processes to achieve the required result, taking into account real constraints (cost-effectiveness, impact on the environment and social environment, ethics, health and safety, technological feasibility, and sustainable development), as well as the principles of inclusive education, ensuring accessibility and equal opportunities for all population groups. Possesses methods for designing, calculating, and regulating energy production and distribution systems, applies information technologies to solve engineering tasks through computer processing, contributing to ensuring access to affordable, reliable, sustainable, and modern energy for all. Is able to use computer technologies to process measurement results and comply with GOST standards and industry regulations. Knows and understands modern social and political issues, as well as problems in the field of energy and ecology, taking into account the principles of sustainable development of cities and
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		settlements to create a safe, sustainable, and favorable urban environment. Understands the benefits and potential challenges of teamwork, describing the qualities and processes required for effective teamwork, and the role of teamwork in the engineering design process. Understands the importance of career planning and management. To carry out control over the operational provision of reliable power supply to consumers, as well as to monitor and analyze the consumption of electricity transported through the networks of the electricity supplier, broken down by source.
13	Education form	Daytime
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	Sarsenbayev E.A., Berdibekov A.O., Abitayeva R.Sh.

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

№	Name of the discipline	Brief description of the discipline	Number of credits	Generated learning outcomes (codes)											
				LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10	LO11	LO12
1	Fundamentals of anti-corruption culture and law	Purpose: to increase the public and individual legal awareness and legal culture of students, as well as the formation of a knowledge system and a civic position on combating corruption as an antisocial phenomenon. Contents: improvement of socio-economic relations of the Kazakh society, psychological features of corrupt behavior, formation of an anti-corruption culture, legal responsibility for acts of corruption in various fields.	5	v										v	
2	Fundamentals of scientific research methods	Purpose: to form a systematic understanding of the methodology of scientific cognition among students; to develop scientific thinking skills; to form experience in organizing and conducting scientific research; to develop a competence-based approach to the use of methods and rules for conducting research in the field of mechanical engineering, related processes and their technologies. Contents: stages of scientific research, terms and concepts, methods of conducting an experiment, mathematical methods of processing research results. Concepts of engineering, laboratory and industrial experiment, bench research.	5										v		v
3	Basics of Financial Literacy	Purpose: formation of financial literacy of students on the basis of building a direct link between the acquired knowledge and their practical application. Contents: using in practice all kinds of tools in the field of financial management, saving and increasing savings, competent budget planning, obtaining practical skills in calculating, paying taxes and correctly filling	5	v					v						

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		out tax reports, analyzing financial information, orienting in financial products to choose adequate investment strategies.													
4	Fundamentals of economics and entrepreneurship	Purpose: To develop basic knowledge of economic processes and skills in entrepreneurial activities. Content: The course aims to develop skills in analyzing economic concepts such as supply and demand, and market equilibrium. It includes the basics of creating and managing a business, developing business plans, risk assessment, and strategic decision-making.	5	v											v
5	Ecology and life safety	Purpose: formation of ecological knowledge and consciousness, obtaining theoretical and practical knowledge on modern methods of rational use of natural resources and environmental protection. Contents: the study of the tasks of ecology as a science, the laws of the functioning of natural systems and aspects of environmental safety in working conditions, environmental monitoring and management in the field of its safety, ways to solve environmental problems; life safety in the technosphere, emergencies of a natural and man-made nature.	5	v									v		
6	Algorithmization and Programming	Goal: Mastering the basics of algorithmization and programming for solving typical problems using modern programming languages. Contents: Basic concepts of algorithmization, structured programming, basic algorithms and data structures, syntax and semantics of the selected programming language, methods for debugging and testing software, development and analysis of algorithms, examples of solving real problems.	5			v			v						
7	Introduction to the specialty	The discipline examines the basics of energy, electric ground transport and charging infrastructure. Introduces the history of the development of the electric power industry. Provides information about the characteristics of the specialty. Studies the main technical means of production, transmission, conversion and consumption of electrical energy. Forms an idea of ground-based electric vehicles and charging infrastructure elements. Shows the possibilities of using renewable energy sources to charge electric vehicles.	4			v							v		

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8	Measurement of electrical and non-electrical quantities	Basic knowledge of metrology and electrical measurements. Basic methods and means of measuring electrical and non-electric quantities. Information about the devices, the principles of action and the special features of the application of measuring instruments. Classifications of measurements and their errors.	5			v						v			
9	Engineering and computer graphics	Discipline is an essential component. The course develops the following skills in students: to depict all kinds of combinations of geometric shapes on a plane, to conduct research and their measurements, allowing for image transformations; create technical drawings, which are the main and reliable means of information, providing a link between the designer and the designer, technologist, builder. Introduces students to the basics of automated preparation of the graphic part of design documents in AutoCAD.	5			v						v			
10	Mathematics I	Purpose: to introduce students to the fundamental concepts of linear algebra, analytical geometry and mathematical analysis. To form the ability to solve typical and applied problems of the discipline. Contents_ Elements of linear algebra, vector algebra and analytical geometry. Introduction to the analysis. Differential calculus of a function of one variable. The study of functions using derivatives. Functions of several variables. Partial derivatives. The extremum of a function of two variables.	5			v									
11	Mathematics II	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the primitive. To teach how to apply a certain integral to solve practical problems. Contents_ integral calculus of the function of one and two variables, series theory. Indefinite integrals, methods of their calculation. Certain integrals and applications of certain integrals. Improper integrals. Theory of numerical and functional series, Taylor and Maclaurin series, application of series to approximate calculations_	5			v									
12	Mathematics III	Purpose: To teach students integration methods. To teach you how to choose the right method for finding the primitive. The	5			v									

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		discipline is a continuation of Mathematics II. The course includes sections: ordinary differential equations and elements of probability theory and mathematical statistics. Differential equations with separable variables, homogeneous, in full differentials, linear inhomogeneous differential equations with constant coefficients, systems of linear differential equations with constant coefficients, finding the probability of events, calculating the numerical characteristics of random variables, using statistical methods for processing experimental data are studied.													
13	Fundamentals of power supply of industrial enterprises	The study of calculation methods, design analysis of workshop power supply systems, development of skills for independent solution of engineering problems and practical application of theoretical knowledge, study of the principles of designing power supply systems at the stages of electrical loads of industrial enterprises with voltage up to 1 kV.	5								v	v			
14	Transmission of electrical energy	Characteristics of energy and electrical systems. Designs of overhead and cable power lines. Equivalent circuits of the network and transformers. Loss of power, voltage, electricity. Technical and economic indicators. The quality of electrical energy. Network connection diagram or network configuration.	5								v	v			
15	Modern industrial electronics	Characteristics of semiconductor components of electronics; schemes of uncontrolled and controlled rectifiers; arrangement of optoelectronic devices; electrical signal amplifiers; converter power supplies; frequency converters; digital converters; microprocessors.	6			v				v					
16	The theoretical mechanics	The purpose of the discipline is to form the foundations of engineering thinking among students by studying the basics of mechanics and mastering the basic principles and laws of theoretical mechanics The content of the discipline: the basic laws of mechanical motion and mechanical interaction of material bodies; the basic concepts of the law of mechanics, methods for studying the equilibria of motion of a material point, a solid and a mechanical system	5		v		v								

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17	Theoretical Foundations of Electrical Engineering I	It is considered in the discipline: basic concepts and definitions used in electrical engineering; modern methods of modeling of electromagnetic processes; methods of analysis of electric and magnetic circuits; numerical methods of the analysis of electrical circuits; basic laws and principles of electrical engineering, properties and characteristics of electrical circuits; methods of analysis of electrical circuits in steady state and transient modes; selection of the optimal method of calculation, to determination of the main parameters and characteristics of electrical circuits	5			v	v								
18	Theory of automatic control	Obtain to basic knowledge of the technical means of automation. Get skills in the application of software tools for the analysis o automatic control systems.	5									v			
19	Physics I	Purpose: to study the basic physical phenomena and laws of classical and modern physics; methods of physical research; the influence of physics on the development of technology; the relationship of physics with other sciences and its role in solving scientific and technical problems of the specialty. Contents: 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										
20	Physics II	Purpose: to form students' knowledge and skills in using fundamental laws, theories of classical and modern physics, as well as methods of physical research as the basis of a system of professional activity. Contents: harmonic oscillations, damped oscillations, alternating current, wave motion, laws of refraction and reflection of light, quantum optics, laws of thermal radiation, photons, their characteristics, wave function, electrical conductivity of metals, atomic nucleus, its structure and properties, binding energy, radioactivity.	5		v										
21	Reading electrical circuits	Theory, the design of electrical apparatus and machines and their graphic designation according to state standards and a unified system of design documents.	5				v								

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22	Identification of control objects in the power system	The main types of sensors for electrical and non-electric quantities and their application in monitoring and control systems are considered. Drawing up functional diagrams of the control object and derivation of the transfer function of sensors.	4						v			v			
23	Intellectual control systems for electrical networks	Processing of steady state data for various operational purposes; diagnostics of protection and automation with alarm; remote change of digital RPA settings, management of their commissioning; registration and signaling of the occurrence of ferroresonance modes in the network; validation of input information; equipment diagnostics and control; formation of a database, storage and documentation of information; technical metering of electricity and control of energy consumption; control of power quality parameters; automatic emergency control;	5									v			
24	Modeling of power converters of energy	Modeling of single-phase and three-phase power converters, modeling of DC machines, modeling of asynchronous and synchronous machines, modeling of switching devices.	4								v	v			
25	Fundamentals of Artificial Intelligence	Purpose: to familiarize students with the basic concepts, methods and technologies in the field of artificial intelligence: machine learning, computer vision, natural language processing, etc. Contents: general definition of artificial intelligence, intelligent agents, information retrieval and state space exploration, logical agents, architecture of artificial intelligence systems, expert systems, observational learning, statistical learning methods, probabilistic processing of linguistic information, semantic models, natural language processing systems.	5		v							v			
26	Fundamentals of sustainable development and ESG projects in Kazakhstan	Purpose: the goal is for students to master the theoretical foundations and practical skills in the field of sustainable development and ESG, as well as to develop an understanding of the role of these aspects in the modern economic and social development of Kazakhstan. Contents: introduces the principles of sustainable development and the implementation of ESG practices in Kazakhstan, includes the study of national	5	v							v		v		

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		and international standards, analysis of successful ESG projects and strategies for their implementation in enterprises and organizations.													
27	Transition in power supply systems	Electromagnetic and electromechanical transients. Short circuits in power supply systems. Short-circuit current limitation. Static and dynamic stability in power supply systems and ways to improve them.	6			v				v					
28	Legal regulation of intellectual property	Purpose: the goal is to form a holistic understanding of the system of legal regulation of intellectual property, including basic principles, mechanisms for protecting intellectual property rights and features of their implementation. 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, and consider legal disputes and methods for resolving them.	5	v								v			
29	Programming Logic Controllers with Unity Pro	Hardware and configuring programmable logic controllers. Unity Pro program development environment. Creation programs in LD, ST, FBD and SFC languages for automated control systems. Operation of programmable logic controllers.	5						v			v			
30	Solving Electrical Engineering Problems in MATLAB	Compilation of characteristic equations and the use of various integration and differentiation methods for solving electrical engineering problems in the MATLAB program	5			v				v					
31	Means of automation of control processes in the electric power industry	Modern devices, equipment, methods and software for automating the process of production, conversion, transmission and consumption of electricity.	5					v				v			
32	Theoretical Foundations of Electrical Engineering II	The course gives an idea of the basic equations and connection schemes; electrical filters and quadripoles; transients in linear electrical circuits, RL and RC circuits of the first degree; calculation of transients in circuits of the second degree. Introduces students to the characteristics of similar networks, types of long networks, the operator method, non-linear chains of sinusoidal currents and methods for their analysis.	5			v	v								
33	Stability of the power systems	Theoretical knowledge, practical skills and abilities to use algorithms for calculating electromagnetic transients. Influence of the automatic excitation controller on the steady-state	6					v		v					

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		operating modes of the SM. Transient processes in the SM in violation of the symmetrical mode of operation of the power system. Stability of engines during transients.													
34	Electrical insulation and cable technology	The purpose of the discipline is the study and development of the principles of design and production of electrical insulation, cables, wires used in electric power, electrical equipment	5						v		v				
35	Electrical and technical material science	Classification of electrotechnical materials; Liquid dielectrics; Polymers; Inorganic electrical insulating materials; Conductor, superconducting and semiconductor materials; Magnetic materials and their classification and properties; Dielectrics and their electrical conductivity; Breakdown of gases, liquid and solid dielectrics; thermal conductivity and radiation resistance of materials.	5						v						
36	SCADA in the power supply system	Structure and composition of SCADA. SCADA functions. End-to-end SCADA design. Basic hardware and software VijeoCitect to create a SCADA system in the power supply system.	5								v	v			
37	Laboratory workshop on modern industrial technologies in the electric power industry I	To form a specialist with solid fundamentals of knowledge, high mathematical culture and practical skills, sufficient for successful production activities and allowing him to independently master new necessary knowledge and achievements in the field of programming and solving engineering problems. Master the methodology of automated software development of automation and control systems. Learn how to use modern software development and design tools, as well as design methodologies and regulatory documentation to acquire skills in creating high-quality automation and control software. Provide theoretical training in the development and design of software tools and automation and control systems.	5						v		v				
38	Laboratory workshop on modern industrial technologies in the electric power industry II	The discipline "Laboratory Workshop on Modern Industrial Technologies in Power Engineering II" is one of the main fundamental disciplines that form professional skills in solving problems in industry, examining the basic principles and methods that are part of electromechanical systems. Acquire	4						v		v			v	

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		the necessary stock of fundamental knowledge in the simulation of electric drive systems; stages of installation and commissioning; system approach to the installation and commissioning of electrical machines. Acquire knowledge of the principles of installation, options for constructing closed-frequency systems of variable frequency drives, calculate and simulate systems of asynchronous variable-frequency drives, perform the entire list of tasks related to the choice of hardware and software, and use the application software package for modeling and analyzing modern power supply systems common industrial mechanisms.													
39	Control system software	The main programs used in the design and operation of energy systems, power plants, electrical substations, etc. Complex calculation and analysis of electrical power systems. Standards and trends in modeling and analysis of power systems. Predictive modeling of electric power systems.	6									v			
40	Electrical machines	The discipline "Electrical Machines" will allow you to have an idea about the technical condition of electric drives used in the process, their torque characteristics and capabilities, instrumentation and devices that control the parameters of electric machines, will give the necessary skills for their proper operation, will allow in the preparation of technical specifications for the reconstruction of electromechanical equipment. The content of the discipline: Power transformers. Single and three phase transformers. Electric cars of alternating and direct currents. Synchronous and asynchronous electric machines.	5							v					
41	Power and electrotechnical equipment	The acquisition of students knowledge of the basics and trends in the development of energy and electrical equipment. Clearly understand the concept of providing consumers with electricity, understand the structure of energy and electrical equipment systems, the relationship between its various links, get an idea of the composition of electricity consumers in various sectors of the economy. Questions on the generalized electromechanical converter are considered. The device and	4							v	v				

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		principles of construction of electromechanic systems. Laws of electromechanics. Electrical insulation and cable technology.													
42	Automated electric drive	Discipline is a basic subject, where students get a general idea of the modern electric drive. The main topics of the course: Mechanics of electric drive, Electric drives of direct and alternating current. Adjustable electric drives. Transients in the drive. Power characteristics of the electric drive. Design of electric drives of typical industrial mechanisms.	5									v			
43	Quality of electrical energy	Issues of ensuring the quality of electrical energy. The main causes and sources of interference that degrade the quality of EE. Methods and measures to improve the quality of EE. Electromagnetic compatibility in power supply systems.	5								v				
44	Computerized protection and safety of electrical systems	Installation and repair of power electrical equipment and lighting devices of substations, industrial buildings and production shops. Evaluation of functional, quantitative and qualitative characteristics of devices used in the adjustment of electrical equipment.	6						v			v			
45	Microprocessor digital protection	Abnormal operating modes of electrical equipment. Requirements for modern microprocessor protection. Basic principles for the implementation of digital protection and automation circuits. Sources of operational current. Current protection. Earth fault protection. Differential current protection. Protection of transformers and autotransformers from internal and external damage. Protection of electric motors.	6					v				v			
46	Installation and adjustment of electrical equipment	Installation and repair of power electrical equipment and lighting devices of substations, industrial buildings and production shops. Evaluation of functional, quantitative and qualitative characteristics of devices used in the adjustment of electrical equipment.	5							v				v	
47	Lighting technology and lighting	Basic concepts of lighting equipment. Sources of light. Electric lighting. Light technical characteristics of lighting fixtures. Normalization and the device of illumination. Calculation of electric lighting. Methods of illumination. Selection of light source and lighting device. Placement of lighting fixtures.	5					v	v						

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		Calculation of the number of fixtures. Choice of voltage and power scheme of lighting installations. The choice of the brand of wires and the way they are laid.													
48	Basics of electrical safety	organization of safety engineering and liability for violation of safety regulations. Electrotraumatism, classification, types and act of electric trauma investigation, ways to reduce electrotrauma. The action of electric current on the human body and the degree of danger. The parameters of the electrical circuit, the effect of voltage, current, frequency, time of action, the resistance of the human body and the current loop on the severity of the outcome of electrical injuries. Gosstandart for electrical safety. Danger of networks with earthed and isolated neutral. Danger of earth fault. Protective measures, the role of isolation. Application of small voltages, safety interlocks, protection during the transition of higher voltage to the lower network. Safety shutdown and automatic capacity compensation. Electrofeedback means, assistance with electrocution.	5					v	v					v	
49	Calculation, design and modeling of automated electric drive	Typical diagrams of AED controlled by asynchronous motors; Principles of construction of multi-loop systems of automated electric drive; Complete electric drives with valve motor and frequency control; Electric drive of various general industrial installations.	5								v	v			
50	Calculation, design and modeling of electrical system automation	Mastering practical methods for calculating power converters for the power supply system and their modeling, methods for choosing power and protective equipment. Design of automation and relay protection of various electric power plants.	5								v	v			
51	Calculation, projecting and modeling of power supply systems	Mastering practical methods for calculating the loads of any power supply system, methods for choosing power and protective equipment, methods for calculating lighting, grounding and lightning protection.	5								v	v			
52	Calculation, projecting and modeling of	Characteristics of energy and electrical systems. Designs of overhead and cable power lines. Equivalent circuits of the network and transformers. Calculation of parameters of steady-	5								v	v			

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	electrical power networks and systems	state modes of electrical networks. Loss of power, voltage, electricity. Technical and economic indicators. The quality of electrical energy. Network connection diagram or network configuration.													
53	Power consumption optimization tools	Methods for optimizing electricity consumption. Devices, equipment and optimization methods in the production, conversion, transmission and consumption of electrical energy.	5						v			v			
54	Digital control systems for electric drives	Electric drives controlled by asynchronous motors with frequency converters; Principles of construction of multi-loop systems of automated electric drive; Complete electric drives with frequency control; Setting up frequency converters for electric drives of various general industrial installations.	5								v	v			
55	Digital electrical apparatus	Contactors and magnetic starters, thyristor starters. Controllers, command devices and rheostats. Automatic switches and fuses. Electromagnetic current and voltage relays. Thermal relay, time relay, polarized, indicator relays. magnetic amplifiers. Semiconductor electrical devices.	4				v								
56	Operation and diagnostics of electrical equipment	Diagnostics, organization of technical operation, maintenance and repair of electrical equipment. Ways to organize the maintenance of electrical machines, transformers, power lines and cables. Modern methods of diagnostics of electrical equipment.	5				v			v					
57	Electrical equipment of substations and power plants	Classification of electrical devices and requirements for them. Electrodynamic forces in electrical devices. Heating of electrical apparatus. Electrical contacts. Electromagnets. Fundamentals of the theory of combustion and extinguishing of an electric arc. Insulation of electrical apparatus. High voltage automatic switches. Disconnectors, separators and short circuiters. Reactors, arresters. Measuring current and voltage transformers.	4				v			v					
58	Energy-saving and resource-saving technologies in power engineering	Energy-saving and resource-saving devices, equipment and methods in the production, conversion, transmission and consumption of electrical energy.	5					v			v				

WORKING CURRICULUM

Academic year	2025-2026 (Autumn, Spring)
Group of educational programs	B062 - "Electrical engineering and energy"
Educational program	6B07128 - "Digital Energy"
The awarded academic degree	Bachelor of engineering and technology
Form and duration of study	full time (shortened after TVET) - 3 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			
									1 sem	2 sem	3 sem	4 sem	5 sem	6 sem		
CYCLE OF GENERAL EDUCATION DISCIPLINES (GED)																
M-2. Module of physical training																
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-4. Module of socio-cultural development																
HUM137	History of Kazakhstan		GED, RC	5	150	15/0/30	105	GE	5							
HUM134	Module of socio-political knowledge (cultural studies, psychology)		GED, RC	5	150	30/0/15	105	E	5							
M-3. Module of information technology																
CSE677	Information and communication technology		GED, RC	5	150	30/15/0	105	E		5						
M-4. Module of socio-cultural development																
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						
M-5. Module of anti-corruption culture, ecology and life safety base																
HUM136	Fundamentals of anti-corruption culture and law	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						
PET519	Fundamentals of scientific research methods	1	GED, CCH	5	150	30/0/15	105	E		5						
CHE656	Ecology and life safety	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						
CYCLE OF BASIC DISCIPLINES (BD)																
M-6. Module of physical and mathematical training																
MAT103	Mathematics III		BD, UC	5	150	15/0/30	105	E	5						MAT102	
M-7. Module of basic training of special disciplines in Digital power engineering																
GEN101	Engineering and computer graphics		BD, UC	5	150	15/0/30	105	E	5							
ELC542	Theoretical Foundations of Electrical Engineering I		BD, UC	5	150	30/15/0	105	E	5							
ERG606	Modern industrial electronics		BD, UC	6	180	30/15/15	120	E	6							
GEN412	The theoretical mechanics		BD, UC	5	150	30/0/15	105	E		5						
ELC543	Theoretical Foundations of Electrical Engineering II	1	BD, CCH	5	150	30/15/0	105	E		5						
ERG611	Solving Electrical Engineering Problems in MATLAB	1	BD, CCH	5	150	30/15/0	105	E		5						
ERG607	Measurement of electrical and non-electrical quantities		BD, UC	5	150	30/15/0	105	E			5					
CSE155	Algorithmization and Programming		BD, UC	5	150	15/15/15	105	E			5					
ROB512	Theory of automatic control		BD, UC	5	150	30/15/0	105	E			5					

ERG176	Electrical and technical material science	1	BD, UC	5	150	30/0/15	105	E			5				
ERG441	Electrical insulation and cable technology	1	BD, UC	5	150	30/0/15	105	E			5				
MNG563	Fundamentals of sustainable development and ESG projects in Kazakhstan	1	BD, UC	5	150	30/0/15	105	E			5				
M-7. Module of basic training of special disciplines in Digital power engineering															
ERG608	Fundamentals of power supply of industrial enterprises		BD, UC	5	150	30/0/15	120	E				5			
ERG612	Means of automation of control processes in the electric power industry	1	BD, CCH	5	150	30/15/0	105	E				5			
ERG613	Intellectual control systems for electrical networks	1	BD, CCH	5	150	30/15/0	105	E				5			
MNG562	Legal regulation of intellectual property	1	BD, CCH	5	150	30/0/15	105	E				5			
ERG616	Identification of control objects in the power system	2	BD, CCH	4	120	30/0/15	75	E				4			
ERG617	Modeling of power converters of energy	2	BD, CCH	4	120	30/0/15	75	E				4			
ERG609	Transmission of electrical energy		BD, UC	5	150	15/15/15	105	E					5		
ERG614	Transition in power supply systems	1	BD, CCH	6	180	30/15/15	120	E					6		
ERG615	Stability of the power systems	1	BD, CCH	6	180	30/15/15	120	E					6		
ERG618	Programming Logic Controllers with Unity Pro	2	BD, CCH	5	150	30/15/0	105	E					5		
ERG619	SCADA in the power supply system	2	BD, CCH	5	150	30/15/0	105	E					5		
CSE831	Fundamentals of Artificial Intelligence	2	BD, CCH	5	150	15/0/30	105	E					5		
CYCLE OF PROFILE DISCIPLINES (PD)															
M-7. Module of basic training of special disciplines in Digital power engineering															
AAP102	Production practice I		PD, UC	2				R			2				
M-8. Module of professional disciplines in Digital power engineering															
ERG562	Laboratory workshop on modern industrial technologies in the electric power industry II		PD, UC	4	120	0/45/0	75	E				4			
AAP183	Production practice II		PD, UC	3				R				3			
ERG538	Automated electric drive	1	PD, CCH	5	150	15/15/15	105	E				5			
ERG635	Digital control systems for electric drives	1	PD, CCH	5	150	15/15/15	105	E				5			
ERG620	Electrical equipment of substations and power plants	2	PD, CCH	4	120	30/0/15	75	E				4			
ERG621	Digital electrical apparatus	2	PD, CCH	4	120	15/15/15	75	E				4			
ERG610	Control system software		PD, UC	6	180	30/15/15	120	E					6		
ERG563	Power and electrotechnical equipment		PD, UC	4	120	30/0/15	75	E					4		
ERG622	Microprocessor digital protection	1	PD, CCH	6	180	30/0/30	120	E					6		
ERG623	Computerized protection and safety of electrical systems	1	PD, CCH	6	180	30/0/30	120	E					6		
ERG632	Calculation, projecting and modeling of power supply systems	2	PD, CCH	5	150	15/0/30	105	E					5		
ERG629	Calculation, projecting and modeling of electrical power networks and systems	2	PD, CCH	5	150	15/0/30	105	E					5		
ERG630	Calculation, design and modeling of electrical system automation	2	PD, CCH	5	150	15/0/30	105	E					5		
ERG631	Calculation, design and modeling of automated electric drive	2	PD, CCH	5	150	15/0/30	105	E					5		
ERG508	Lighting technology and lighting	1	PD, CCH	5	150	30/0/15	105	E						5	
ERG624	Energy-saving and resource-saving technologies in power engineering	1	PD, CCH	5	150	30/0/15	105	E						5	
ERG625	Quality of electrical energy	2	PD, CCH	5	150	30/0/15	105	E						5	
ERG626	Power consumption optimization tools	2	PD, CCH	5	150	30/0/15	105	E						5	
ERG627	Operation and diagnostics of electrical equipment	3	PD, CCH	5	150	30/0/15	105	E						5	
ERG124	Basics of electrical safety	3	PD, CCH	5	150	15/15/15	105	E						5	

ERG628	Installation and adjustment of electrical equipment	3	PD, CCH	5	150	30/0/15	105	E						5	
M-9. Module of final attestation															
ECA103	Final examination		FA	8										8	
M-8. Module of professional disciplines in Digital power engineering															
ERG504	Laboratory workshop on modern industrial technologies in the electric power industry I		PD, UC	5	150	0/45/0	105	E			5				
ERG527	Electrical machines		PD, UC	5	150	30/15/0	105	E			5				
Additional type of training (ATT)															
AAP500	Military training														
Total based on UNIVERSITY:										33	32	30	30	37	23
										65		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	27	0	5	32
BD	Cycle of basic disciplines	0	56	25	81
PD	Cycle of profile disciplines	0	29	35	64
Total for theoretical training:		27	85	65	177
FA	Final attestation				8
TOTAL:					185

Decision of the Educational and Methodological Council of KazNRTU named after K.Satpayev. Minutes № 3 dated 20.12.2024

Decision of the Academic Council of the Institute. Minutes № 3 dated 19.12.2024

Signed:

Governing Board member - Vice-Rector for Academic Affairs

Uskenbayeva R. K.

Approved:

Vice Provost on academic development

Kalpeyeva Z. B.

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

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Department Chair - Power Engineering

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Representative of the Academic Committee from Employers

Abdykalykov G. Y.

____Acknowledged____

