Institute of Energy and mechanical
Department of Power Engineering

EDUCATIONAL PROGRAM

7M07113 – Electrical Engineering and power engineering

Code and classification of the field of education: **7M07 Engineering, manufacturing and construction industries**
Code and classification of training areas: **7M071 Engineering and Engineering affairs**
Group of educational programs: **M099 - Energy and electrical engineering**
NRK Level: **Level 7**
ORC Level: **Level 7**
Duration of study: **2 years**
Volume of credits: **120 ECTS**

Almaty 2024

Educational program **7M07113 «Electrical engineering and power engineering»** was approved at the meeting of K.I. Satbayev KazNRTU Academic Council

Minutes # 12 dated «22» 04 2024.

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

Minutes # 06 dated «19» 04 2024.

Educational program **7M07113 «Electrical engineering and power engineering»** was developed by Academic committee based on direction «Engineering and Engineering»

Full name	Academic degree/ academic title	Post	Place of work	Signature
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1. Description of the educational program

The professional activity of graduates of the program is directed in the field of electric power, thermal power engineering and electrical engineering.

The direction of the specialty and specialization program covers engineering and engineering.

The purpose of the Master's educational program "Electrical Engineering and Power Engineering" is to train scientific and scientific-pedagogical personnel with relevant professional knowledge and practical skills in the field of electric power industry, capable of solving problems of improving society, economy, production, science and education. The Master of Technical Sciences in the educational program "Electrical Engineering and Power Engineering" must have competencies in accordance with the types of professional activity:

- to search, analyze and process information to solve the set scientific and production tasks;
- demonstrate the ability to plan and conduct experiments, interpret the data obtained and draw conclusions;
- use modern information technologies to solve applied problems;
- to choose analytical and numerical methods in the development of mathematical models of electrical installations and systems, technological processes in the electric power industry;
- demonstrate knowledge for the analysis and synthesis of automatic control systems in the electric power industry;
- demonstrate scientific and mathematical principles of reliability of technical systems;
- know the methods of calculation and selection of power energy converters and conversion equipment;
- choose methods for calculating relay protection devices and analyze the reliability of their operation;
- know the methods of calculation and selection of elements of an automated electric drive;
- use modern systems and methods of electromechanical conversion

The educational program "Electrical Engineering and Power Engineering" provides training for masters in the following activities: Design and engineering activities

- the ability to compose and develop various simulation models and electrical circuits;
- knowledge to carry out technological and electric power calculations, to choose electrical and electromechanical equipment.

Design and technological activities

-the ability to justify the effective operating parameters and indicators of the electric power system;

- knowledge to develop energy-efficient, resource-saving technologies and measures to protect the environment;
- skills to make a business plan for a technological project.

Research activities

- the ability to conduct a literary and patent search;
- ability to plan and conduct research; - the ability to analyze and summarize the results of the study;
- skills to make reports and conclusions, publish research results;

Organizational and managerial activities

- the ability to organize the activities of the team, make work plans and set tasks;
- the ability to carry out activities for the organization of production, develop and compile the necessary documentation;
- ability to solve logistical issues and control the execution of tasks.

2. The purpose and objectives of the educational program

The purpose of the Master's educational program "Electrical Engineering and Power Engineering" is to train scientific and scientific-pedagogical personnel with relevant professional knowledge and practical skills in the field of electric power industry, capable of solving problems of improving society, economy, production, science and education.

Tasks of the EP: Based on the achievements of modern science, technology and production, to give knowledge and skills in the field of: - production of electric energy and substations; - electric power networks and systems; - power supply of enterprises; - automated electric drive; - relay protection and automation of electric power systems; - renewable energy. In case of successful completion of the full Master's degree course, the graduate is awarded the academic degree "Master of Technical Sciences in the field of Electric Power Engineering". The Master's degree program "Electrical Engineering and Power Engineering" differs from the existing educational program in the specialty 6M071800 – "Electric Power Engineering" by updating the internal content of the disciplines. The Master's degree program provides for further deepening of the competencies acquired in the bachelor's degree. In this connection, modern innovative disciplines have been introduced into the program:

-energy management system according to international standards;
- modern high voltage equipment;
- modeling of elements of electric power systems;
- management of the energy complex and regulation of the energy sector;
- theory and practice of technical experiment in EE;
- digital electric drive control systems;

- emergency and technological automation of power systems; - special and special automatic control systems in EE.

In the process of mastering the educational program, the Master of Technical Sciences in the field of electric power engineering must acquire the following key competencies:

- to search, analyze and process information to solve the set scientific and production tasks;
- demonstrate the ability to plan and conduct experiments, interpret the data obtained and draw conclusions;
- use modern information technologies to solve applied problems;
- to choose analytical and numerical methods in the development of mathematical models of electrical installations and systems, technological processes in the electric power industry;
- demonstrate knowledge for the analysis and synthesis of automatic control systems in the electric power industry;
- demonstrate scientific and mathematical principles of reliability of technical systems;
- know the methods of calculation and selection of power energy converters and conversion equipment;
- choose methods for calculating relay protection devices and analyze the reliability of their operation;
- know develop plans for the organization of innovative activities at the enterprise; - assess innovation and technological risks when introducing new technologies; - to know the principles of operation and specifics of emergency and technological automation of power systems;
- have practical skills in maintenance, repair and diagnostics of industrial digital electric drive control systems;
- demonstrate the ability to choose and use methods and methods of optimizing power grids;
- possess the ability to install, test, adjust and put into operation electric power and electrical equipment;
- organize and carry out the operation, repair and maintenance of industrial electrical installations;
- know the methods of overvoltage protection, insulation testing methods and operating principles of test installations;
- know the types of high-voltage electrical technologies used;
- be able to use methods of modeling electrical installations and electrical systems.

Obr the ability to compose and develop various simulation models and electrical circuits; - knowledge to carry out technological and electric power calculations, to choose electrical and electromechanical equipment;

Design and technological activities - the ability to justify the effective operating parameters and indicators of the electric power system;

- knowledge to develop energy-efficient, resource-saving technologies and measures to protect the environment;
- skills to make a business plan for a technological project;

Research activities - the ability to conduct a literary and patent search;
- ability to plan and conduct research;
- the ability to analyze and summarize the results of the study;
- skills to make reports and conclusions, publish research results;

Organizational and managerial activities
- the ability to organize the activities of the team, make work plans and set tasks;
- the ability to carry out activities for the organization of production, develop and compile the necessary documentation;
- ability to solve logistical issues and control the execution of tasks.

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

The previous level of education of applicants is higher professional education (bachelor's degree). The applicant must have a diploma of the established sample and confirm the level of knowledge of the English language with a certificate or diplomas of the established sample. The procedure for admission of citizens to the magistracy is established in accordance with the "Standard rules for admission to training in educational organizations implementing educational programs of postgraduate education".

The formation of a contingent of undergraduates is carried out by placing a state educational order for the training of scientific and pedagogical personnel, as well as paying for training at the expense of citizens' own funds and other sources. The State provides citizens of the Republic of Kazakhstan with the right to receive free postgraduate education on a competitive basis in accordance with the state educational order, if they receive education of this level for the first time. At the "entrance", a master's student must have everything.

Special requirements for admission to the program apply to graduates of related educational programs: heat power engineering, automation and management.

Code	Type of competence	Description of competence	Competence result	Ответствен-ный
Common (Implies full training with possible additional depending on the level of knowledge)				

G1	Communication	Fluent monolingual oral, written and communication skills - ability of non-fluent communication with a second language - The ability to use communicative	Complete 4-year training with the development of at least 240 academic credits (including 120 contact classroom academic credits) with the possible transfer of credits in the second language where	Department of Kazakh and Russian Language, Department of English
		communication in various situations - there are basics of academic writing in the native language - diagnostic test for language level	students have an advanced level. The language level is determined by passing a diagnostic test	
G2	Mathematical literacy	- Basic mathematical thinking at the communication level - ability to solve situational problems based on the mathematical apparatus of algebra and the principles of mathematical analysis - diagnostic test for mathematical literacy in algebra	Complete 4-year training with the development of at least 240 academic credits (including 120 contact classroom academic credits). With a positive diagnostic test, the level of mathematics is 1, with a negative one – the level of algebra and the beginning of analysis	Mathematical literacy
G3	Basic literacy in natural sciences	- basic understanding of the scientific picture of the world with an understanding of the essence of the basic laws of science - understanding of basic hypotheses, laws, methods, formulation of conclusions and estimation of errors	Complete 4-year training with the development of at least 240 academic credits (including 120 contact classroom academic credits). With a positive diagnostic test, the level of Physics 1, General Chemistry, with a negative – the level of the Beginning of physics and the Basic basics of chemistry	Departments in the areas of natural sciences
SPECIFIC (implies reduced training due to credit transfer, depending on the level of knowledge on competencies for graduates of 12-year schools, colleges, universities, including humanitarian and economic areas)				
S1	Communication	- Fluent bilingual oral, written and communication skills - ability of non-fluent communication with a	Full credit transfer by language (Kazakh and Russian)	Department of Kazakh and Russian Language

		third language - skills of writing text of various 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 for fullfledged perception, interpretation of the original text		
S2	Mathematical literacy	- Special mathematical thinking using induction and deduction, generalization and concretization, analysis and synthesis, classification and systematization, abstraction and analogy - the ability to formulate, justify and prove	Transfer of credits in the discipline of Mathematics (Calculus) I	Department of Mathematics
		provisions - application of general mathematical concepts, formulas and extended spatial perception for mathematical problems - complete understanding of the basics of mathematical analysis		
S3	Special literacy in natural sciences (Physics, Chemistry, Biology and Geography)	- A broad scientific perception of the world, assuming an understanding of natural phenomena - critical perception for understanding the phenomena of the surrounding world - cognitive abilities to formulate a scientific understanding of the forms of existence of matter, its interaction in nature	Transfer of credits in Physics I, General Chemistry, General Biology, Introduction to Geology, Introduction to Geodesy; Educational practice, etc.	Departments in the areas of natural sciences

S4	English language	- readiness for further selfstudy in English in various fields - readiness to gain experience in project and research work using English	Transfer of English language credits above academic to professional level (up to 15 credits)	Department of English
S5	Computer skills	- Basic programming skills in one modern language - using software and applications to teach various disciplines	Transfer of credits in the discipline Introduction to information and communication technologies, Information and communication technologies	Department of Software Engineering
S6	Sociohumanitarian competencies and behavior	- understanding and awareness of the responsibility of each citizen for the development of the country and the world - the ability to discuss ethical and moral aspects in society, culture and science	Transfer of credits in the Modern history of Kazakhstan (with the exception of the state exam)	Department of Social Disciplines
		- critical understanding and capacity for polemics for debating on modern scientific hypotheses and theories	Transfer of credits in philosophy and other humanities	
PROFESSIONAL				
(implies reduced training due to credit transfer, depending on the level of knowledge on competencies for graduates of colleges, secondary schools, universities)				
P1	Professional competencies	- critical perception and deep understanding of professional competencies at level 5 or 6 - the ability to discuss and polemize on professional issues within the framework of the mastered program	Transfer of credits in basic professional disciplines, including introduction to the specialty, engineering ethics, technology of robotic production, technological automation facilities, theoretical foundations of electrical engineering, technological measurements and instruments, mathematical foundations of control theory, electronic automation devices.	Graduating Department

P2	General engineering competencies	- basic general engineering skills and knowledge, the ability to solve general engineering tasks and problems - be able to use application software packages for processing experimental data, solving systems of algebraic and differential equations	Transfer of credits in general engineering disciplines (engineering graphics, descriptive geometry, fundamentals of electrical engineering, fundamentals of microelectronics.)	Graduating Department
P3	Engineering and computer competencies	- basic skills of using computer programs and software systems to solve general engineering tasks	Transfer of credits in the discipline of computer graphics, computer modeling and programming in the MatLab environment.	Graduating Department
P4	Socio-economic competencies	- critical understanding and cognitive ability to reason on contemporary social and economic issues - basic understanding of the economic assessment of the objects of study and the profitability of projects.	Transfer of credits in socio-humanitarian and technical-economic disciplines to the credit of the elective cycle	Graduating Department

The university may refuse to transfer credits if the low diagnostic level is confirmed or the final grades for completed disciplines were lower than A and B.

4. Passport of the educational program

4.1. General information

№	Field name	Note
1	Code and classification of the field of education	7M07 Engineering, manufacturing and construction industries
2	Code and classification of training areas	7M071 Engineering and Engineering affairs
3	Group of educational programs	M099 Energy and electrical engineering
4	Name of the educational program	7M07113 - Electrical engineering and power engineering
5	Brief description of the educational program	The educational program "Electrical Engineering and Power Engineering" provides training for masters in the following activities: Design and engineering activities

		- the ability to compose and develop various simulation models and electrical circuits; - knowledge to carry out technological and electric power calculations, to choose electrical and electromechanical equipment; Design and technological activities - the ability to justify the effective operating parameters and indicators of the electric power system; - knowledge to develop energy-efficient, resource-saving technologies and measures to protect the environment; - skills to make a business plan for a technological project; Research activities - the ability to conduct a literary and patent search; - ability to plan and conduct research; - the ability to analyze and summarize the results of the study; - skills to make reports and conclusions, publish research results; - Organizational and managerial activities - the ability to organize the activities of the team, make work plans and set tasks; - the ability to carry out activities for the organization of production, develop and compile the necessary documentation; - ability to solve logistical issues and control the execution of tasks
6	Purpose of the OP	The purpose of the Master's educational program "Electrical Engineering and Power Engineering" is to train scientific and scientificpedagogical personnel with relevant professional knowledge and practical skills in the field of electric power industry, capable of solving
		problems of improving society, economy, production, science and education.
7	Type of EP	New
8	The level of the NRK	7 level
9	ORC Level	7 level
10	Distinctive features of the EP	No
11	List of competencies of the educational program:	**B – basic knowledge, skills and abilities** B1 is capable of philosophical analysis of social phenomena, personality behavior and other phenomena. I am ready to conduct a philosophical assessment of social phenomena; B2 – to know and put into practice the basics of engineering professional ethics; B3 – be able to analyze the current problems of the modern history of Kazakhstan. **P – professional competencies**

		P1 – a wide range of theoretical and practical knowledge in the professional field; P2 –is able to analyze electrical circuit diagrams and wiring diagrams of electric power systems. P3 – ready to install, adjust and operate electromechanical and electrical systems; P4 – ready to participate in the development and design of new facilities of traditional and alternative energy. **O – 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.I am ready to use English in my professional activity in the field of electric power industry; 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. I am ready to use Kazakh (Russian) language in my professional activity in the field of electric power industry; 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 – to know and solve the problems of human influence 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 problems, reasoning conclusions and competent information management; C2 –to be a specialist in conducting experimental studies of electric power facilities; C3 –to be a researcher on the study of modern electromechanical and electrical systems;
12	Learning outcomes of the educational program:	The graduate of this educational program is awarded the academic degree "Master" Master of Technical Sciences in the direction. A graduate who has mastered master's degree programs must have the following general professional competencies: – the ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activities, develop their innovative abilities; – the ability to independently formulate research goals, establish the sequence of solving professional tasks; – the ability to apply in practice the knowledge of fundamental and applied sections of disciplines that

		determine the orientation (profile) of the master's degree program; – the ability to professionally choose and creatively use modern scientific and technical equipment to solve scientific and practical problems; – the ability to critically analyze, present, defend, discuss and disseminate the results of their professional activities; – proficiency in the preparation and execution of scientific and technical documentation, scientific reports, reviews, reports and articles; – willingness to lead a team in the field of their professional activities, tolerantly perceiving social A graduate who has mastered the master's degree program must have professional competencies corresponding to the types of professional activities that the master's degree program is focused on: research activity: - the ability to form diagnostic solutions to professional problems by integrating fundamental sections of sciences and specialized knowledge acquired during the development of the master's degree program; – the ability to independently conduct scientific experiments and research in the professional field, generalize and analyze experimental information, draw conclusions, formulate conclusions and recommendations; – the ability to create and explore models of the studied objects based on the use of in-depth theoretical and practical knowledge in the field of production, transmission and consumption of electrical energy; scientific and production activity: - the ability to independently carry out production and scientific and production field, laboratory and interpretive work in solving practical problems; – the ability to professionally operate modern field and laboratory equipment and devices in the field of the master's degree program; – the ability to use modern methods of processing and interpreting complex information to solve production problems; project activity: – the ability to independently draw up and submit projects of research and scientific-production works; – readiness to design complex research and scientificproduction works in solving professional tasks; organizational and managerial activity: - readiness to use practical skills of organization and management of research and scientific-production works in solving professional tasks;

		– readiness for the practical use of normative documents in the planning and organization of scientific and production work; scientific and pedagogical activity: - ability to conduct seminars, laboratory and practical classes; – the ability to participate in the management of scientific and educational work of students in the field of production, transmission and consumption of electric energy. When developing a master's degree program, all general cultural and general professional competencies, as well as professional competencies related to those types of professional activities that the master's program focuses on, are included in the set of required results of mastering the master's program. Mandatory standard requirements for completing the Master's degree and awarding the academic degree of Master of Technical Sciences: mastering at least 59 academic credits of theoretical training, passing the state exam in the specialty, preparation and defense of the final dissertation work before the SAC. Special requirements for completing a master's degree in this program , the graduate must know: - methods of construction of modern electric power and electromechanical systems; - current trends in the development of electrical equipment and electrical installations, technical means and automation systems of electric power facilities; - standards and industry rules, methodological and regulatory materials accompanying the operation, installation, commissioning and design of electric power systems; be able to: - develop and research traditional and autonomous electric power systems using modern technical and technological means.
13	Form of training	Daytime
14	Duration of training	2 years
15	Volume of loans	120 ECTS
16	Languages of instruction	Russian
17	Academic degree awarded	Master of Technical Sciences in EP "7M07113 - Electrical Engineering and Power Engineering"
18	Developer(s) and authors:	Sarsenbaev Y.A., Khidolda Y.

	КК1
РО1	Possess broad knowledge and skills in the field of renewable energy sources. To know solar, wind, wave, geothermal and hydroelectric power plants, the principles of their operation, operation.

PO2	Possess knowledge of the main pedagogical trends of our time. Be able to conduct a dialogue with students, basic teaching skills, elements of psychology.
PO3	Use a scientific approach to studying the problems of the energy complex. Solve the problems of supplying and providing electricity to remote villages through renewable energy sources.
PO4	Apply knowledge of the main philosophical directions - from ancient Chinese and Greek philosophical schools to modern schools of philosophy, the presence of a technical, philosophical outlook on life in addition to a technical one.
PO5	Demonstrate professional knowledge of the English language, with high technical level negotiation skills using technical terminology.
PO6	Possess knowledge in the field of management of the energy complex and regulation of the energy sector.
PO7	Demonstrate knowledge in the field of development of electric power systems and automation and management of technical and technological systems using modern methods and tools for management, control and analysis.
PO8	Possess knowledge in the field of power electronics, automation of processes in them.
PO9	Be able to work with electric power systems and networks, automatic control devices and relay protection, power supply systems for facilities and industries
PO10	Know microprocessor technologies and equipment relay protection.
PO11	Demonstrate knowledge of international and domestic standards, prospects for the technical development of the energy sector, principles of operation, technical characteristics, design features of the used electric power plants and systems, advanced foreign experience in the field of electric power industry.
PO12	Use knowledge and skills of working with various types of electric transport, electrical facilities of industrial enterprises, low and high voltage factory electrical equipment, electrical installations, electrical networks of enterprises, organizations and institutions.

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

№	Name of the discipline	Brief description of the discipline	Number of credits	Generated learning outcomes (codes)											
				PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	Foreign language (professional)	The course is designed for undergraduates of technical specialties to improve and develop foreign language communication skills in professional and academic fields. The course introduces students to the general principles of professional and academic intercultural oral and written communication using modern pedagogical technologies.public discussions; interpret and present the results of scientific research in a foreign language.	3					+							
2	History and philosophy of science	The subject of philosophy of science, dynamics of science, specifics of science, science and pre-science, antiquity and the formation of theoretical science, the main stages of the historical development of science, features of classical science, non-classical and post-non-classical science, philosophy of mathematics, physics, engineering and technology, specifics of engineering sciences, ethics of science, social and moral responsibility of a scientist and engineer.	3				+								
3	Higher school pedagogy	Undergraduates will master the methodological and theoretical foundations of higher school pedagogy, plan and organize the processes of teaching and upbringing, master the communicative technologies of subject-subject interaction between a teacher and a master in the educational process of a university.	3		+										
4	Psychology of management	The discipline studies the modern role and content of psychological aspects in managerial activity. The improvement of the psychological literacy of the student in the process of implementing professional activities is considered. Self-improvement in the field of psychology and studying the composition and structure of management activities, both at	3		+										

		the local level and abroad. The psychological feature of modern managers is considered.													
5	Intellectual property and research	Purpose: the goal is to train specialists who can effectively manage rights to the results of intellectual activity in the field of science, as well as ensure their legal protection and commercialization. Contents: analysis of legal protection of research and development results, methods of commercialization of scientific inventions, ethical and legal aspects of scientific activity in the context of IP.	5			+								+	
6	Modeling of elements of electric power systems	Physical processes in energy systems. Mathematical models of the basic elements of the energy system. Modeling elements of the electrical system in the MatLab software environment.	5							+					
7	Reliability in power industry	The basic methods to ensure and improve reliability; methods for evaluating the reliability of components, maintenance and restoration of health and life of power equipment; methods of engineering calculation of reliability of complex systems and forecasting reliability of electric power systems; methods for testing the reliability of the systems	5									+			+
8	Optimal and adaptive control systems	The formulation of optimal control problems and methods for its solution, adaptive systems and methods for controlling adaptive systems, the synthesis of optimal and extremal systems.	5							+					
9	Specific and special automatic control systems in the power industry	Mathematical devices and methods used in the study of automatic control systems. Analysis of the processes in non-linear, discrete, stahosticheskih systems and delay systems, and variable parameters.	5								+	+			
10	Project Management	Purpose: Studying the principles of project management using modern business technologies Contents: The course studies the components of project management based on modern behavioral models of project-oriented business development management. The program is based on international standards PMI PMBOK, IPMA ICB and RK standards in the field of project management. The features of organizational management of business development through the interaction of strategic, project and operational management are studied	5						+						

11	Sustainable development strategies	The goal is to develop deep knowledge and competencies in the development and implementation of sustainable development strategies at various levels. The content covers a wide range of topics, ranging from global environmental challenges such as climate change, biodiversity loss and natural resource depletion, to socio-economic aspects including inequality, health and education.	5	+										+	
12	The theory of automated electric drive	Fundamentals of electric drive mechanics. Electromechanical properties of DC motors. Electromechanical properties of DC motors. Electromechanical properties of AC motors. Transients in electric drives. The choice of engines power.	5								+	+			
13	The theory of electromechanical energy conversion	Fundamentals of electric drive mechanics: equations of motion, reduction of moments and moments of inertia to the motor shaft. Energy conversion systems for direct and alternating current. Static and dynamic properties of systems with electromechanical energy conversion. Transient processes in electromechanical systems. Calculation and choice of power.	5								+	+			
14	Renewable energy sources	In the process of studying the discipline, students should understand the concept of providing consumers with electricity, understand the structure of the electric power industry, the relationship between its various links, have an idea of the latest achievements in obtaining renewable energy sources, get an idea of the composition of electricity consumers in various industries. The discipline focuses the knowledge gained in chemistry, biology, physics, theoretical foundations of electrical engineering on the practical problems of the electric power industry, shows their connection with special disciplines, processes and technologies for obtaining renewable energy sources from the appropriate materials used.	5	+											
15	Scientific and technical problems of power industry	The discipline addresses three groups of major problems related to meeting the growing demand for energy: a shortage of energy and energy, an increasing burden on the environment, geopolitical and social threats.	5			+								+	
16	Power electronics	Uncontrolled rectifiers: the main circuit parameters and ratios. Controlled rectifiers: regulation principles, main	5								+				

		characteristics, reversible circuits, control methods (separate joint), modes of operation: rectifier and inverter, thyristor protection against switching overvoltage. Regulators AC voltage: single-phase, three-phase, adjusting the characteristics of different regulators. Switching Regulators voltage Types pulse width modulation, the application controllers. Frequency converter with direct connection and the intermediate DC link. Application of frequency converters.													
17	Theory and practice of relay protection	Expansion of ideas about the possibilities of RH; Fixing and concretization of theoretical material concerning the principles of operation and arrangement of RH, their basic properties, application techniques; Gaining skills in calculating the parameters necessary for setting up the RH; Correct choice of methods and means of RH; Assessment of the effectiveness and reliability of the selected RH. Formation of clear ideas about the principle of the operation of RH devices, allowing them to participate in their development, works on installation and commissioning, servicing of RH equipment	5									+	+		
18	ASDC and optimization of the modes of power supply systems	The main objective of the discipline is to form a master's degree of knowledge about the optimization of energy systems, energy conversion, energy audits and energy-audit facilities, energy-saving technologies.	5							+		+			
19	High-voltage electrical technologies and equipment	High-voltage electrical technologies based on the use of strong electric and magnetic fields. Plasma gas discharge. Design of insulating structures for high-voltage electrical and electro-technological equipment. Features of the development of discharges in technological installations. Powerful pulse current sources, high voltage generators. The main electrotechnological high voltage equipment.	5												+
20	Monitoring and energy audit of power complexes	To prepare a specialist to solve the problems of design, research and operation of electric power and electrotechnical installations and systems, able to analyze the efficiency of energy conversion schemes, assess the prospects of new methods of energy production and introduce innovative developments into practice.	5			+			+						

21	Installation, commissioning and operation of eletrical equipment	The discipline introduces the organization and execution of works on installation, commissioning and operation of power installations, automated electric drive and automation systems for industrial plants and complexes	5								+				+
22	Design of industrial electric drives	Fundamentals of electric drive mechanics: equations of motion, reduction of moments and moments of inertia to the motor shaft. Determining the actual states of the object, synthesizing its structure, choosing the right criterion for managing the object, synthesizing the structure of the control system, evaluating the advantages of the selected structure, predicting the behavior of the synthesized control, signaling and regulation system, evaluating the advantages and disadvantages of the system.	5							+		+			
23	Energy management system according to international standards	The discipline studies the basics of energy management of enterprises. Framework for energy management, regulations, and requirements of the enterprise from the point of view of normative documents. The procedure for the implementation of energy management.	5						+						
24	Modern high voltage equipments	During the study of the discipline provides basic information about the calculation of electric fields, the nature of the breakdown of dielectrics, the design features of high-voltage insulation, the mechanisms of defects in the insulation and methods of its control, overvoltage and methods of protection against them.	5												+
25	Theory and practice of technical experiment in the power industry	The general equations of control objects. Identification (definition of the structure and parameters of the mathematical model) static (linear and nonlinear) characteristics and dynamic performance in the form of the transfer function as a result of accelerating the processing characteristics of the objects (in a step exposure at the entrance) exponential, S-shaped and vibrational forms (active experiment). Study on experimental method of identifying frequency characteristics. Determination of the transfer function of stochastic control objects on the basis of the solution of the integral equation Wiener-Hopf different methods (passive experiment).	5							+		+			

26	Digital control systems of electric drives	The concepts and mathematical foundations of discrete control systems. Mathematical analysis of digital control systems. Microprocessor control of electric tools. The principle of the state variables measuring devices (coordinate) in electric drives with digital control. Design of digital control of electric systems.	5							+					
27	Operation of electric power systems and networks	Proper planning and execution of preventive maintenance, planning and calculation of the number of spare parts, as well as ways to improve operational reliability.	5												+

NJSC "KAZAKH NATIONAL RESEARCH TECHNICAL UNIVERSITY named after K.I. SATPAEV"

SATBAYEV UNIVERSITY

APPROVED
Chairman of the Management Board-
Rector of Kaznu named after K.Satpayev
_____ M.M. Begentaev
«__» _____ 2024 .

CURRICULUM
of Educational Program on enrollment for 2024-2025 academic year

Educational program 7M07113 - "Electrical and Energy Engineering "
Group of educational programs M099 - "Power and Electrical Engineering"

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

Discipline code	Name of disciplines	Cycle	Total amount in credits	Total hours	Classroom amount lec/lab/pr	SIS (including TSIS) in hours	Form of control	Allocation of face-to-face training based on			
								1 course		2 course	
								1 semester	2 semester	3 semester	4 semester
CYCLE OF BASIC DISCIPLINES (BD)											
M-1. Module of basic training (university component)											
LNG213	English (professional)	BD UC	3	90	0/0/2	60	E	3			
HUM214	Management Psychology	BD UC	3	90	1/0/1	60	E	3			
HUM212	History and philosophy of science	BD UC	3	90	1/0/1	60	E		3		
HUM213	Higher school pedagogy	BD UC	3	90	1/0/1	60	E		3		
component of choice											
ERG222	Specific and special automatic control systems in the power industry	BD CCH	5	150	2/1/0	105	E	5			
ERG221	Optimal and adaptive control systems										
MNG781	Intellectual property and research				2/0/1						
ERG273	The theory of the automated electric drive	BD CCH	5	150	2/1/0	105	E	5			
ERG272	The theory of electromechanical energy conversion				2/0/1						
MNG782	Sustainable development strategies										
ERG218	Reliability in power industry	BD CCH	5	150	2/0/1	105	E			5	
MNG704	Project Management										
ERG214	Modeling of elements of electric power systems				2/1/0	105					
CYCLE OF PROFILE DISCIPLINES (PD)											
M-2. Module of specialized training in electric engineering (university component, component of choice)											
ERG233	Theory and practice of relay protection	PD UC	5	150	2/0/1	105	E	5			
ERG265	Scientific and technical problems of power industry	PD UC	5	150	2/0/1	105	E	5			
ERG269	Renewable energy sources	PD UC	5	150	2/0/1	105	E		5		
ERG252	Power electronics	PD UC	5	150	2/1/0	105	E		5		
ERG228	Design of industrial electric drives	PD, CCH	5	150	2/0/1	105	E			5	
ERG260	Theory and practice of technical experiment in the power industry										
ERG239	Digital control systems of electric drives	PD, CCH	5	150	2/1/0	105	E		5		
ERG203	ASDC and optimization of the modes of power supply systems			150	1/1/1	105	E				
ERG217	Installation, commissioning and operation of eletrical equipment	PD, CCH	5	150	2/1/0	105	E		5		
ERG241	Operation of electric power systems and networks			150							
ERG206	High-voltage electrical technologies and equipment	PD, CCH	5	150	2/0/1	105	E			5	
ERG246	Modern high voltage equipments										
ERG247	Energy management system according to international standards	PD, CCH	5	150	1/1/1	105	E			5	
ERG256	Monitoring and energy audit of power complexes				2/0/1	105					
M-3. Practice-oriented module											
AAP273	Pedagogical practice	BD UC	8							8	
AAP269	Research practice	PD UC	8								8
M-4. Experimental research module											
AAP268	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	4					4			
AAP268	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	4						4		
AAP251	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	2							2	
AAP255	Research work of a master's student, including internship and completion of a master's thesis	RWMS UC	14								14
M-5. Module of final attestation											

ECA212	Preparation and defense of a master's thesis	FA	8								8
Total based on UNIVERSITY:								30	30	30	30
								60		60	

Number of credits for the entire period of study					
Cycle code	Cycles of disciplines	Credits			
			university component (UC)	component of choice (CCH)	Total
BD	Cycle of basic disciplines		20	15	35
PD	Cycle of profile disciplines		28	25	53
	Total for theoretical training:	*0*	*44*	*40*	*88*
	RWMS				*24*
FA	Final attestation	12			8
	TOTAL:	12	44	40	120

Decision of the Academic Council of Kazntu named after K.Satpayev. Protocol № 12 "22" 04 2024 y.

Decision of the Educational and Methodological Council of Kazntu named after K.Satpayev. Protocol № 6 "19" 04 2024 y.

Decision of the Academic Council of the Instituteof Energy and Mechanical Engineering. Protocol № 4 "18" 01 2024 y.

Vice-Rector for Academic Affairs — **R.K. Uskenbayeva**

Director Institute of Energy and Mechanical Engineering — **K.K. Yelemessov**

Department Head «Power Engineering» — **Ye.A. Sarsenbayev**

Specialty Council representative from employers — **G.E. Abdykalykov**