

AGREED

Deputy Chief

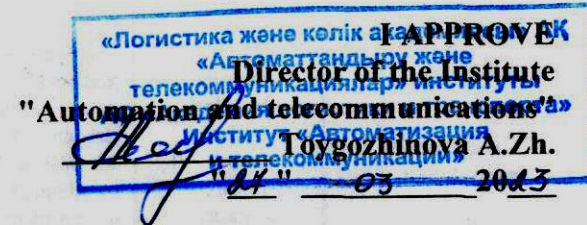
«Almaty power supply distance»

branch of NC KTZ JSC -

«Almaty branch of the backbone network»

Orymbaev B.I.

«04» 03 2023



CATALOG OF ELECTIVE DISCIPLINES

EDUCATIONAL PROGRAMS

6B07121 Electrical power engineering

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 6 – Ecology and life safety	GED	EC	Ecology and life safety	150	5	3	LO 2	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
Module 5 – IT competencies		EC	Scientific research methods				LO 1, 5	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.	Philosophy, Information and Communication Technologies	Fundamentals of computer modeling, Innovative computer-aided design systems
Module 9 – Natural Sciences		EC	Basics of economics and entrepreneurship				LO 8, 13	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 doing business, business planning, entrepreneurial secrecy, social responsibility of. Active learning methods: case methods; business role-playing games, group work.	Sociology, Political science, Philosophy	Organization of the production process of the energy sector, Управленческая экономика, Тайм-менеджмент

Module 1 – General education disciplines		EC	Basics of law and anti-corruption culture			3	LO 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, Psychology, Culturology, History of Kazakhstan	Философия, Final assessment
Module 11 – Basic special disciplines 2	BD	EC	Electrical Materials and High Voltage Engineering	180	6	4	LO 12	Studies the main phenomena occurring in dielectric, semiconductor, conductor and magnetic materials, the main electrical, physico-chemical and mechanical properties, the classification of electrical materials used in the energy sector. As well as the basics of electrical discharges in gases, the characteristics of the internal insulation of electrical installations, the main methods for testing insulation, overvoltages in electrical networks and methods of protection against overvoltages. For the formation of competence within the discipline, interactive teaching methods, a calculation and analytical method using computer technologies (Excel, MathCad), as well as the implementation of experimental laboratory work both on a specialized training stand and simulating insulation tests in a virtual environment are used. As part of the introduction of elements of the dual education system, the study of individual modules of the discipline is provided for in the branch of the department on the basis of the Almaty power supply distance (repair and revision section).	Applied Physics, Digital electronics	Electromechanics and electrical equipment. Final assessment
			Materials Science in the Energy Industry				LO 12	Studies the main characteristics and principles of the use of electrical materials in devices of electrical engineering and electric power industry. Students will be able to classify electrical materials according to their composition, physical properties and technical purpose. The formation of general competencies is carried out by performing laboratory work on specialized training stands. Within the framework of the discipline, interactive teaching methods, the method of case-tasks are used.	Applied Physics, Digital electronics	Electromechanics and electrical equipment. Final assessment
Module 12 – Engineering 1 and Industrial Practice	BD	EC	Alternative energy and energy saving technologies	180	6	6	LO 6	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, Digital electronics	Electric power systems and networks, Traction and transformer substations, Production practice 1, 2. Final assessment
			Energy efficiency and energy saving based on RES				LO 6	Studies the principles of energy conversion, the operating conditions of the main elements of power plants during operation, methods of technical and economic calculations	Applied Physics, Digital devices	Electrical equipment of power stations, networks and systems.

								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.	and microprocessors	Traction and transformer substations, Production practice 1, 2, Final assessment
Module 13 – Engineering 2	BD	EC	Electric power systems and networks	180	6	6	LO 4, 7	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.	Applied Physics, Electrical machines, Electromechanics and electrical equipment	Electricity supply for electrified roads, Traction and transformer substations, Production practice 1, 2, Final assessment
			Electrical equipment of power stations, networks and systems				LO 6, 7	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.	Applied Physics. Digital devices and microprocessors	Power supply of electric transport and subways. Traction and transformer substations, Production practice 1, 2, Final assessment
Module 17 – Relay protection, power supply of electrified roads	BD	EC	Relay protection and automation of electric power systems	180	6	7	LO 5, 9	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.	Digital electronics, Electric power systems and networks	Traction and transformer substations, Production practice 2, Final assessment
			Microprocessor relay protection and automation				LO 5, 9	Formation of students' skills in the practical 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.	Digital devices and microprocessors, Electrical equipment of power stations, networks and systems	Traction and transformer substations, Production practice 2, Final assessment
Module 11 – Basic special	BD	EC	Digital electronics	180	6	3	LO 5,7	Formation of students' understanding of digital electronics, the basics of digital circuitry, the principles of operation and	Applied Physics,	Information and measuring technology.

disciplines 2								design of digital devices. The course discusses the main methods of description and synthesis of logic circuits, modern means of developing digital devices.	Engineering Mathematics	Relay protection and automation of electric power systems, Basics of building SCADA systems in the electric power industry
			Digital devices and microprocessors				LO 5,7	It is focused on the study of the theoretical and practical foundations of the functioning of digital devices and microprocessors in order to create schematic diagrams of communication devices and infocommunication technology. Within the framework of the discipline, interactive teaching methods, computational and analytical method, and the method of case tasks are used.	Applied Physics, Engineering Mathematics	Control and measuring instruments, Relay protection and automation of electric power systems. Basics of building SCADA systems in the electric power industry
Module 12 – Engineering 1 and Industrial Practice	BD	EC	Information and measuring technology	180	6	3	LO 5, 8	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 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.	Applied Physics, Digital electronics	Traction and transformer substations, Relay protection and automation of electric power systems
			Control and measuring instruments				LO 5, 8	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 devices and microprocessors	Relay protection and automation of electric power systems, Electrical equipment of power stations, networks and systems
Module 13 – Engineering 2	PD	EC	Electromechanics and electrical equipment	180	6	5	LO 4, 12	Studies electromechanical processes of energy conversion, principles of operation, design and characteristics of electric machines of direct and alternating currents, electrical insulating and cable technology, theory and application of induction heating, arc discharge, modern automatic control systems for electric drives. As part of the study of the discipline, the solution of practical problems is provided, including: the design of a traction motor, the choice of cable technology, electrical insulation and electrical equipment.	Electrical machines, Electrical, Materials and High Voltage Engineering	Transition processes in the electric power industry. Production practice 1
			Electromechanics, electronics and				LO 9	Studies modern protection and emergency automation equipment in the electric power industry on a digital basis.	Digital devices and	Transition processes in the electric power

			microprocessor technology					using microprocessor systems in electrical complexes, considers the basic principles of the functioning of the hardware structure and program control. Within the framework of the discipline, interactive teaching methods, a calculation and analytical method are used.	microprocessors, Materials Science in the Energy Industry	industry, Relay protection and automation of electric power systems, Production practice 1
Module 17 – Relay protection, power supply of electrified roads	PD	EC	Electricity supply for electrified roads	270	9	8	LO 9, 10	Studies methods for evaluating and selecting rational technological modes of operation of power supply devices, the choice of locations for traction substations and linear devices for traction power supply, depending on the size of the movement. The discipline provides for guest lectures by top managers of NC KTZ JSC. Interactive teaching methods, project method are used. It is possible to perform group work at the final certification.	Electric power systems and networks, Contact networks and power transmission lines, Traction and transformer substations	Production practice 2, Final assessment
			Power supply of electric transport and subways				LO 9, 10	Studies the technological modes of operation of power supply devices for electric transport and the subway, the methodology for calculating the main parameters of the traction power supply system. The discipline includes guest lectures by representatives of the transport company, as well as scientific and design institutes. Non-game interactive teaching methods are used.	Electrical equipment of power stations, networks and systems, Contact networks and power transmission lines	Production practice 2, Final assessment
Module 16 – Diagnostics, reliability and operation of devices	PD	EC	Stability of energy systems and reliability of electrical equipment	180	6	6	LO 7, 8, 9	Studies the theory of reliability of energy systems, the physical nature of electrical equipment failures, mathematical models of failures, elements of probability theory and mathematical statistics and their application in reliability calculations, the basics of reliability analysis, methods for calculating reliability indicators and indicators of the level of reliability of electric power systems. Within the framework of the discipline, interactive teaching methods, a calculation and analytical method are used. The discipline provides for guest lectures by stakeholders of energy companies.	Electrical Materials and High Voltage Engineering, Electrical machines	Technical diagnostics and repair of electrical equipment, Production practice 2, Final assessment
Module 15 – Electromagnetic compatibility and power quality			Power quality and reactive power compensation				LO 8	Studies electrical devices used in the use of electrical energy, starting from its production, transmission, distribution and consumption, their purpose, main characteristics, as well as areas of application, principles of operation, design of monitoring and measuring indicators of power quality and reactive power compensation. Within the framework of the discipline, interactive teaching methods, a calculation and analytical method are used.	Control and measuring instruments, Transition processes in the electric power industry	Traction and transformer substations, Production practice 1, Final assessment
Module 1 – General education disciplines	PD	EC	Managerial Economics	90	3	5	LO 8, 13	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 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.	Basics of economics and entrepreneurship	Organization of the production process of the energy sector, Final assessment

			Time -management				LO 11	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 economics and entrepreneurship	Organization of the production process of the energy sector, Final assessment
Module 5 – IT competencies	PD	EC	Introduction to MongoDB	90	3	6	LO 5	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.	Fundamentals of computer modeling, Digital electronics, Scientific research methods	Basics of building SCADA systems in the electric power industry, Final assessment
			Machine Learning A-Z: Python & R in Data Science				LO 5, 6	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.	Fundamentals of computer modeling, Digital devices and microprocessors, Scientific research methods	Basics of building SCADA systems in the electric power industry. Final assessment
	PD	EC	Clever networks based on Smart-Grid	90	3	7	LO 5, 7, 11	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	Basics of building SCADA systems in the electric power industry, Final assessment
			Active-adaptive control in power systems				LO 5, 6	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	Basics of building SCADA systems in the electric power industry, Final assessment
TOTAL			2130	71						

Head of the Department «Energy»

Egzekova A.T.