EDUCATIONAL PROGRAM

6B07133 "Digital Energy "

code and Name educational programs

Level: *bachelor's degree*

Approved
The Board of Directors of JSC KazUTB named after K.Kulazhanova" from "02.04" 2025 protocol No. 3

Recommended
The Academic Council of JSC "KazUTB named after K. Kulazhanova" from "28.03" 2025 protocol No. 8

Astana – 2025

CONTENT

Preface

Educational program «6B07133 Digital Energy»was developed in accordance with the requirements of the State Compulsory Standard of Higher and Postgraduate Education, approved by the order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No. 2, as well as on the basis of professional standards: "Development of IoT systems" dated December 5, 2022 ; "Development of technical documentation" dated December 5, 2022.

Educational program 6B07133 "Digital Energy" was approved at the meeting of the Council on Academic Quality on "27" 03 2025, protocol No. 4
Chairman Baibolova L.K.

Educational program 6B07133 "Digital Energy" was approved at the meeting of the Academic Quality Commission of the Technological Faculty on "29" 11 2024, protocol No. 2
Chairman Zhunusova G.S.

Educational program 6B07133 "Digital Energy" was developed and discussed at the meeting of the Department of Information Technologies on "19" 11 2024, protocol No. 4
Head of Department Serimbetov B.A

Educational program	Edition 4	

Approval sheet

Educational program "6B07133 Digital energy "

AGREED:

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1 Passport of the educational programs

International Standard Classification of Education (ISCED) level	6
National Qualification Framework (NQF) level	6
Sectoral Qualifications Framework (SQF) level	6
Code and name of the field of education	6B07 Engineering, manufacturing and construction industries
Direction of training	6B071 Engineering and Engineering affairs
Number and name of the group educational programs	B062 Electrical engineering and energy
Code and name of the educational program (EP)	6B07133 Digital energy
Educational program profile	Higher engineering education in the field of "Digital Energy"
Goal of the educational program	The purpose of the educational program is to train highly qualified specialists for the energy industry with professional skills in the field of design, operation and management of energy complexes.
Competetion criterion of the educational program	240 academic credits
Language of instruction of the educational program	russian, kazakh
Distinctive features of the educational program	-
Partner University	-

2 Qualification characteristics of a graduate of an educational program

Degree awarded	Bachelor of Engineering and Technology in the educational program "6B07133 Digital Energy"
Field of professional activity	Digital energy specialists develop and implement intelligent energy process management systems using modern digital technologies. They ensure automation, monitoring and optimization of energy networks, including the integration of renewable energy sources and cybersecurity.
Types of professional activities	– development of digital solutions for automation of energy systems, – design of intelligent energy networks (Smart Grid). – operation of digital equipment and control systems, – implementation of remote monitoring and diagnostics technologies. – setup, configuration and maintenance of digital systems, – integration of IoT, Big Data and AI in the energy sector. – control and maintenance of the operability of digital infrastructure, – ensuring the reliability and safety of power systems.
Object of professional activity	The objects of professional activity in the field of digital energy are:

	energy systems and networks (generation, transmission, distribution and consumption of electricity); digital and intelligent energy process control systems (SCADA, EMS, Smart Grid, etc.); software and hardware systems for automation and monitoring of energy facilities; Renewable energy sources and their digital integration into the energy system; information technologies, including big data storage and processing systems, IoT, AI;
Functions of professional activity	The functions of professional activity in the field of digital energy include: development and implementation of digital solutions for energy process management; design, adjustment and operation of intelligent automation and dispatching systems; collection, processing and analysis of technological data using modern digital platforms; ensuring reliability, energy efficiency and cybersecurity of energy facilities; integration of renewable energy sources into digital energy infrastructure; participation in the maintenance and modernization of equipment using digital technologies.

3 Requirements for the content of the educational program

Name cycles and disciplines	Workload in academic credits
Cycle of general education disciplines(GED)	**56**
Required component	51
University component	5
Cycle basic disciplines (BD)	**89**
University component	25
Component of choice	62
Professional practice	2
Cycle profiling disciplines (MD)	**87**
University component,	15
Component of choice	55
Professional practice	17
Final assessment	**8**
Total	**240**

4 Additional educational programs (minor)

4.1 Minor "Modern aspects of artificial intelligence application"

Name of disciplines	Workload in academic credits
Introduction to Artificial Intelligence	5
Development of artificial neural networks	5
Artificial Intelligence in Management	5
Total	15

5 Competency map of the educational program "6B07133 Digital Energy"

Competence map of the educational program	Learning outcome code	Learning outcome (according to Bloom's Taxonomy)
Behavioural skills and personality traits (Softskills)	LO_{GED1}	It forms a system of general competencies that ensure the socio-cultural development of the personality of a future specialist based on his ideological, civic and moral position, oriented towards a healthy lifestyle.
	LO_{GED2}	He is capable of communication in oral and written forms in Kazakh, Russian and foreign languages to solve problems of interpersonal, intercultural and professional communication.
	LO_{GED3}	Promotes the development of information literacy through the acquisition and use of modern information and communication technologies in all fields of activity
Digital competencies (Digital skills)	LO1	Applies economic, legal aspects, fundamentals of financial literacy and sustainable development in professional activities
Professional skills (Hardskills)	LO2	Applies mathematical, natural science, digital and basic professional knowledge to perform engineering calculations of electrical and technical equipment.
	LO3	He has skills in the development and operation of electrical devices, systems and power plants.
	LO4	Carries out operation, maintenance and repair of electric power equipment, lighting systems and electric power transmission networks, taking into account modern technologies and regulatory requirements.
	LO5	Solves problems in the field of digital energy, taking into account the environmental aspects of life safety based on scientific research, innovation and business models
	LO6	Applies principles, methods, and regulatory frameworks for standardization, certification, and technical regulation to develop and evaluate energy standards.
	LO7	It uses digital tools to perform calculation tasks, design diagrams and draw up technical drawings, documentation for energy and electricity supply facilities.
	LO8	It monitors and manages automated processes in the energy sector using SCADA systems and SMART technologies.
	LO9	Develops software solutions for energy and automated,

		electromechanical systems using microprocessor technology and digital technologies.
	LO10	Develops intelligent digital solutions for the management and optimization of power systems and networks using artificial intelligence and neural network technologies.
	LO11	Provides protection, reliability and stable functioning of power systems using cryptographic analysis methods.
	LO12	Applies digital algorithms in the field of automatic control in the design, modeling and configuration of control systems for electric power facilities.

6 Learning outcomes of the educational program and modules

Key competencies	Learning Outcomes (LO) for the educational program	Name of module	Learning outcomes for the module	Name of disciplines that form learning outcomes
Behavioural skills and personal qualities (Softskills)	LO$_{GED1}$	Man and society are the basis of ideological and socio-political knowledge	Applies the basic laws of the history of Kazakhstan, philosophy, socio-political knowledge for effective socialization and adaptation in changing socio-cultural conditions, forming a personality capable of mobility in the modern world, critical thinking and physical self-improvement	Module of socio-political knowledge (political science, sociology, cultural studies, psychology)
				Physical culture
				History of Kazakhstan
				Philosophy
	LO$_{GED2}$	Information and communication module	Capable of interpersonal social and professional communication in Kazakh, Russian and foreign languages.	Russian language
				Foreign language
	LO$_{GED3}$		Has a command of various types of information and communication technologies for searching, storing, processing, protecting and distributing information	Information and communication technologies
Digital competencies (Digital skills)	LO1	Module of economic, legal, scientific and environmental knowledge	Demonstrates knowledge and understanding of facts, phenomena and complex dependencies in the field of economics, law, and the peculiarities of interaction between nature and society to ensure life safety	Module of economics, entrepreneurship, law and financial literacy (fundamentals of economics and entrepreneurship, fundamentals of law and anti-corruption culture, fundamentals of financial literacy)
	LO2	Electronics and methods of monitoring the condition of cable systems and electrical	Apply methods and means of electronic diagnostics to assess the technical condition of cable lines and electrical insulation, analyze the obtained data, identify damage and predict the service life of cable systems in order to improve the reliability and safety of operation of	Higher Mathematics
				Introduction to the specialty
				Physics
				ICT

		insulation	electrical power equipment.	Educational practice
Professional skills (Hardskills)	LO3	Electronics and methods of monitoring the condition of cable systems and electrical insulation	Apply methods and means of electronic diagnostics to assess the technical condition of cable lines and electrical insulation, analyze the obtained data, identify damage and predict the service life of cable systems in order to improve the reliability and safety of operation of electrical power equipment.	Theoretical foundations of electrical engineering Industrial electronics Theory and operation of electrical machines Electronic devices in production
		Design in energy networks	Develop design solutions for energy networks taking into account regulatory requirements, calculate electrical loads, select optimal power supply schemes and ensure the technical and economic feasibility of projects.	Electromechanical energy converters Electric drive theory
		Control and stability of electromechanical and power systems	Analyze the dynamic characteristics and stability of electromechanical and energy systems, develop and apply automatic control methods to ensure their reliable and efficient operation in various operating modes.	Properties and application of materials in electrical engineering Modern electrical materials
		Standardization and reliability assurance in engineering systems	Apply regulatory documents and standards in the process of design, operation and assessment of engineering systems, as well as conduct reliability analysis, identify failure risks and develop measures to improve the sustainability and safety of technical solutions.	Power electronics and energy converters
Professional skills (Hardskills)	LO4	Electronics and methods of monitoring the condition of cable systems and electrical insulation	Apply methods and means of electronic diagnostics to assess the technical condition of cable lines and electrical insulation, analyze the obtained data, identify damage and predict the service life of cable systems in order to improve the reliability and safety of operation of electrical power equipment.	Electric power systems and networks Modern energy conversion technologies Fundamentals of Electrical Power Transmission
		Design in energy networks	Develop design solutions for energy networks taking into account regulatory requirements, calculate electrical loads, select optimal power supply schemes and ensure the technical and economic feasibility of projects.	Power systems and power supply of industrial facilities
		Control and stability of electromechanical and power systems	Analyze the dynamic characteristics and stability of electromechanical and energy systems, develop and apply automatic control methods to ensure their reliable and efficient operation in various operating modes.	Architectural and industrial lighting Energy-saving technologies in lighting

Professional skills (Hardskills)	LO5	Scientific and innovative activities and entrepreneurship in digital energy	Develop and implement innovative projects in the field of digital energy, evaluate their technical and economic efficiency, apply the principles of entrepreneurship and commercialization of scientific developments in the energy sector.	Fundamentals of Scientific Research
				Digital Energy: Innovations and Business Models
				Startups in digital energy
		Man and society: the foundations of ideological and socio-political knowledge	Applies the basic laws of the history of Kazakhstan, philosophy, socio-political knowledge for effective socialization and adaptation in changing socio-cultural conditions, forming a personality capable of mobility in the modern world, critical thinking and physical self-improvement	Sustainable development, ecology and life safety
	LO6	Standardization and reliability assurance in engineering systems	Apply regulatory documents and standards in the process of design, operation and assessment of engineering systems, as well as conduct reliability analysis, identify failure risks and develop measures to improve the sustainability and safety of technical solutions.	Standardization and conformity assessment
				Standardization, certification and measuring instruments
Professional skills (Hardskills)	LO7	Design in energy networks	Develop design solutions for energy networks taking into account regulatory requirements, calculate electrical loads, select optimal power supply schemes and ensure the technical and economic feasibility of projects.	CAD
				3D modeling of power facility control systems
				Technical documentation and graphic symbols in energy
				Engineering design
				Basics of reading and designing electrical circuits
				Design, calculation of electrical networks
				Design and operation of power supply systems
Professional skills (Hardskills)	LO8	Electronics and methods of monitoring the condition of cable systems and electrical insulation	Apply methods and means of electronic diagnostics to assess the technical condition of cable lines and electrical insulation, analyze the obtained data, identify damage and predict the service life of cable systems in order to improve the reliability and safety of operation of electrical power equipment.	SCADA systems in energy
				Instruments and methods of measurement in electric power engineering
				Automated control and measurement systems in energy

		Control and stability of electromechanical and power systems	Analyze the dynamic characteristics and stability of electromechanical and energy systems, develop and apply automatic control methods to ensure their reliable and efficient operation in various operating modes.	Elements and equipment of automation control systems
				Industrial practice 1
		Design in energy networks	Develop design solutions for energy networks taking into account regulatory requirements, calculate electrical loads, select optimal power supply schemes and ensure the technical and economic feasibility of projects.	Electrical insulating materials and their condition monitoring
				Diagnostics and monitoring of cable networks
		Digital and dispatching technologies for power industry management	Apply modern digital and dispatch technologies to monitor, control and optimize the operating modes of electric power systems, use SCADA, EMS and other platforms software to improve the efficiency, reliability and security of power supply.	Fundamentals of SMART technologies in energy systems
				Industrial practice 2
	LO9	Digital and dispatching technologies for power industry management	Apply modern digital and dispatch technologies to monitor, control and optimize the operating modes of electric power systems, use SCADA, EMS and other platforms software to improve the efficiency, reliability and security of power supply.	Industrial Controller Programming Technologies
				Digital and microprocessor technology
				Digital automation in power grids
		Design in energy networks	Develop design solutions for energy networks taking into account regulatory requirements, calculate electrical loads, select optimal power supply schemes and ensure the technical and economic feasibility of projects.	Automation of electromechanical systems
Professional skills (Hardskills)	LO10	Electronics and methods of monitoring the condition of cable systems and electrical insulation	Apply methods and means of electronic diagnostics to assess the technical condition of cable lines and electrical insulation, analyze the obtained data, identify damage and predict the service life of cable systems in order to improve the reliability and safety of operation of electrical power equipment.	Intelligent algorithms and technologies in power grid protection systems
				Development of artificial neural networks
		Digital and dispatching technologies for power industry management	Apply modern digital and dispatch technologies to monitor, control and optimize the operating modes of electric power systems, use SCADA, EMS and other platforms software to improve the efficiency, reliability and security of power supply.	Industrial Internet of Things
				Introduction to Artificial Intelligence
				Artificial Intelligence in Facility

				Management
				Intelligent control systems for electrical networks
				Intelligent control systems based on PLC
Professional skills (Hardskills)	LO11	Standardization and reliability assurance in engineering systems	Apply regulatory documents and standards in the process of design, operation and assessment of engineering systems, as well as conduct reliability analysis, identify failure risks and develop measures to improve the sustainability and safety of technical solutions.	Dynamic and static stability of power systems
				Reliability of electric power systems
		Digital and dispatching technologies for power industry management	Apply modern digital and dispatch technologies to monitor, control and optimize the operating modes of electric power systems, use SCADA, EMS and other platforms software to improve the efficiency, reliability and security of power supply.	Cryptographic methods of information protection
	LO12	Design in energy networks	Develop design solutions for energy networks taking into account regulatory requirements, calculate electrical loads, select optimal power supply schemes and ensure the technical and economic feasibility of projects.	Models and algorithms for power system control
				Structure and functional principles of automated control systems for power grid facilities
				Pre-graduate practice
		Control and stability of electromechanical and power systems	Analyze the dynamic characteristics and stability of electromechanical and energy systems, develop and apply automatic control methods to ensure their reliable and efficient operation in various operating modes.	Digital Dispatch Control Systems in Energy Infrastructure
		Standardization and reliability assurance in engineering systems	Apply regulatory documents and standards in the process of design, operation and assessment of engineering systems, as well as conduct reliability analysis, identify failure risks and develop measures to improve the sustainability and safety of technical solutions.	Intelligent methods for ensuring the stability of energy systems
		Digital and dispatching technologies for power industry management	Apply modern digital and dispatch technologies to monitor, control and optimize the operating modes of electric power systems, use SCADA, EMS and other platforms software to improve the efficiency, reliability and security of power supply.	Automatic control theory
				Renewable Energy Management
				Final assessment

7 The relationship between the attainability of the formed learning outcomes according to the educational program and academic disciplines

№	Name of the disciplines	Brief description of the discipline	Number of credits	Formed learning outcomes (codes)														
				LO$_{GED1}$	LO$_{GED1}$	LO$_{GED1}$	LO1	LO2	LO3	LO4	LO5	LO6	LO7	LO8	LO9	LO10	LO11	LO12
		Cycle of general education disciplines University component/Elective component																
1.	Module of socio-political knowledge (political science, sociology, cultural studies, psychology)	This program involves studying four scientific disciplines - sociology, political science, cultural studies, psychology, each of which has its own subject, terminology and research methods. Interactions between these scientific disciplines are carried out on the basis of the principles of information complementarity; integrativity; methodological integrity of the research approaches of these disciplines; commonality of the methodology of training focused on the result; a unified systemic representation of the typology of learning outcomes as formed abilities. In the disciplines of sociology and psychology, special attention is paid to inclusion as a key social and humanistic value. It is considered an integral part of modern social and psychological knowledge, contributing to the formation of a respectful attitude towards social and individual diversity, recognition of human rights and the principles of equality in students.	8	+														
2.	Physical culture	This program is aimed at studying the general education discipline "Physical Education", which provides physical training in accordance with world educational standards. The program defines joint cooperation between the teacher and the student in the process of physical education throughout the entire training in the context of the requirements for the level of mastery of the discipline.	8	+														
3.	History of Kazakhstan	The program consists of five thematic blocks: Ancient people, the formation of a nomadic civilization, the Turkic civilization and the Great Steppe, Kazakhstan in the new era (XVIII - early twentieth centuries), Kazakhstan in	5	+														

		the Soviet period, Independent Kazakhstan. The purpose of the discipline is to provide objective knowledge about the main stages of the development of the history of Kazakhstan from ancient times to the present.																
4.	Philosophy	This program is aimed at studying the updated content of the general education discipline "Philosophy", developing openness of consciousness in students, understanding of their own national code and national self-awareness, spiritual modernization, competitiveness, realism and pragmatism, independent critical thinking, the cult of knowledge and education, the assimilation of such key ideological concepts as justice, dignity and freedom, as well as the development and strengthening of the values of tolerance, intercultural dialogue and the culture of peace.	5	+														
5.	Russian language	This program on the general education discipline "Kazakh language" is aimed at a new format of language learning and the formation of socio-cultural knowledge, improvement of the student's communicative competence, and development of personal potential. This program is intended to develop the linguistic personality of the student, capable of carrying out cognitive and communicative activities in Russian in the areas of interpersonal, social, professional, and intercultural communication in the context of the implementation of state programs of trilingualism and spiritual modernization of national consciousness.	10		+													
6.	Foreign language	This program is designed to provide training for students in the general education discipline "Foreign Language" as one of the compulsory disciplines of the general education cycle. The goal of the program is to develop intercultural and communicative competence of students in the process of foreign language education at a sufficient level (A2, Common European Framework of Reference) and the level of basic sufficiency (B1, Common European Framework of Reference). Depending on the level of training, the student reaches level B2 of the Common European Framework of Reference at the time of completion of the course, if the student's language level at the start is higher than level B1 of the Common European Framework of Reference.	10		+													
7.	Information and communication technologies	The program is aimed at studying the updated content of the general education discipline "Information and Communication Technologies" (hereinafter referred to as the discipline), developing the ability to critically understand the	5			+												

		role and importance of modern information and communication technologies in the era of digital globalization, developing a new "digital" thinking, acquiring knowledge and skills in using modern information and communication technologies in various types of activities.																
8.	Module of economics, entrepreneurship, law and financial literacy (fundamentals of economics and entrepreneurship, basics of law and anti-corruption culture, basics of financial literacy)	Integrated discipline covers the fundamentals of economics, entrepreneurship, law and financial literacy. Examines key economic concepts, business principles, legal aspects of business and the basics of anti-corruption culture. Examines basic principles of financial planning, personal finance and investment management. Develops skills for effective economic decision-making, legal defense, building sustainable business competences and personal financial management	5				+											
		Cycle of basic disciplines University component/ Elective component																
9.	Introduction to the specialty	The student demonstrates knowledge of the history and stages of automation development, as well as key concepts and terms. He understands the role of automation in production processes, its importance for improving efficiency and quality, and applies basic principles to the analysis and description of technological processes. Based on the theoretical knowledge gained, the student creates simple process automation schemes.	4					+										
10.	Higher mathematics	The discipline is aimed at studying the mathematical apparatus that allows you to model and solve mathematical problems, practical problems of elements of linear and vector algebra, mathematical analysis, probability theory. After mastering the discipline, students will be able to apply mathematical methods to solve problems in their professional activities.	5					+										
11.	Theoretical foundations of electrical engineering	The course examines the basic concepts and methods in the field of electrical engineering, gives students the opportunity to understand electrical and magnetic phenomena, choose the right elements of electrical circuits and use them effectively. The course also examines the principles of electrical circuits,	5						+									

		circuit design, conversion methods, as well as the processes of production and distribution of electrical energy.																	
12.	Sustainable development, ecology and life safety	The course is aimed at forming a systemic understanding of the principles of ensuring balance between economy, social development of society, preservation of environment, protection of life and human health. Develops skills of effective management of energy and waste in the circular economy in the development of national strategies and implementation of business processes; analysis, forecasting and minimization of technological, natural and social risks; Sustainable lifestyle and responsible attitude to one's own security.	5								+								
13.	Physics	The discipline studies fundamental physical laws and their application in technology. The sections of physics such as mechanics, molecular physics, thermodynamics, electromagnetism and optics are considered. Measurement methods in experimental studies are being studied. As a result, students gain an understanding of physical processes and their application in the development and analysis of technical systems and devices.	6					+											
14.	Technical documentation and graphic symbols in the energy industry	The discipline studies the principles of developing drawings, design and operational documentation, as well as the use of digital tools for their creation and processing. Competencies are being formed in reading, formatting and digitalizing design and operational documentation based on the requirements of rules and standards that provide professional training in the field of digital design and technical support of energy facilities.	4										+						
15.	Fundamentals of reading and designing electrical circuits	The discipline studies the basic principles of reading and designing electrical circuits, including familiarity with symbols and standards, methods of analyzing electrical circuits, designing electrical connections and components, as well as the use of specialized software tools for circuit development and modeling. As a result of the study, students will master the basics of reading and designing electrical circuits, correctly interpret electrical circuits of various complexity, develop and analyze circuits to ensure the safe and efficient operation of electrical systems.	4										+						
16.	Instruments and measurement	The discipline studies various instruments and measurement methods in the electric power industry, including technologies for measuring electrical	5											+					

	methods in the electric power industry	network parameters, monitoring electricity quality, measuring currents, voltages and capacities, as well as the use of modern tools for diagnosing and monitoring the operation of energy equipment. As a result of the study, students will master the principles of operation of instruments and measurement methods in the electric power industry, select and apply measuring devices to control the parameters of electric power systems, analyze measurement results to ensure their accuracy and reliability.																	
17.	Automated control and measurement systems in the energy industry	The discipline studies the principles of construction, functioning and application of automated control and measurement systems in the energy sector, covering modern measurement technologies, sensors, interfaces and software tools for monitoring and diagnostics of energy facilities. As a result of the study, students will master the principles of building automated control and measurement systems, work with modern measuring instruments in the energy sector, analyze the parameters of power equipment, apply methods of processing and interpreting measurement information.	5												+				
18.	Industrial electronics	The discipline studies the basics of electronics used in industry. It includes the principles of operation of semiconductor devices, power electronics, converters, power supplies and sensors. Examines circuit design, control of electric drives, and protection of electrical equipment.	5						+										
19.	Electronic devices in production	The discipline studies the principles of operation and application of electronic devices in production processes, including their role in automation, control and monitoring of production operations, the use of sensors, measuring devices, converters and control systems to improve the accuracy, reliability and efficiency of equipment. As a result of the study, students will master the principles of operation of electronic devices, their role and application in production processes, and use devices for monitoring, controlling and automating various stages of production.	5						+										
20.	Fundamentals of electric energy transmission	The discipline studies the principles and technologies of electric energy transmission, including the basics of electrical circuits and transformers, methods of voltage and current regulation, design and operation of power transmission lines, equipment to ensure reliable and efficient power supply. As a result of the study, students will master the principles of electric energy transmission, analyze the processes of transmission and distribution of	5							+									

		electricity, and develop solutions to improve the efficiency and reliability of energy supply at various stages of electric energy transmission.																	
21.	Electric power systems and networks	The discipline studies the structure, principles of operation, and basic elements of electric power systems and networks, including generation, transmission, distribution of electricity, design, operation, and maintenance of energy networks that provide stable and efficient power supply in various operating conditions. As a result of the study, students will master the principles of functioning of electric power systems and networks, analyze their structure and operating modes, develop methods for optimizing and improving the reliability of energy supply.	5						+										
22.	Engineering design	The discipline studies the processes of development, design and optimization of technical systems and structures. The course covers design methods, the use of CAD systems to create drawings and models, as well as principles for selecting materials and components for various types of projects. Special attention is paid to calculations, strength and reliability analysis, as well as interaction with other engineering disciplines in the implementation of projects.	4									+							
23.	3D modeling of power facility control systems	The discipline studies 3D modeling methods and technologies for the design and analysis of energy management systems, including the creation of digital counterparts, process visualization, integration with SCADA systems, and the use of 3D models to optimize the operation and maintenance of energy equipment.	4									+							
24.	Electrical insulation materials and control of their condition	The discipline studies the properties and applications of electrical insulation materials, including their choice depending on operating conditions, methods for monitoring their condition, diagnostics of insulation in energy systems, as well as modern technologies to prevent failures and ensure the reliability of electrical equipment. As a result of the study, students will master the properties of electrical insulation materials, choose them for various electrical devices, and use methods to monitor their condition to ensure the reliability and safety of electrical equipment.	5										+						
25.	Diagnostics and monitoring of	The discipline studies methods and means of diagnostics and monitoring of cable networks, including monitoring of technical condition, damage	5										+						

	cable networks	detection, analysis of insulation parameters and the use of modern diagnostic devices and technologies to ensure the reliability and safety of power systems. As a result of the study, students will master methods for diagnosing and monitoring cable networks, identify malfunctions, assess the technical condition of cable lines, and apply modern devices and technologies to ensure reliable, safe operation of cable systems.																	
26.	Reliability of electric power systems	The discipline studies the theoretical foundations and methods of ensuring the reliability of electric power systems, including assessing resilience to external and internal influences, modeling failures and emergencies, as well as developing strategies and technologies to minimize risks, increase the continuity of energy supplies and ensure safety in the operation of energy infrastructure. As a result of the study, students will master the basic principles of ensuring the reliability of electric power systems, analyze the factors affecting the smooth operation of power grids, apply methods to assess and improve reliability in the design and operation of electric power facilities.	4															+	
27.	Dynamic and static stability of power systems	The discipline studies the principles and methods of ensuring the stability of energy systems under various disturbances. Digital technologies of modeling, frequency and voltage regulation, and emergency control are considered. Competencies in sustainability analysis, application of modern software tools and development of solutions for reliable and safe operation of power grids are being formed.	4															+	
28.	Theory and operation of electric machines	The discipline studies the theoretical foundations of operation, designs of electric machines, features of energy transformation, calculation methods, analysis of electric machines, principles of operation, maintenance, diagnostics to ensure reliability and efficiency in energy systems and industrial installations. As a result of the study, students will master the theoretical foundations of the operation of electric machines, analyze their operational characteristics, develop and apply methods of diagnosis, maintenance, and repair of electric machines to ensure their reliable and efficient operation.	5						+										
29.	Electromechanical energy converters	The discipline studies the principles of operation, designs of electromechanical energy converters, including generators, motors, transformers, their characteristics, calculation methods, analysis, principles of	5						+										

		their application in various branches of energy, industry for efficient energy conversion and transmission. As a result of the study, students will master the principles of operation of electromechanical energy converters, analyze their characteristics, design and select converters for various technical systems, develop methods for controlling and optimizing their operation.																
30.	Power system management models and algorithms	The discipline studies 3D modeling methods and technologies for the design and analysis of energy management systems, including the creation of digital counterparts, process visualization, integration with SCADA systems, and the use of 3D models to optimize the operation and maintenance of energy equipment. As a result of the study, students will master the principles of 3D modeling of power facility management systems, create and analyze three-dimensional models to optimize the operation of power facilities, and use modern software tools to simulate and visualize control processes. The discipline studies mathematical models and algorithms for managing energy systems, including optimizing operating modes, load forecasting, balancing generation and consumption, and developing automated solutions to improve the sustainability, reliability, and efficiency of energy infrastructure. As a result of the study, students will master the methods of modeling and developing algorithms for managing energy systems, apply mathematical models to analyze and optimize the operation of power grids, and develop effective control algorithms to ensure the stability and reliability of energy supply.	5														+
31.	The structure and functional principles of automated control systems of power grid facilities	The discipline studies the structure, components and functional principles of automated control systems (ACS) of power grid facilities. The levels of management, the interaction of technical and software tools, the processes of collecting, processing and transmitting information, as well as the principles of building reliable and efficient automated control systems to ensure stable operation of power systems are considered.	5															+
32.	Fundamentals of SMART technologies in energy systems	The discipline studies the fundamentals of the application of SMART technologies in energy systems, including the integration of intelligent sensors, control automation, data collection and analysis, the use of Internet of Things (IoT) technologies and artificial intelligence to improve the efficiency and reliability of energy infrastructure. As a result of the study, students will	5											+				

		master the basics of SMART technologies in energy systems, apply intelligent methods of management, monitoring and optimization of energy consumption, and use modern solutions to improve the efficiency and sustainability of energy facilities.																
33.	The Industrial Internet of Things	The discipline covers the principles and technologies related to the application of the Internet of Things (IoT) in industry. The basics of connecting devices, sensors, and systems to the Internet for real-time data monitoring, management, and analysis are discussed. It includes the study of the architecture of IoT systems, data transmission protocols, as well as technologies for collecting and processing big data.	5															+	
34.	Theory of electric drive	The discipline studies the theoretical foundations of electric drives, including the principles of converting electrical energy into mechanical energy, analyzing the characteristics of various types of drives, methods of controlling electric drives, as well as their application in automation systems, industry and energy to improve the efficiency and reliability of mechanisms. As a result of the study, students will master the theoretical foundations of electric drives, analyze their characteristics, design control circuits for electric drives, and apply calculation methods to ensure efficient operation and reliability of electric drive systems.	5						+										
35.	Automation of electromechanical systems	The discipline studies methods and means of automating electromechanical systems, including principles of construction, control of drives, use of sensors and controllers, as well as modern technologies for improving reliability and energy efficiency in electric drive and production installations.	5													+			
36.	Computer-aided design system	The discipline studies the basics of using computer-aided design (CAD) systems in engineering practice, mastering work with modern software products, creating and analyzing projects, and effectively using automated tools to optimize design processes and improve the quality of finished products. As a result of the study, students will master the principles of computer-aided design (CAD), use software to develop, model, optimize projects in various fields of engineering, and use CAD to solve design problems for complex technical systems.	5										+						
37.	Design,	The discipline studies the methods of designing and calculating electrical	5										+						

	calculation of electrical networks	networks, including equipment selection, load calculation, determination of conductor cross-sections, calculation of energy losses, as well as the design of power supply schemes to ensure the reliability, safety and economic efficiency of energy systems. As a result of the study, students will master the methods of designing and calculating electrical networks, develop electricity distribution schemes, and calculate network parameters to ensure their efficiency, reliability, and safety in operation.																	
38.	Engineering design	The discipline studies the processes of development, design and optimization of technical systems and structures. The course covers design methods, the use of CAD systems to create drawings and models, as well as principles for selecting materials and components for various types of projects. Special attention is paid to calculations, strength and reliability analysis, as well as interaction with other engineering disciplines in the implementation of projects.	4										+						
39.	Properties and application of materials in electrical engineering	The discipline studies the properties of various materials used in electrical engineering, including conductors, insulating materials, magnetic and semiconductor materials, as well as their application in the design of electrical and electronic devices, cables, transformers and other components of electrical systems. As a result of the study, students will master the basic properties of materials used in electrical engineering, choose suitable materials for various electrical devices and systems, evaluate their characteristics in terms of efficiency and reliability in operation.	5						+										
40.	Modern electrotechnical materials	The discipline studies the properties, classification and application of modern conductive, semiconductor, dielectric and magnetic materials. Competencies related to the selection of materials for improving energy efficiency, reliability and durability of electric power equipment are being formed, taking into account the requirements of digital and sustainable energy	5						+										
		Cycle of basic disciplines University component/ Elective component																	
41.	Theory of automatic control	The discipline studies methods of analysis and synthesis of control systems, modeling and sustainability assessment. Competencies for designing digital automatic control systems for the energy sector, including feedbacks and regulators, are being formed, taking into account the requirements of	5																+

		digitalization and improving the reliability of electric power processes.																
42.	Renewable energy management	The discipline studies the principles and methods of managing renewable energy sources, including solar, wind, hydro, and bioenergy. The article examines the features of the integration of renewable energy sources into the energy system, the technical and economic aspects of their use, as well as modern approaches to monitoring, forecasting and optimizing energy production from renewable sources.	5															+
43.	Fundamentals of scientific research	The discipline is aimed at studying the scientific method, methods of data collection and analysis, as well as the stages of development and implementation of scientific research. The discipline forms students' competencies in the application of scientific methods and tools for information analysis, as well as develops analytical, critical thinking and the ability to scientifically study information phenomena.	5								+							
44.	Architectural and industrial lighting	The discipline studies the design, features, and technologies of architectural and industrial lighting, including the selection of light sources, the calculation of illumination, and the use of various lighting control systems to ensure energy efficiency, comfort, and safety in industrial, commercial, and public spaces. As a result of the study, students will master the basics of designing architectural and industrial lighting, learn how to choose lighting solutions for various objects, develop lighting schemes taking into account energy efficiency, safety and aesthetic requirements.	5							+								
45.	Intelligent methods for ensuring the sustainability of energy systems	The study of intelligent methods for analyzing and ensuring the sustainability of energy systems using digital technologies, modeling and AI. Develops competencies in the field of regime management, diagnostics and predictive assessment of energy system reliability in the context of renewable energy integration and digitalization of energy infrastructure.	5													+		
46.	Intelligent PLC-based control systems	The discipline studies the principles of the development and application of intelligent control systems based on programmable logic controllers (PLCs), including the design, configuration, optimization of automated processes in various industries, the use of PLCs for control, control of technological installations, integration with other systems to improve the efficiency and reliability of management. As a result of the study, students will master the	5													+		

		principles of PLC-based intelligent control systems, develop PLC programming for industrial process control, and apply systems to improve control efficiency and reliability in various fields.																	
47.	Intelligent electric grid management systems	The discipline studies the principles and methods of developing intelligent control systems for electric power systems, including networks, such as artificial intelligence, machine learning, to optimize power distribution, monitor network conditions, predict loads, improve reliability, and improve the efficiency of electric grid infrastructures. As a result of the study, students will master the principles of intelligent power grid management systems, apply modern automation methods to monitor, manage and optimize the operation of power grids, and develop solutions to improve their reliability and efficiency.	5														+		
48.	Cryptographic methods of information protection	The discipline studies the basic concepts and terminology of cryptography. Tasks and objectives of cryptography, encryption algorithms, symmetric encryption, main algorithms Advantages and disadvantages of hashing and digital signatures, principles of hash functions. Students learn the basic methods of cryptanalysis, cryptographic protection protocols, and apply ethical and legal aspects of cryptography.	5															+	
49.	Design and operation of power supply systems	The discipline studies the principles of designing and operating power supply systems, including the calculation and selection of equipment for efficient power distribution, the design of transmission lines, transformer substations and distribution networks, as well as maintenance and management methods to ensure the reliability and stability of power supply in various operating conditions. As a result of the study, students will master the principles of designing and operating power supply systems, develop power supply schemes for various facilities, carry out the necessary calculations and ensure reliable, safe and efficient operation of power systems.	5										+						
50.	Power electronics and energy converters	The discipline studies the principles of operation, applications of power electronics and energy converters, devices for converting, controlling and regulating electrical energy, such as inverters, rectifiers, frequency converters and other devices, their use in energy systems, automation and vector control to improve the efficiency and reliability of power grids and equipment. As a result of the study, students will master the principles of operation of power	5						+										

		electronics and energy converters, analyze and calculate electrical energy conversion schemes, and use power electronic devices to control and regulate parameters in energy and industrial systems.																
51.	Standardization and conformity assessment	The discipline studies the principles of standardization, technical regulation and conformity assessment in the energy sector. Competencies are being formed in the application of standards in digital energy systems, ensuring the quality, safety and reliability of equipment, as well as assessing the conformity of products and processes with the requirements of national and international standards.	5								+							
52.	Standardization, certification and measuring instruments	The discipline is aimed at providing students with knowledge and skills in the field of standardization, certification and measurements for the participation of enterprises in foreign economic activity and joining international certification systems. After studying the discipline, students acquire competencies in the basics of standardization, certification, working with measuring instruments and applying standards to ensure product compliance with international requirements.	5								+							
53.	Startups in the digital energy sector	The discipline studies the concepts and principles of startups in the field of digital energy, including innovative technologies, the Internet of Things (IoT), artificial intelligence, blockchain and big data, which are used to optimize and automate processes in the energy sector, develops skills in creating and managing startups that contribute to the digital transformation of the energy industry. As a result of the study, students will master the basics of creating and developing startups in the field of digital energy, where they develop innovative ideas, evaluate their technical and economic effectiveness, and apply digital technologies to solve urgent problems in the energy sector.	5							+								
54.	Industrial controller programming technologies	The discipline studies programming technologies for industrial controllers, including the basics of working with programmable logic controllers (PLCs), programming languages, methods for developing and optimizing control programs for automation of industrial processes, control of technological installations and real-time monitoring. As a result of the study, students will master the programming technologies of industrial controllers, develop and debug control programs for automating technological processes, and apply modern programming languages and environments to solve industrial	5												+			

		automation problems.																
55.	Digital automation in power grids	The discipline studies the principles and technologies of digital automation in power grids, including the use of intelligent sensors, automated control systems, SCADA, modern analytical platforms for monitoring, managing and optimizing electrical networks, the use of artificial intelligence and the Internet of Things (IoT) to improve the efficiency, reliability and sustainability of energy supply. As a result of the study, students will master the principles of digital automation in power grids, apply modern digital technologies and intelligent devices to monitor, control and optimize the operation of electrical networks, ensure their reliability and efficiency.	5							+				+				
56.	Digital and microprocessor technology	The discipline is devoted to the study of the principles of operation of digital and microprocessor systems, as well as their application in various fields of automation and control. The basics of digital logic, architecture of microprocessors and microcontrollers, their interaction with peripheral devices, as well as the principles of digital device development are considered.	5											+				
57.	Digital energy: innovations and business models	The discipline studies innovative technologies and business models in the digital energy sector, including the use of the Internet of Things (IoT), artificial intelligence, blockchain and big data to optimize energy processes, as well as the development of new approaches to energy infrastructure management and the creation of sustainable and profitable business structures in the context of the digital transformation of the energy industry. As a result of the study, students will master the key areas of digital energy transformation, use innovative technologies and modern business models, assess their impact on the development of the industry and apply the knowledge gained to form effective solutions in the digital energy sector.	5							+								
58.	Digital dispatch control systems in the energy Infrastructure	The discipline studies architecture, principles of operation and technologies of digital dispatch control systems in the energy infrastructure. Methods of data collection, transmission and processing, automation of management of power grid facilities, ensuring reliability and cybersecurity, as well as the use of modern digital platforms and intelligent algorithms in dispatching are considered.	5															+
59.	Elements and	The discipline covers the basics of designing and operating key elements and	5										+					

	equipment of control automation systems	devices used in control systems. The principles of operation of regulators, sensors, actuators and other components providing control and regulation of technological processes are considered.																	
60.	Energy-saving technologies in lighting	The discipline studies energy-saving technologies in lighting, including the use of LED technologies, automatic lighting control systems, intelligent sensors and systems that optimize energy consumption, increase the efficiency of illuminated spaces and reduce operating costs, while providing the necessary brightness and comfort for users. As a result of the study, students will master the principles of energy conservation in lighting systems, choose and implement effective lighting solutions, apply modern technologies and equipment to reduce energy consumption and improve the environmental efficiency of lighting installations.	5							+									
61.	Power systems and power supply of industrial facilities	The discipline studies the design, operation and management of power systems for industrial facilities, including the development of power supply systems, calculation and selection of equipment, energy distribution schemes, methods for improving reliability, sustainability and energy efficiency in the operation of energy infrastructure in industrial enterprises. As a result of the study, students will master the principles of building power systems and power supply systems for industrial facilities, develop power supply schemes, perform the necessary calculations and ensure reliable, efficient and safe operation of energy infrastructure in industrial enterprises.	5							+									
62.	SCADA systems in the energy industry	The discipline studies the principles of operation and application of SCADA systems in the energy sector, their role in monitoring, managing and automating processes at energy facilities such as power plants, substations and distribution networks, as well as technologies for data collection, monitoring the condition of equipment and optimizing the operation of energy systems in real time. As a result of the study, students will master the principles of building and operating SCADA systems in the energy sector, apply them to monitor, manage and analyze the operation of power facilities, develop and configure SCADA solutions to improve the efficiency and reliability of energy processes.	5											+					
Minor																			

63.	Introduction to Artificial Intelligence	The discipline is aimed at studying the basic concepts, methods and technologies used in modern artificial intelligence systems. Looks at artificial neural networks, machine learning, deep learning, and applied algorithms and models used in various fields such as computer vision, natural language processing, robotics, and Game Art. Able to analyze and solve problems using artificial intelligence methods.	4											+		
64.	Artificial intelligence in object management	The discipline studies the basic concepts and principles of artificial intelligence systems, as well as their application in object management. Methods and technologies of artificial intelligence for effective management of objects. Upon completion of the course, students receive the skills and knowledge necessary for successful management of facilities using modern artificial intelligence technologies.	5											+		
65.	Development of artificial neural networks	The discipline focuses on the study of methods for creating and training neural networks, which are mathematical models that mimic the work of the human brain. During the course of studying this discipline, students will learn about various types of neural networks, their structures and learning algorithms. Upon completion of the course, students will be able to create, train and apply neural networks to solve various tasks in the field of artificial intelligence and machine learning.	5											+		

8 Alignment of planned learning outcomes with assessment technologies and teaching methods within the module

Learning Outcomes (LO) Number	Planned learning outcomes for the module	Assessment technologies (tools)	Methods of learning and teaching
LO1	Applies economic, legal aspects, the basics of financial literacy and sustainable development in professional activities	Test, practical tasks, oral survey	Interactive method, thematic discussions.
LO2	Applies mathematical, scientific, numerical and basic professional knowledge to perform engineering calculations for electrical equipment.	Test, oral survey, tests	Thematic discussions, case-study method, project method, startup projects.
LO3	Possesses skills in the development and operation of electrical	Reflection after completing the	Interactive method, thematic

	devices, systems and power plants.	task, projects, laboratory work	discussions, case-study method, project method.
LO4	Carries out operation, maintenance and repair of electrical power equipment, lighting systems and electrical power transmission networks taking into account modern technologies and regulatory requirements.	Reflection after completing the task, projects, laboratory work	Interactive method, combined method, research method.
LO5	Solves problems in the field of digital energy, taking into account environmental aspects of life safety based on scientific research, innovation and business models	Test, laboratory and practical work, reflection after completing the task	Interactive method, case-study method, project method, startup projects.
LO6	Applies the principles, methods and regulatory frameworks of standardization, certification and technical regulation to develop and evaluate standards in the field of energy.	Test, solving situational problems, reflection after completing the task	Thematic discussions, combined method, research method, startup projects.
LO7	Uses digital tools to perform calculation tasks, design schemes and prepare technical drawings, documentation for energy and power supply facilities.	Reflection after completing the task, projects, presentations, laboratory work	Interactive method, thematic discussions, combined method, startup projects.
LO8	Carries out control and management of automated processes in the energy sector using SCADA systems and SMART technologies	Reflection after completing the task, projects, presentations, laboratory work	Research method, project method, startup projects.
LO9	Develops software solutions for energy, automated, and electromechanical systems using microprocessor technology and digital technologies.	Reflection after completing the task, projects, presentations, laboratory work	Interactive method, combined method, research method, project method, startup projects.
LO10	Develops intelligent digital solutions for the management and optimization of energy systems and networks using artificial intelligence and neural network technologies	Reflection after completing the task, projects, presentations, laboratory work	Thematic discussions, research method, project method.
LO11	Ensures protection, reliability and stable operation of power systems using cryptographic analysis methods	Test, solving situational problems, projects and presentations	Interactive method, thematic discussions, case-study method.
LO12	Applies digital algorithms in the field of automatic control in the design, modeling and configuration of control systems for power engineering facilities	Test, solving situational problems, laboratory and practical work, reflection after completing the task, projects and presentations	Interactive method, combined method, case-study method, research method.

9 Correlation of the learning outcomes of the educational program with the labor functions of professional standards (if any)

Name of the professional standards used	Professions at level 6 and/or 7 of the SQF	Labor functions	Tasks	Learning outcomes for the educational program
Development of IoT systems	Cloud IoT Systems Engineer	Labor function 1: Ensuring physical fitness	Task 1: Managing IoT devices Task 2: Analyzing and monitoring IoT devices	LO6 Develops circuit solutions and performs calculations for elements of robotic systems using microelectronics and digital technologies.
		Labor function 3: Ensuring operability at the application level	Task 3: Designing software for IoT devices	LO7 Calculates operations according to the theory of automatic control, theoretical mechanics, hydraulics and pneumatics using modern methods of measurement, control and management of technological processes LO8 Solves applied engineering problems related to the design, development and implementation of SCADA systems and startups in the field of automation, including the selection of hardware and software solutions, as well as integration with industrial controllers LO9 Applies artificial intelligence to the development of IoT devices to optimize intelligent systems, automated processes, and devices that can adapt to changes in the external environment and effectively interact with users and other devices.
Professional standard " Development of technical documentation "	Technical Documentation Specialist (Technical Writer)	Labor function 2 Development documentation plan		LO4 Develops technical specifications and projects for automation of technological processes and production, as well as mathematical models for managing technological processes.
		Labor function 3 Development technical documentation		LO5 Possesses the skills to develop design and operational documentation in accordance with the requirements of regulatory documentation.

10 Graduate Model

	GRADUATE MODEL		
Professional standard "Development of IoT systems", "Development of technical documentation"	Competencies (soft skills, digital skills)		
	Attributes of a graduate	Knowledge	Skills
	-High professionalism in the field of Automation and management; -Emotional intelligence; -Adaptability to global challenges; - Leadership; - Skill in creating documentation for IoT and AI systems, including user instructions and technical descriptions -Proficiency in methods of drawing up technical specifications and design documentation in accordance with GOST, ESKD, SPDS - Skill in preparing documentation for SCADA systems and other integration projects	1.Configure and install sensors and reading devices to transmit information for verification and analysis of transmitted data. 2. Select and compile a description of the characteristics of sensors and reading devices for the required project 3. Methods of collecting information (questionnaires, interviews, Internet searches). 2. Types of technical documentation, their features. 4. General requirements for the structure of sections of technical documentation. 5. Standards for the development and execution of technical documentation 6. Standards for the development and execution of technical documentation. 7. Project management. 8. Life cycle of software and information systems. 9. Methods and principles of information security.	1. Characteristics of devices and their application in industries. 2. Software for IoT systems 3. Machine-to-machine communication methodology 4. Technology of working with embedded systems 5. Standards for the development and execution of technical documentation. 6. General requirements for the structure of sections of a technical document. 7. Terminology used to describe the user interface of technical documentation.
	Professional skills (hard skills)		
	-O defines the essence and content of the processes of management, leadership, entrepreneurship and administration; - Has the ability to establish communication processes, decision-making; has the ability to choose an effective management and leadership style, methods of managing groups, conflicts, stress; - Has communication skills to communicate with colleagues and customers during the project development process, and also takes part in the organization and management of projects - Calculates and prepares a business plan and project analysis of an investment and business project - Applies regulations for organizing the management of life cycle processes of IT infrastructure and the activities of IT enterprises - Possesses precision and attention to detail when preparing documentation. - Able to work in a team on design documentation, interact with engineers, technologists, and contractors.		

Типтік оқу жоспары / Типичный учебный план / Typical curriculum
ББББ 6В07133 Сандық энергетика / ОП 6В07133 Цифровая энергетика / EP 6B07133 Digital energy

Модульдің № / № модуля / Module №	Пәндердің № / № дисциплины / Discipline №	ОҚУ ПӘНДЕРІНІҢ АТАУЫ НАИМЕНОВАНИЕ УЧЕБНЫХ ДИСЦИПЛИН NAME OF TEACHING DISCIPLINES	Оқу пәндерінің циклы (міндетті компонент / таңдау компоненті) Цикл учебных дисциплин (обязательный компонент / компонент по выбору) Educational disciplines cycle (compulsory component / component by choice)	Оқу пәндерінің коды Код учебной дисциплины Educational discipline code	Семестр / semester	Кредиттер саны Количество кредитов Number of credits	Курстық жұмыс (жоба) Курсовая работа (проект) Course work (project)	Білім алушылардың жұмыс уақытының бюджеті сағаттен Бюджет рабочего времени (час) Budget of working time (hours)							Семестр бойынша бөлу Распределение по семестрам Distribution of semesters								Оқыту тілі (үш тілде білім беру бағдарламасы бойынша: оқыту тілінде, екінші тілде, ағылшын тілінде) / Язык обучения (для программы трехязычного образования: на языке обучения, на втором языке, на английском языке) / Language of education (for trilingual education programs: in the language learning in the second language, in English)
								Барлық сағат / Всего часов / Total hours	Аудиториялық жұмыс / Аудиторная работа / Class work				ОБӨЖ / СРОП / IWST	БАӨЖ / СРО / IWS	1 КУРС / YEAR		2 КУРС / YEAR		3 КУРС / YEAR		4 КУРС / YEAR		
									Барлық аудит. сағат Всего аудит. часов Total classroom hours	оның ішінде / в том числе / including					1 Академиялық кезең / Academic period	2 Академиялық кезең / Academic period	3 Академиялық кезең / Academic period	4 Академиялық кезең / Academic period	5 Академиялық кезең / Academic period	6 Академиялық кезең / Academic period	7 Академиялық кезең / Academic period	8 Академиялық кезең / Academic period	
										Д / ЛК / Lec	СПС / СПЗ / SPL	ЛС / ЛЗ / LC			Семестрдағы апталар саны / Недель в семестре / Weeks in a semester		Семестрдағы апталар саны / Недель в семестре / Weeks in a semester		Семестрдағы апталар саны / Недель в семестре / Weeks in a semester		Семестрдағы апталар саны / Недель в семестре / Weeks in a semester		
															15	15	15	15	15	15	15	15	
															аптасына аудиториялық сағат / аудиторных часов в неделю / classroom hours per week		аптасына аудиториялық сағат / аудиторных часов в неделю / classroom hours per week		аптасына аудиториялық сағат / аудиторных часов в неделю / classroom hours per week		аптасына аудиториялық сағат / аудиторных часов в неделю / classroom hours per week		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Модуль / Module № 1		**Ақпараттық-коммуникациялық модуль / Информационно-коммуникационный модуль / Information and communication module**																					
	1	Шетел тілі Иностранный язык Foreign language	ЖБП (МК) ООД (ОК) GED (CC)	IYa 1104-25 (1) IYa 1104-25 (1) IYa 1104-25 (1)	1	5		150	45		45		15	90	0 + 3 + 0								Білім алушының таңдауы бойынша/ По выбору обучающегося/
	2	Қазақ (Орыс) тілі Казахский (Русский) язык Kazakh (Russian) language	ЖБП (МК) ООД (ОК) GED (CC)	K(R)Ya 1105-25 (1) K(R)Ya 1105-25 (1) K(R)Ya 1105-25 (1)	1	5		150	45		45		15	90	0 + 3 + 0								Білім алушының таңдауы бойынша/ По выбору обучающегося/
	3	Ақпараттық-коммуникациялық технологиялар Информационно-коммуникационные технологии Information and communication technologies	ЖБП (МК) ООД (ОК) GED (CC)	IKT 1108-25 IKT 1108-25 IKT 1108-25	2	5		150	45	15		30	15	90		1 + 0 + 2							Білім алушының таңдауы бойынша/ По выбору обучающегося/
	4	Қазақ (Орыс) тілі Казахский (Русский) язык Kazakh (Russian) language	ЖБП (МК) ООД (ОК) GED (CC)	K(R)Ya 1105-25 (2) K(R)Ya 1105-25 (2) K(R)Ya 1105-25 (2)	2	5		150	45		45		15	90		0 + 3 + 0							Білім алушының таңдауы бойынша/ По выбору обучающегося/
	5	Шетел тілі Иностранный язык Foreign language	ЖБП (МК) ООД (ОК) GED (CC)	IYa 1104-25 (2) IYa 1104-25 (2) IYa 1104-25 (2)	2	5		150	45		45		15	90		0 + 3 + 0							Білім алушының таңдауы бойынша/ По выбору обучающегося/
Барлығы модуль бойынша / Итого по модулю / Total for module						**25**		**750**	**225**	**15**	**180**	**30**	**75**	**450**									
Модуль / Module № 2		**Адам және қоғам дүниетанымдық және әлеуметтік-саяси білімнің негіздері / Человек и общество основы мировоззренческих и социально-политических знаний / Man and society are the foundations of ideological and socio-political knowledge**																					
	1	Қазақстан тарихы История Казахстана History of Kazakhstan	ЖБП (МК) ООД (ОК) GED (CC)	IK 1101-25 IK 1101-25 IK 1101-25	1	5		150	45	30	15		15	90	2 + 1 + 0								Білім алушының таңдауы бойынша/ По выбору обучающегося/
	2	Дене шынықтыру Физическая культура Physical Culture	ЖБП (МК) ООД (ОК) GED (CC)	FK 1106-25 (1) FK 1106-25 (1) FK 1106-25 (1)	1	2		60	30		30		30		0 + 2 + 0								Білім алушының таңдауы бойынша/ По выбору обучающегося/
	3	Экономика, кәсіпкерлік, құқық және қаржылық сауаттылық модулі (экономика және кәсіпкерліктің негіздері, құқық негіздері және сыбайлас жемқорлыққа қарсы мәдениет, қаржылық сауаттылық негіздері) Модуль экономики, предпринимательства, права и финансовой грамотности (основы экономики и предпринимательства, основы права и антикоррупционная культура, основы финансовой грамотности) Module of economics, entrepreneurship, law and financial literacy (fundamentals of economics and entrepreneurship, basics of law and anti-corruption culture, basics of financial literacy)	ЖБП (ЖК) ООД (ВК) GED (UC)	MEPPFG 1107-25 MEPPFG 1107-25 MEPPFG 1107-25	2	5		150	45	30	15		15	90		2 + 1 + 0							Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	4	Дене шынықтыру Физическая культура Physical Culture	ЖБП (МК) ООД (ОК) GED (CC)	FK 1106-25 (2) FK 1106-25 (2) FK 1106-25 (2)	2	2		60	30		30		30			0 + 2 + 0							Білім алушының таңдауы бойынша/ По выбору обучающегося/
	5	Әлеуметтік-саяттану білім модулі (әлеуметтану, саяттану, мәдениеттану, психология) Модуль социально-политических знаний (политология, социология, культурология, психология) Module of socio-political knowledge (political science, sociology, cultural studies, psychology)	ЖБП (МК) ООД (ОК) GED (CC)	MSPZ 2103-25 MSPZ 2103-25 MSPZ 2103-25	3	8		240	120	60	60		15	105			4 + 4 + 0						Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	6	Дене шынықтыру Физическая культура Physical Culture	ЖБП (МК) ООД (ОК) GED (CC)	FK 1106-25 (3) FK 1106-25 (3) FK 1106-25 (3)	3	2		60	30		30		30				0 + 2 + 0						Білім алушының таңдауы бойынша/ По выбору обучающегося/
	7	Философия Философия Philosophy	ЖБП (МК) ООД (ОК) GED (CC)	Fil 2102-25 Fil 2102-25 Fil 2102-25	4	5		150	45	30	15		15	90				2 + 1 + 0					Білім алушының таңдауы бойынша/ По выбору обучающегося/
	8	Дене шынықтыру Физическая культура Physical Culture	ЖБП (МК) ООД (ОК) GED (CC)	FK 1106-25 (4) FK 1106-25 (4) FK 1106-25 (4)	4	2		60	30		30		30					0 + 2 + 0					Білім алушының таңдауы бойынша/ По выбору обучающегося/

	9	Тұрақты даму, экология және тіршілік қауіпсіздігі Устойчивое развитие, экология и безопасность жизнедеятельности Sustainable development, ecology and life safety	БП (ЖК) БД (ВК) BD (UC)	UREBZh 3207-25 UREBZh 3207 -25 UREBZh 3207-25	6	5		150	45	15	30		15	90						1 + 2 + 0			Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
Барлығы модуль бойынша / Итого по модулю / Total for module						**36**		**1080**	**420**	**165**	**255**	**0**	**195**	**465**									
Модуль / Module № 3		**Электроника және кабельдік жүйелер мен электр оқшаулау күйін бақылау әдістері / Электроника и методы контроля состояния кабельных систем и электроизоляции / Electronics and methods of monitoring the condition of cable systems and electrical insulation**																					
	1	Жоғары математика Высшая математика Higher mathematics	БП (ЖК) БД (ВК) BD (UC)	VMat 1201-25 VMat 1201-25 VMat 1201-25	1	5		150	45	15	30		15	90	1 + 2 + 0								Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	2	Мамандыққа кіріспе Введение в специальность Introduction to the specialty	БП (ЖК) БД (ВК) BD (UC)	VS 1202 -25 VS 1202 -25 VS 1202 -25	1	4		120	45	15	30		15	60	1 + 2 + 0								Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	3	Физика Физика Physics	БП (ЖК) БД (ВК) BD (UC)	Fiz 1205-25 Fiz 1205-25 Fiz 1205-25	2	6		180	60	15	15	30	15	105		1 + 1 + 2						Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	4	Электротехниканың теориялық негіздері Теоретические основы электротехники Theoretical foundations of electrical engineering	БП (ЖК) БД (ВК) BD (UC)	TOE 2206 -25 TOE 2206 -25 TOE 2206 -25	3	5		150	45	15	30		15	90			1 + 2 + 0					Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	5	Энергетикадағы бақылау мен өлшеудің автоматтандырылған жүйелері Автоматизированные системы контроля и измерений в энергетике Automated control and measurement systems in the energy industry	БП (ТК) БД (КВ) BD (EC)	ASKIE 2209-25 ASKIE 2209-25 ASKIE 2209-25	3	5		150	45	15	30		15	90			1 + 2 + 0					Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	6	Электр энергетикасындағы өлшеу құралдары мен әдістері Приборы и методы измерения в электроэнергетике Instruments and measurement methods in the electric power industry		PMIE 2209-25 PMIE 2209-25 PMIE 2209-25																		
	7	Өндірістегі электрондық аспаптар Электронные приборы в производстве Electronic devices in production	БП (ТК) БД (КВ) BD (EC)	EPP 2207-25 EPP 2207-25 EPP 2207-25	3	5		150	45	15	30		15	90			1 + 2 + 0					Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	8	Өнеркәсіптік электроника Промышленная электроника Industrial electronics		PE 2207-25 PE 2207-25 PE 2207-25																		
	9	Электр энергетикалық жүйелер мен желілер Электро энергетические системы и сети Electric power systems and networks	БП (ТК) БД (КВ) BD (EC)	ESS 2209-25 ESS 2209-25 ESS 2209-25	3	5		150	45	15	30		15	90			1 + 2 + 0					Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	10	Электр энергиясын беру негіздері Основы передачи электрической энергии Fundamentals of electric energy transmission		OPEE 2209-25 OPEE 2209-25 OPEE 2209-25																		
	11	Оқу практикасы Учебная практика Educational practice	БеП (ЖК) ПД (ВК) PD (UC)	UP 25 (CE) UP 25 (CE) UP 25 (CE)	2	2		60	0							2 апта / недель / weeks						Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	12	Жасанды нейрондық желілерді әзірлеу Разработка искусственных нейронных сетей Development of artificial neural networks	БеП (ТК) ПД (КВ) PD (EC)	RINS 3323-25 RINS 3323-25 RINS 3323-25	6	5		150	45	15	30		15	90						1 + 2 + 0			Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	13	SCADA-энергетикадағы жүйелер SCADA-системы в энергетике SCADA systems in the energy industry		SCADA SE3323-25 SCADA SE4335-25 SCADA SE4335-25																		
Барлығы модуль бойынша / Итого по модулю / Total for module						**42**		**1260**	**375**	**120**	**225**	**30**	**120**	**705**									
Модуль / Module № 4		**Энергетикалық желілерде жобалау / Проектирование в энергетических сетях / Design in energy networks**																					
	1	Энергетикадағы техникалық құжаттама және графикалық белгілер Техническая документация и графические символы в энергетике Technical documentation and graphic symbols in the energy industry	БП (ТК) БД (КВ) BD (EC)	TDGSE 1203 -25 TDGSE 1203 -25 TDGSE 1203 -25	1	4		120	45	15	30		15	60	1 + 2 + 0								Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	2	Электр схемаларын оқу және жобалау негіздері Основы чтения и проектирования электрических схем Fundamentals of reading and designing electrical circuits		OChPES 1203-25 OChPES 1203-25 OChPES 1203-25																		
	3	Инженерлік жобалау Инженерное проектирование Engineering design	БП (ТК) БД (КВ) BD (EC)	IP 2212-25 IP 2212-25 IP 2212-25	4	4		120	45	15	30		15	60					1 + 2 + 0				Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	4	3D энергия объектілерін басқару жүйелерін модельдеу 3D моделирование систем управления энергообъектами 3D modeling of power facility management systems		3DM SUE 2212-25 3DM SUE 2212-25 3DM SUE 2212-25																		
	5	Электр оқшаулағыш материалдар және олардың жай-күйін бақылау Электроизоляционные материалы и контроль их состояния Electrical insulation materials and control of their condition	БП (ТК) БД (КВ) BD (EC)	EMK 3216-25 EMK 3216-25 EMK 3216-25	4	5		150	45	15	30		15	90					1 + 2 + 0				Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	6	Кабельдік желілерді диагностикалау және мониторингілеу Диагностика и мониторинг кабельных сетей Diagnostics and monitoring of cable networks		DMKS 3214-25 DMKS 3214-25 DMKS 3214-25																		
	7	Энергия жүйелерін басқару модельдері мен алгоритмдері Модели и алгоритмы управления энергосистемами Power system management models and algorithms	БП (ТК)	MAUE 3219-25 MAUE 3219-25 MAUE 3219-25																		Білім алушының таңдауы

Модуль / Modu	8	ЭНЕРГОЖЕЛІЛІК объектілердің АБЖ құрылымы және функционалдық принциптері Структура и функциональные принципы АСУ энергосетевых объектов The structure and functional principles of automated control systems of power grid facilities	БП (ТК) БД (КВ) BD (EC)	SFPASUESO 3219-25 SFPASUESO 3219-25 SFPASUESO 3219-25	5	5		150	45	15	30		15	90					1 + 2 + 0				бойынша/ По выбору обучающегося/ By student's option
	9	Электромеханикалық энергия түрлендіргіштері Электромеханические преобразователи энергии Electromechanical energy converters	БП (ТК) БД (КВ) BD (EC)	EPE 4335-25 EPE 4335-25 EPE 4335-25	5	5		150	45	15	30		15	90					1 + 2 + 0				Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	10	Электр машиналарының теориясы және жұмысы Теория и эксплуатация электрических машин Theory and operation of electric machines		TEEM 4335-25 TEEM 4335-25 TEEM 4335-25																			
	11	Электромеханикалық жүйелерді автоматтандыру Автоматизация электромеханических систем Automation of electromechanical systems	БП (ТК) БД (КВ) BD (EC)	AES 3219 -25 AES 3219 -25 AES 3219 -25	6	5		150	45	15	30		15	90						1 + 2 + 0			Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	12	Электр жетегі теориясы Теория электропривода Theory of electric drive		TE 3219-25 TE 3219-25 TE 3219-25																			
	13	Автоматтандырылған жобалау жүйесі Система автоматизированного проектирования Computer-aided design system	БеП (ТК) ПД (КВ) PD (EC)	SAP 4307-25 SAP 4307-25 SAP 4307-25	7	5		150	45	15	30		15	90							1 + 2 + 0		Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	14	Электр желілерін жобалау, есептеу Проектирование, расчет электрических сетей Design, calculation of electrical networks		PRES 4307-25 PRES 4307-25 PRES 4307-25																			
	15	Энергожүйелер және өнеркәсіптік объектілерді электрмен жабдықтау Энергосистемы и электроснабжение промышленных объектов Power systems and power supply of industrial facilities	БеП (ТК) ПД (КВ) PD (EC)	EEPO 4333-25 EEPO 4333-25 EEPO 4333-25	7	5		150	45	15	30		15	90							1 + 2 + 0		Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	16	Электрмен жабдықтау жүйелерін жобалау және пайдалану Проектирование и эксплуатация систем электроснабжения Design and operation of power supply systems		PESE 4333-25 PESE 4333-25 PESE 4333-25																			
Барлығы модуль бойынша / Итого по модулю / Total for module						**38**		**1140**	**360**	**120**	**240**	**0**	**120**	**660**									
Модуль / Module № 5		**Электромеханикалық және энергетикалық жүйелерді басқару және тұрақтылық / Управление и устойчивость электромеханических и энергетических систем / Control and stability of electromechanical and energy systems**																					
	1	Заманауи электротехникалық материалдар Современные электротехнические материалы Modern electrotechnical materials	БП (ТК) БД (КВ) BD (EC)	SEM 2209-25 SEM 2209-25 SEM 2209-25	4	5		150	45	15	30		15	90				1 + 2 + 0					Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	2	Электротехникадағы материалдардың қасиеттері мен қолданылуы Свойства и применение материалов в электротехнике Properties and application of materials in electrical engineering		SPME 2209-25 SPME 2209-25 SPME 2209-25																			
	3	Өндірістік практика 1 Производственная практика 1 Industrial practice 1	БеП (ЖК) ПД (ВК) PD (UC)	PP 1-25 (CE) PP 1-25 (CE) PP 1-25 (CE)	4	5		150	0									5 апта / недель / weeks					Білім алушының таңдауы бойынша/ По выбору обучающегося/
	4	Сәулет және өнеркәсіптік жарықтандыру Архитектурное и промышленное освещение Architectural and industrial lighting	БеП (ТК) ПД (КВ) PD (EC)	APO 4335-25 APO 4335-25 APO 4335-25	7	5		150	45	15	30		15	90							1 + 2 + 0		Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	5	Жарықтандырудағы энергия үнемдеу технологиялары Энергосберегающие технологии в освещении Energy-saving technologies in lighting		ETO 4335-25 ETO 4335-25 ETO 4335-25																			
	6	Басқаруды автоматтандыру жүйелерінің элементтері мен аппаратурасы Элементы и аппаратура систем автоматизации управления Elements and equipment of control automation systems	БеП (ТК) ПД (КВ) PD (EC)	EASAU 3322-25 EASAU 3322-25 EASAU 3322-25	7	5		150	45	15	30		15	90							1 + 2 + 0		Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	7	Энергетикалық инфрақұрылымдағы диспетчерлік басқарудың цифрлық жүйелері Цифровые системы диспетчерского управления в энергетической инфраструктуре Digital dispatch control systems in the energy infrastructure		CSDUEI 3225-25 CSDUEI 3225-25 CSDUEI 3225-25																			
Барлығы модуль бойынша / Итого по модулю / Total for module						**20**		**600**	**135**	**45**	**90**	**0**	**45**	**270**									
Модуль / Module № 6		**Инженерлік жүйелердегі стандарттау және сенімділікті қамтамасыз ету / Стандартизация и обеспечение надёжности в инженерных системах / Standardization and reliability assurance in engineering systems**																					
	1	Электр энергетикалық жүйелердің сенімділігі Надежность электроэнергетических систем Reliability of electric power systems	БП (ТК) БД (КВ) BD (EC)	NES 3219 -25 NES 3219 -25 NES 3219 -25	4	4		120	45	15	30		15	60				1 + 2 + 0					Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	2	Энергия жүйелерінің динамикалық және статикалық тұрақтылығы Динамическая и статическая устойчивость энергосистем Dynamic and static stability of power systems		DSUE 3219 -25 DSUE 3219 -25 DSUE 3219 -25																			
	3	Энергия жүйелерінің тұрақтылығын қамтамасыз етудің интеллектуалды әдістері Интеллектуальные методы обеспечения устойчивости энергосистем Intelligent methods for ensuring the sustainability of energy systems	БеП (ТК) ПД (КВ) PD (EC)	IMOUE 4333-25 IMOUE 4333-25 IMOUE 4333-25	8	5		150	45	15	30		15	90								1 + 2 + 0	Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	4	Қуат электроникасы және энергия түрлендіргіштері Силовая электроника и преобразователи энергии Power electronics and energy converters		SEPE 4333-25 SEPE 4333-25 SEPE 4333-25																			
	5	Стандарттау және сәйкестікті растау Стандартизация и подтверждения соответствия Standardization and conformity assessment	БеП (ТК)	SPS 4335-25 SPS 4335-25 SPS 4335-25																			Білім алушының таңдауы бойынша/

	6	Стандарттау, сертификаттау және өлшеу құралдары Стандартизация, сертификация и измерительные средства Standardization, certification and measuring instruments	ПД (КВ) PD (EC)	SSIS 4335-25 SSIS 4335-25 SSIS 4335-25	8	5		150	45	15	30		15	90									1 + 2 + 0	По выбору обучающегося/ By student's option
Барлығы модуль бойынша / Итого по модулю / Total for module						**14**		**420**	**135**	**45**	**90**	**0**	**45**	**240**											
Модуль / Module № 7	**Электр энергетикасын басқарудың цифрлық және диспетчерлік технологиялары / Цифровые и диспетчерские технологии управления электроэнергетикой / Digital and dispatching technologies for electric power industry management**																								
	1	Энергетикалық жүйелердегі SMART технологиялардың негіздері Основы SMART технологий в энергетических системах Fundamentals of SMART technologies in energy systems	БП (ТК) БД (КВ) BD (EC)	OSMARTTES 2215-25 OSMARTTES 2215-25 OSMARTTES 2215-25	5	5		150	45	15	30		15	90					1 + 2 + 0					Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	2	Заттардың индустриялық интернеті Индустриальный интернет вещей The Industrial Internet of Things		IIV 2215-25 IIV 2215-25 IIV 2215-25																				
	3	Жасанды интеллектке кіріспе Введение в искуственные интеллект Introduction to Artificial Intelligence	БП (ТК) БД (КВ) BD (EC)	BII 3216-25 BII 3216-25 BII 3216-25	5	5		150	45	15	30		15	90					1 + 2 + 0					Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	4	Объектілерді басқаруды жасанды интеллект Искусственный интеллект в управлении объектами Artificial intelligence in object management		IIUO 3216-25 IIUO 3216-25 IIUO 3216-25																				
	5	Автоматты басқару теориясы Теория автоматического управления Theory of automatic control	БеП (ЖК) ПД (ВК) PD (UC)	TAU 3324-25 TAU 3324-25 TAU 3324-25	5	5		150	45	15	30		15	90					1 + 2 + 0					Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	6	Ақпаратты қорғаудың криптографиялық әдістері Криптографические методы защиты информации Cryptographic methods of information protection	БеП (ТК) ПД (КВ) PD (EC)	KMZI 3225-25 KMZI 3225-25 KMZI 3225-25	5	5		150	45	15	30		15	90					1 + 2 + 0					Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	7	Цифрлық және микропроцессорлық техника Цифровая и микропроцессорная техника Digital and microprocessor technology		TsMPT 3225-25 TsMPT 3225-25 TsMPT 3225-25																				
	8	Жаңартылатын энергияны басқару Управление возобновляемыми источниками энергии Renewable energy management	БеП (ЖК) ПД (ВК) PD (UC)	UVIE 3324 -25 UVIE 4324 -25 UVIE 4324 -25	6	5		150	45	15	30		15	90						1 + 2 + 0				Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	9	Өндірістік практика 2 Производственная практика 2 Industrial practice 2	БеП (ЖК) ПД (ВК) PD (UC)	PP 2-25 (CE) PP 2-25 (CE) PP 2-25 (CE)	6	5		150	0											5 апта / недель / weeks				Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	10	Электр желілерін басқарудың зияткерлік жүйелері Интеллектуальные системы управления электрическими сетями Intelligent electric grid management systems	БеП (ТК) ПД (КВ) PD (EC)	ISUES 3325-25 ISUES 3325-25 ISUES 3325-25	6	5		150	45	15	30		15	90						1 + 2 + 0				Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	11	Энергия желілеріндегі цифрлық автоматтандыру Цифровая автоматизация в энергосетях Digital automation in power grids		TSAE 3325-25 TSAE 3325-25 TSAE 3325-25																				
	12	Өнеркәсіптік контроллерлерді бағдарламалау технологиялары Технологии программирования промышленных контроллеров Industrial controller programming technologies	БеП (ТК) ПД (КВ) PD (EC)	TPPK 4330-25 TPPK 4330-25 TPPK 4330-25	7	5		150	45	15	30		15	90								1 + 2 + 0		Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	13	PLC негізіндегі интеллектуалды басқару жүйелері Интеллектуальные системы управления на базе ПЛК Intelligent PLC-based control systems		ISUPLK 4330-25 ISUPLK 4330-25 ISUPLK 4330-25																				
Барлығы модуль бойынша / Итого по модулю / Total for module						**40**		**1200**	**315**	**105**	**210**	**0**	**105**	**630**											
Модуль / Module № 8	**Цифрлық энергетикадағы ғылыми-инновациялық қызмет және кәсіпкерлік / Научно-инновационная деятельность и предпринимательство в цифровой энергетике / Scientific and innovative activities and entrepreneurship in the digital energy sector**																								
	1	Ғылыми зерттеулердің негіздері Основы научных исследований Fundamentals of scientific research	БеП (ЖК) ПД (ВК) PD (UC)	ONI 4328-25 ONI 4328-25 ONI 4328-25	7	5		150	45	15	30		15	90								1 + 2 + 0		Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	2	Диплом алдындағы практикасы/Өндірістік практика Преддипломная практика/Производственная практика Pre-graduation practice/Industrial practice	БеП (ЖК) ПД (ВК) PD (UC)	PDP/PP 25 (CE) PDP/PP 25 (CE) PDP/PP 25 (CE)	8	7		210	0													7 апта / недель / weeks		Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	3	Цифрлық энергетикадағы стартаптар Стартапы в цифровой энергетике Startups in the digital energy sector	БеП (ТК) ПД (КВ) PD (EC)	STsTsE 4335-25 STsTsE 4335-25 STsTsE 4335-25	8	5		150	45	15	30		15	90									1 + 2 + 0	Білім алушының таңдауы бойынша/ По выбору обучающегося/ By student's option
	4	Инновация және бизнес модельдері Цифровая энергетика: инновации и бизнес-модели Digital energy: innovations and business models		TsIBM 4335-25 TsIBM 4335-25 TsIBM 4335-25																				
Барлығы модуль бойынша / Итого по модулю / Total for module						**17**		**510**	**90**	**30**	**60**	**0**	**30**	**180**											
Модуль / Module № 9	**Қорытынды аттестаттау / Итоговая аттестация / Final assessment**																								
	1	Қорытынды аттестаттау Итоговая аттестация Final assessment			8	8		240														8 апта / недель / weeks		
Барлығы модуль бойынша / Итого по модулю / Total for module						**8**		**240**	**0**	**0**	**0**	**0**	**0**	**0**											
БАРЛЫҒЫ МОДУЛЬДАР БОЙЫНША / ИТОГО ПО МОДУЛЯМ / TOTAL FOR MODULES						**240**		**7200**	**2055**	**645**	**1350**	**60**	**735**	**3600**											

ОТЗЫВ/РЕЦЕНЗИЯ

на образовательную программу «Цифровая энергетика» по направлению подготовки 6В071 Инженерия и инженерное дело.

ТОО "ZHOBA LTD", Республика Казахстан, г. Тараз

Название предприятия, страна, город

Общая характеристика образовательной программы:

Образовательная программа «Цифровая энергетика» разработана в ответ на глобальные вызовы цифровой трансформации электроэнергетики, возрастающие потребности рынка труда и стратегические инициативы Казахстана по модернизации энергетического сектора. В условиях активного внедрения интеллектуальных технологий и перехода к устойчивой энергетике, подготовка специалистов, обладающих компетенциями в области цифровых решений, анализа данных и интеллектуального управления энергосистемами, приобретает критическую значимость.

Актуальность программы обусловлена следующими факторами:

Глобальная цифровизация энергетики. Внедрение интеллектуальных энергосистем (smart grid), технологий машинного обучения, цифровых двойников и платформ управления энергопотреблением формирует устойчивый спрос на квалифицированных специалистов в данной области.

Энергетическая безопасность и устойчивость. Казахстанская энергетическая отрасль сталкивается с необходимостью повышения надежности энергосистем, минимизации потерь и повышения эффективности использования энергоресурсов. Современные цифровые технологии позволяют решить эти задачи, что делает подготовку специалистов в сфере цифровой энергетики приоритетной.

Реализация стратегических программ. Государственная инициатива «Цифровой Казахстан» и программы перехода к низкоуглеродной экономике требуют квалифицированных кадров, способных внедрять цифровые технологии для интеграции возобновляемых источников энергии (ВИЭ) и управления распределенной генерацией.

Рост энергопотребления и необходимость оптимизации. С увеличением энергопотребления возрастает потребность в интеллектуальном управлении энергосистемами, что требует новых подходов к прогнозированию, распределению и оптимизации ресурсов.

Инновационные решения для индустриальных предприятий. Промышленные предприятия нуждаются в внедрении автоматизированных и интеллектуальных систем энергоменеджмента для сокращения затрат и повышения энергоэффективности, что увеличивает спрос на выпускников, обладающих знаниями в области цифровой энергетики.

Описание и оценка структуры образовательной программы.

Образовательная программа включает:

-общеобразовательные дисциплины, обеспечивающие теоретическую подготовку в области цифровых технологий в энергетике (56 кредитов);

-профильные дисциплины, направленные на изучение методов цифрового моделирования, управления интеллектуальными энергосистемами и анализа данных (84 кредита);

-базовые дисциплины, предусматривающие изучение современных программных решений, разработку и тестирование цифровых платформ управления электроэнергетическими объектами (70 кредитов);

-производственную практику на ведущих предприятиях отрасли, включая проектно-аналитические и исследовательские задачи (19 кредитов);

-итоговую аттестацию, включающую защиту выпускной квалификационной работы с акцентом на цифровизацию энергетики (8 кредитов);

-общий объем программы – 240 кредитов.

Общее заключение

Образовательная программа «Цифровая энергетика» представляет собой актуальную и востребованную образовательную траекторию, обеспечивающую подготовку высококвалифицированных специалистов в области цифровизации энергетики. Программа отвечает требованиям современного рынка труда, способствует развитию научно-технического потенциала страны и обеспечивает выпускников знаниями и навыками, необходимыми для эффективной реализации цифровых решений в электроэнергетическом секторе. В связи с этим ОП рекомендуется к внедрению в учебный процесс КазУТБ имени К. Кулажанова.

Директор ТОО "ZHOBA LTD"
Берсинкулов Р.К.

Республика Казахстан, г. Тараз,
ул. Ерденбека Ниеткалиева, дом 7.

РЕЦЕНЗИЯ

на образовательную программу «Цифровая энергетика» по направлению подготовки 6В071 Инженерия и инженерное дело, ТОО «Корпорация Сайман», Республика Казахстан, г. Алматы

Название предприятия, страна, город

Общая характеристика образовательной программы:

Представленная на рецензию образовательная программа «Цифровая энергетика» разработана на кафедре «Информационные технологии» КазУТБ имени К.Кулажанова в соответствии с требованиями национальной и отраслевой системы квалификаций, а также профессиональных стандартов.

Актуальность подготовки специалистов в области «Цифровой энергетики» обусловлена следующими факторами:

Казахстанский рынок труда испытывает дефицит высококвалифицированных кадров в сфере цифровой энергетики. По данным Министерства энергетики РК, потребность в специалистах с компетенциями в цифровизации энергетики возрастает на 15-20% ежегодно;

Внедрение цифровых технологий в энергосекторе требует подготовки не менее 5 000 специалистов до 2030 года, обладающих знаниями в области цифровых технологий.

Согласно исследованиям, предприятия энергетического сектора Казахстана теряют до 10% эффективности из-за недостатка специалистов, владеющих технологиями цифрового управления энергосистемами.

Развитие интеллектуальных энергосистем (smart grid), автоматизированных систем управления (SCADA, EMS, DMS), прогнозной аналитики потребления и цифровых симуляций работы энергосистем создаёт дополнительный спрос на специалистов, разбирающихся в цифровой энергетике.

Ожидается, что к 2027 году не менее 70% объектов энергетической инфраструктуры будут оснащены цифровыми решениями.

Описание и оценка структуры образовательной программы.

Структура ОП включает следующие компоненты:

-цикл общеобразовательных дисциплин (56 кредитов);

-цикл базовых дисциплин (84 кредита);

-цикл профилирующих дисциплин (70 кредитов);

-профессиональную практику (19 кредитов);

-итоговую аттестацию (8 кредитов);

-общее количество кредитов составляет 240.

Практические занятия и самостоятельная работа обучающихся ориентированы на решение актуальных задач энергетической отрасли Казахстана. В программу включены кейсы из реальной практики отечественных и международных компаний, что способствует приобретению практических навыков и повышает конкурентоспособность выпускников.

Профессиональная практика и дуальное обучение направлены на развитие навыков работы с оборудованием, автоматикой, системами

управления, организациями передачи электрической энергии, а также на изучение вопросов ликвидации аварийных ситуаций, принятия управленческих решений, соблюдения норм охраны труда и техники безопасности. По данным анализа трудоустройства выпускников аналогичных программ, не менее 85% выпускников находят работу в профильных компаниях в течение первого года после окончания обучения.

Общее заключение

Образовательная программа «Цифровая энергетика» соответствует современным требованиям рынка, стратегии цифровизации Казахстана и международным трендам развития энергетического сектора. Программа позволяет готовить востребованных специалистов, способных обеспечивать стабильность, эффективность и устойчивость энергетической системы страны в условиях цифровой трансформации. В связи с этим ОП рекомендуется к внедрению в учебный процесс КазУТБ имени К.Кулажанова.

Заместитель Директора по производству
ТОО «Корпорация Сайман»
Республика Казахстан, г. Алматы, ул.

Алиев А.С.

ОТЗЫВ/РЕЦЕНЗИЯ

на образовательную программу 6В07133 «Цифровая энергетика» по направлению подготовки 6В071 Инженерия и инженерное дело.

ТОО «AG TECH», Республика Казахстан, г.Астана

Название предприятия, страна, город

Общая характеристика образовательной программы:

Представленная на рецензию ОП 6В07133 «Цифровая энергетика» разработана на кафедре «Информационные технологии» КазУТБ имени К. Кулажанова в соответствии с требованиями Национальной, отраслевой систем квалификации и профессиональными стандартами.

Актуальность подготовки специалистов в области «Цифровой энергетики» заключается в следующем:

-в необходимости удовлетворения потребности рынка труда. Казахстан активно движется в сторону цифровизации экономики, и энергетический сектор не является исключением. Внедрение технологий Индустрии 4.0, таких как IoT, Big Data, AI и цифровые двойники, требует специалистов, обладающих не только классическими знаниями в энергетике, но и навыками работы с современными цифровыми решениями.

Согласно прогнозам Министерства энергетики РК и независимых исследований, в ближайшие годы ожидается высокий спрос на инженеров и аналитиков, способных работать с цифровыми платформами для управления энергетическими системами, прогнозирования потребления электроэнергии и оптимизации работы сетей;

-развитие Индустрии 4.0 в энергетике, активно внедряемой в электроэнергетическом секторе Казахстана. Уже сейчас в стране реализуются проекты по:

-интеллектуальным энергосистемам (smart grid);

-автоматизированным системам управления (SCADA, EMS, DMS);

-прогнозной аналитике потребления и производства электроэнергии с помощью ИИ;

-цифровым моделям и симуляциям работы энергосистем.

Для реализации этих проектов нужны специалисты, которые разбираются как в энергетике, так и в цифровых технологиях.

В Казахстане разработаны стратегии по цифровой трансформации энергетики, включая «Цифровой Казахстан» и Дорожную карту по развитию ВИЭ (возобновляемых источников энергии). Правительство и частные компании инвестируют в модернизацию электросетевого комплекса и внедрение цифровых технологий.

Крупные предприятия, такие как «Самрук-Энерго», KEGOC, «КазТрансГаз» и КазМунайГаз, уже внедряют элементы цифровой энергетики, что создаёт дополнительный спрос на подготовленных специалистов.

С учетом глобального тренда на декарбонизацию и развитие ВИЭ, цифровизация становится неотъемлемой частью энергетического сектора. Умные системы управления электроэнергией позволяют повышать эффективность использования ВИЭ, балансировать нагрузку и сокращать выбросы CO_2.

Получаемые в результате обучения навыки, компетенции, возможность дуального обучения, позволяют говорить о практической ориентированности образовательной программы, с учетом лиц с особыми образовательными потребностями.

Описание и оценка структуры образовательной программы.

Структура образовательной программы состоит из цикла общеобразовательных дисциплин (ООД) в объеме 56 кредитов, цикла базовых дисциплин (БД) в объеме 84 кредита, цикла профилирующих дисциплин (ПД) в объеме 70 кредитов, профессионально

практике в объеме 22 кредита, итоговой аттестации в объеме 8 кредитов, общее количество кредитов составляет 240.

Задания практических занятий, самостоятельной работы обучающихся подготовлены на основе задач решаемых в энергетической отрасли Республики Казахстан.

Профессиональная практика, дуальное обучение ориентированы на изучение обучающимися оборудования, автоматики, систем управления, организации передачи электрической энергии, устранению аварий на сетях, принятия управленческих решений в рамках своих компетенций, соблюдению требований охраны труда и техники безопасности на производстве.

Общее заключение

Представленная ОП «Цифровая энергетика» в соответствии с содержанием и организацией, учебными планами, учебным графиком, рабочими программами дисциплин, практик, оценочными средствами для промежуточных и итоговых аттестаций, отвечает вызовам современного рынка и стратегическим целям Казахстана и рекомендуются к внедрению в учебном процессе КазУТБ имени К. Кулажанова.

ОП позволяет готовить востребованных специалистов цифровой энергетике, способных обеспечивать стабильность, эффективность и устойчивость энергетической системы страны в условиях цифровой трансформации.

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