AGREED
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on production
JSC "Alatau Zharyk Companiyasy"
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"04" 03 2023

I APPROVE
Director of the Institute
"Automation and telecommunications"
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"24" 03 2023

CATALOG OF ELECTIVE DISCIPLINES

EDUCATIONAL PROGRAMS

6B07188 IT Energy

Education level: bachelor's degree

Duration of study: 4 years

Year of admission: 2023 y.

Module	Cycle	Component	Name of the discipline	Overall labor intensity		Semester	Learning outcome	Brief description of the discipline	Prerequisites	Postrequisites
				in academic hours	in academic loans					
1	2	3	4	5	6	7	8	9	10	11
Module 1 - General education subjects	GED	EC	Ecology and life safety	150	5	3	LO 10	The study of the basic environmental concepts, environmental problems and approaches to their solution, sources and types of environmental pollution by enterprises, the principles of standardizing the quality of atmospheric air and water, the main provisions of legislation in various fields, natural and man-made emergencies, their causes, methods of prevention and protection . Teaching methods - analysis of specific situations (case-study).	School component disciplines	Labor protection, Final assessment
		EC	Scientific research methods				LO 2, 9	Obtaining theoretical and applied knowledge by students on the methods of scientific research of problems in the field of study, training of specialists with the skills of cognitive activity in the field of science, the formation of deep ideas about the content of scientific activity, its methods and forms of knowledge.	Phylosophy, Information and Communication Technologies	Fundamentals of computer modeling, Innovative computer-aided design systems
Module 4 – Economic and managerial competencies		EC	Basics of economics and entrepreneurship				LO 6	He studies the activities of enterprises in various types of markets, the model of equilibrium and functioning of the market, state regulation of prices and tariffs. Considers the concept of entrepreneurship and the limits of its legal regulation, the conditions for the development of entrepreneurship, organizational and legal forms of	Sociology, Political science, Phylosophy	Managerial Economics, Time -management

								doing business, business planning, entrepreneurial secrecy, social responsibility of. Active learning methods: case methods; business role-playing games, group work.		
Module 1 - General education subjects		EC	Basics of law and anti-corruption culture				PO 13, 14	Improving the public and individual legal awareness and legal culture of students, as well as the formation of a system of knowledge and civil position to combat corruption as an anti-social phenomenon. As a result of studying the course, the student must master the fundamental concepts of law, the constitutional structure of the state power of the Republic of Kazakhstan, the rights and freedoms of citizens enshrined in the Constitution, the mechanism and protection of the legitimate interests of a person in case of their violation.	Sociology, Political science , Phylosophy , Culturology , History of Kazakhstan	Phylosophy , Final assessment
Module 9 – Engineering 2 and industrial practice	BD	EC	Electric power systems and networks	180	6	6	PO 5, 7, 12	Studies the task, structure, choice of electrical equipment of electrical networks and substations, basic regulatory and technical documentation for systems in general and specific electrical equipment, principles for choosing a circuit and layout of high voltage switchgears, design of switchgears at substations. The discipline includes guest lectures by representatives of top managers of energy companies.	Information and measuring technology	Digital electrical and traction substations, Local automation and control systems, Clever networks based on Smart-Grid
			Electrical equipment of power stations, networks and systems				PO 5, 7, 12	Studies the main characteristics, areas of application, principles of operation, design of electrical equipment used in power stations and substations, networks and systems. Calculates short circuit currents and selects equipment at power stations and substations, for own needs of power plants and substations. The discipline provides for guest lectures by stakeholders of energy companies.	Control and measuring instruments	Digital electrical and traction substations. Local automation and control systems , Active-adaptive control in power systems
Module 10 – Administration of information systems and networks	BD	EC	Fundamentals of computer networks and telecommunications (Cisco + Huawei)	180	6	4	PO 4, 8	Mastering the principles of building and functioning of local, regional, global computer networks and mobile telecommunications by students, as well as gaining practical skills in working with their information resources, working with Cisco and Huawei networks, SD-WAN and SDN. Active learning methods - "simulator" learning methods, i.e. aimed at the formation of special knowledge, skills: situational tasks, error detection method, project method, case method, open and closed tests.	Information and Communication Technologies, Fundamentals of computer modeling	Introduction to MongoDB, Cybersecurity in the electric power industry , Local automation and control systems
			Cloud Infrastructure Basics				PO 2, 3	Mastering the technology of creating a cloud service, working with existing cloud services, students will learn how to use cloud computing and will be ready to use cloud computing technology in solving problems of optimizing IT processes.	Information and Communication Technologies, Algorithms, data structures and	MachineLearning A-Z: Python& R inDataScience, Local automation and control systems

								Within the framework of the discipline, interactive teaching methods, the calculation-analytical method, the case-task method, game methods are used.	programming, Fundamentals of computer modeling	
Module 9 – Engineering 2 and industrial practice	BD	EC	Alternative energy and energy saving technologies	180	6	6	PO 11	Studies the methods and ways of using non-traditional and renewable energy sources (RES), the principles of building autonomous energy supply systems, the main properties, designs and principles of operation of the main power and auxiliary equipment, modern and promising directions of development (technologies) of RES, their impact on the environment and ecology . The formation of general competencies is carried out by performing laboratory work on specialized training stands. Within the framework of the discipline, the calculation and analytical method, the method of case tasks are used.	Applied Physics	Electric power systems and networks, Digital electrical and traction substations, Industrial practice 2, Final assessment
			Energy efficiency and energy saving based on RES				PO 11	Studies the principles of energy conversion, the operating conditions of the main elements of power plants during operation, methods of technical and economic calculations for conducting surveys of enterprises and energy audits when using energy-saving technologies. Assess the effectiveness of renewable energy sources in order to develop and implement the necessary changes in their structure from the standpoint of increasing efficiency and addressing energy saving issues. The formation of general competencies is carried out by performing laboratory work on training stands. Within the framework of the discipline, the calculation and analytical method, the method of case tasks are used.	Applied Physics	Electrical equipment of power stations, networks and systems, Digital electrical and traction substations, Industrial practice 2, Final assessment
Module 11 – Relay protection and automation	BD	EC	Relay protection and automation of electric power systems	180	6	7	PO 11	Forms knowledge about the principles of organization and technical implementation of modern relay protection of electric power systems for carrying out technical calculations of parameters, setting up and selecting elements of relay protection devices with individual work on the MathCad, AutoCad software packages, as well as laboratory work on a specialized training stand using the computer simulation method and practical analysis of simulation results. Practical classes of certain modules are studied on the basis of the branch of the department in real production conditions. Guest lectures by top managers of NC KTZ JSC, including representatives of scientific and design institutes, are planned. It is possible to perform group work at the final certification.	Information and measuring technology	Digital electrical and traction substations, Industrial practice 2, Final assessment
			Microprocessor relay				PO 11	Formation of students' skills in the practical	Control and	Digital electrical and

			protection and automation					application of relay protection and automation to ensure the reliability of power supply systems. When studying the discipline, it is envisaged to perform laboratory work on the stand, settlement and graphic work. Practical classes of individual modules of the discipline are studied on the basis of the branch of the department, as part of the introduction of elements of the dual training system. The discipline provides for guest lectures by stakeholders of energy companies. The method of computer simulation and analysis of the results is used. It is possible to perform group work with public defense of your own project.	measuring instruments	traction substations, Industrial practice 2, Final assessment
Module 8 – Database Design and Administration	BD	EC	Object-oriented programming	180	6	4	PO 3	The study of the basics of the classical theory of object-oriented programming, including: the ways of evolution of programming technologies from algorithmic to OOP, the basic principles of object-oriented construction of software systems (Abstraction, Encapsulation, Hierarchy, Modularity, Typing, Parallelism, Persistence), concepts of classes, objects, relationships between them, as well as the multilevel OMG model. the study of the means of object-oriented and generalized programming of the C++ language, the means of the STL standard library. Within the framework of the discipline, methods of active learning are used - presentations based on modern multimedia tools, a method of working in small groups.	Information and Communication Technologies, Algorithms, data structures and programming	Programming in 1C, Database development and administration, Programming in Java , Big Data storage and processing, Final assessment
			Linux operating systems				PO 3, 4	Formation of the ability of future students to work with the structures and mechanisms of various operating systems, as well as in the Linux operating system. Within the framework of the discipline, the following aspects of Linux are considered: functions and architectural requirements for the OS, general principles of resource management, file system architecture, memory management, input management, data management system. In practical exercises, Linux (Ubuntu) OS is used. Within the framework of the discipline, active learning methods are used - "brainstorming", thematic discussion.	Information and Communication Technologies	Programming in Python, Big Data storage and processing, Final assessment
Module 7 – Engineering 1	BD	EC	Information and measuring technology	180	6	3	PO 5, 12	Studies methods and means of measuring the energy parameters of electrical circuits, measuring and information systems and complexes, the principles of constructing measuring instruments, including digital ones. Students will use active methods to plan and execute an experimental study using electrical measuring instruments, evaluate the	Applied Physics	Digital electrical and traction substations, Relay protection and automation of electric power systems

								results of measurements of electrical quantities by performing laboratory work on specialized training stands, and compare measurement results using a virtual environment. Evaluates the accuracy of measurement tools and results, verifies electrical measuring instruments. Within the framework of the discipline, interactive teaching methods, a calculation-analytical method, and a case-task method are used.		
			Control and measuring instruments				PO 5, 12	Studies the device and principle of operation of measuring equipment and instrumentation used in the energy industry, methods for measuring and controlling the parameters of electrical circuits and electrical equipment, the structure of analog and digital measuring instruments, their characteristics. As a result of studying the discipline, the student will be able to classify the readings of instruments that regulate the technological process. The formation of general competencies is carried out by performing laboratory work on training stands. Within the framework of the discipline, interactive teaching methods, a calculation and analytical method are used.	Applied Physics	Digital electrical and traction substations, Microprocessor relay protection and automation
Module 12 – Programming and Data Processing	PD	EC	Programming in Java	180	6	5	PO 2, 3	Formation of a system of concepts, knowledge, skills and abilities in the field of modern programming, which includes methods for designing, analyzing and creating software products in the Java language, based on the use of object-oriented methodology.Within the framework of the discipline, active learning methods are used - presentations based on modern multimedia tools, the method of working in small groups, practical analysis of the results.	Information and Communication Technologies, Algorithms, data structures and programming, Object-oriented programming	Big Data storage and processing, Final assessment
			Programming in Python				PO 2, 3	Formation of students to create modern cross-platform applications in Python using the universal PyQt5 graphics platform, interaction with the Internet, office documents, databases, graphics, multimedia and printing. Within the framework of the discipline, active learning methods are used - laboratory experiments, the method of working in small groups, "brainstorming".	Algorithms, data structures and programming, Object-oriented programming	Machine Learning A-Z: Python& R in DataScience, Final assessment
	PD	EC	Big Data storage and processing	270	9	8	PO 1, 2, 8	Providing students with the necessary knowledge and skills to work with big data based on relational and non-relational databases. Studying the basic concepts related to big data, its storage and processing, the basic principles of working with relational databases and building database architecture, mastering basic knowledge of the SQL query language and data visualization, studying the	Information and Communication Technologies, Algorithms, data structures and programming, Database development and	Final assessment

								main types of data processing, introduction to modern big data processing languages . To master the discipline, software is used: Windows, Microsoft Office, AnacondaNavigator, Dbeaver, Superset, Internet access. Within the framework of the discipline, active learning methods are used - the method of working in small groups, laboratory experiments.	administration, Programming in Java	
			Programming in 1C				PO 1, 2, 3	Formation of students about programming on the basis of "1C:Enterprise", general concepts about the main objects that make up applied solutions, and their acquisition of initial practical skills in working in various options and modes of the system. Within the framework of the discipline, active learning methods are used - the method of working in small groups, laboratory experiments.	Information and Communication Technologies, Algorithms, data structures and programming, Database development and administration, Object-oriented programming	Final assessment
Module 13 – Management in Power Systems	PD	EC	Technical means of dispatching control in the electric power industry	180	6	6	PO 11, 12	Studies methods and means of collecting, transmitting, converting and displaying telemechanical information for the purposes of dispatching and technological control of energy systems and their individual elements. Within the framework of the discipline, interactive teaching methods, a calculation and analytical method are used. The discipline provides for guest lectures by stakeholders and specialists from the operational dispatch department of energy companies.	Automation control systems and telemechanics of an electrical substation, Automatic control systems	Digital electrical and traction substations, Local automation and control systems, Final assessment
			Technical means of automation and operational management in power systems				PO 4,12	Studies the principles of building and configuring automated control systems for technical objects based on typical hardware and software, including complexes of hardware and software for obtaining, processing and visualizing information about the state of an automation object. Within the framework of the discipline, interactive teaching methods, a calculation and analytical method are used. The discipline provides for guest lectures by stakeholders and specialists from the operational dispatch department of energy companies.	Automation control systems and telemechanics of an electrical substation, Automatic control systems	Digital electrical and traction substations, Local automation and control systems, Final assessment
Module 4 – Economic and managerial competencies	PD	EC	Managerial Economics	90	3	5	PO 6	Formation of the conceptual apparatus and development of economic analysis skills using modern models and laws of economic science, consideration of economic problems and tasks facing the head of the company. The study of this discipline will allow students to gain and develop knowledge in the field of analytical research of economic, technological and technical parameters of an enterprise, and will also allow them to master	Basics of law and anti-corruption culture	Final assessment

								the skills of applying special methods of economic justification of management decisions and assessing their consequences. Active learning methods are used - situational tasks, case method.		
			Time -management				PO 6	Formation of students' general ideas about the essence and types of time management, principles and methods of time resource management for more successful professional activities. Active learning methods are used - situational tasks, case method.	Basics of law and anti-corruption culture	Final assessment
Module 6 – IT competencies	PD	EC	Introduction to MongoDB	90	3	6	PO 8	Formation of students' ability to process large amounts of data (MongoDB) to solve professional problems, effectively apply methods, technologies and tools for analyzing big data in professional activities. Methods of active learning are applied - group work.	Information and Communication Technologies, Algorithms, data structures and programming	Big Data storage and processing, Artificial intelligence, Final assessment
			Machine Learning A-Z: Python & R in Data Science				PO 8	Introducing students to the field of Data Science and Machine Learning, which covers data visualization, data analysis, libraries and open source tools. Methods of active learning are applied - group work.	Information and Communication Technologies, Programming in Python, Database development and administration	Artificial intelligence, Final assessment
Module 13 – Management in Power Systems	PD	EC	Clever networks based on Smart-Grid	90	3	7	PO 12	Studies modernized power supply networks that use information and communication networks and technologies to collect information about energy production and energy consumption, which automatically improve efficiency, reliability, economic benefits, as well as the sustainability of electricity production and distribution.	Electric power systems and networks, Innovative computer-aided design systems	Digital electrical and traction substations, Final assessment
			Active-adaptive control in power systems				PO 3, 9	Studies a new generation electric power system based on the multi-agent principle of organization and management of its functioning and development in order to ensure the efficient use of all resources (natural, social production and human) for reliable, high-quality and efficient energy supply to consumers through the flexible interaction of all its subjects (all types of generation , electrical networks and consumers) based on modern technological means and a single intelligent hierarchical control system.	Electric power systems and networks, Innovative computer-aided design systems	Digital electrical and traction substations, Final assessment
ИТОГО				**2130**	71					

Заведующий кафедрой «Энергетика» **Егзекова А.Т.**