EDUCATIONAL INSTITUTION "Alikhan Bokeikhan University"
Information and Technology Faculty
Departmentinformation- technology science

6B07125 ELECTROENERGETICS

THE CATALOGUE OF ELECTIVE SUBJECTS

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Awarded degree: bachelor of technology and technology on the educational program
6B07125 ELECTROENERGETICS

Group of education: B062 Electrical and power engineering

Elective course №	The name of subject		Prerequisites	Postrequisites	Short description of the content, the aims of education, expected results
BASIC DISCIPLINES					
Be sure to select(BSS)					
1	General energy	3	Physics, Mathematics, I, II	Alternative and renewable energy sources, Transmission and distribution of electricity	**Purpose:** Formation of scientific knowledge and understanding of the physical essence of the processes of obtaining, transferring and converting energy **Contents:** Energy resources and their use. Renewable and non-renewable energy sources. The main provisions of technical thermodynamics. Fundamentals of heat transfer theory. Convective and radiant heat transfer. Modern methods of obtaining electrical energy. Cycles of thermal electric, hydroelectric and nuclear power plants. Methods for converting various types of energy into electrical energy. Non-traditional ways of obtaining energy. The concept of the electrical system. Management of electric power systems. The influence of technology and energy on the biosphere. **Expected Result:** **Know:** the main physical phenomena associated with the production of electrical and thermal energy. Various methods of obtaining electrical and thermal energy. Bases of energy saving policy of the States; **Able to:** explain the physical principles of turbines, steam generators, cycles of heat and electricity. **Possess skills:** skills of calculation of efficiency indicators of theoretical and actual cycles of thermal power plants and nuclear power plants, determination of actual and theoretical capacity of thermal power plants.
1	World energy	3	Physics, Mathematics, I, II atics	Unconventional energy, Transmission of electricity by direct and alternating current	**Objective:** formation of students ' knowledge about energy sources, methods of their transformation into thermal, mechanical and electrical energy. **Content** Hydropower, Wind energy, Solar energy, Geothermal energy, Biofuels, Secondary energy and energy conservation. **Expected Result:** **Know:** fundamentals of General energy, including basic methods and methods of energy conversion, technology of electricity production at thermal, nuclear and hydraulic power plants, non-traditional and renewable sources of electricity **Able to:** perform simple calculations of heat exchangers and evaluation of thermodynamic efficiency of actual cycles of power plants; **Possess skills:** in work operational requirements to various types of electric power industry; bases of ensuring safety of activity.

2	Descriptive geometry and engineering graphics using computer technology	5	Drawing (school course), Computer Science (school course)	Design of power stations and substations, Electrical drawings and diagrams	**Purpose:** The purpose of the discipline is for students to acquire knowledge of the theoretical foundations of the construction and transformation of a projection drawing as a graphical model of spatial figures, followed by the application of skills in the practice of technical drawings, their design according to the rules of state standards, including using artificial intelligence (AI). **Contents:** Theory of drawing construction. Projection methods. The Monge plot. Ways to transform orthogonal projections. Positional and metric problems. Polyhedra. Surfaces of rotation. Axonometric projections. General rules for the execution of drawings. Images: views, sections, cross sections. Types of connections. Reading and detailing assembly drawings. Schemes. The basics of the AutoCAD computer graphics system. Execution of drawings and diagrams. Three-dimensional modeling. **Expected Result:** **Know:** construction of drawings; projection methods; Monge plots; methods for converting orthogonal projections; positional and metric tasks; axonometric projections; general rules for drawing execution; reading and detailing assembly drawings. The basics of computer graphics programs. Three-dimensional modeling.; **Able to:** perform AutoCAD diagrams and drawings based on a computer graphics system; read, solve problems on the mutual affiliation and mutual intersection of geometric shapes; determine the geometric shapes of simple parts from their images and perform these images both from nature and from the drawing of an assembly unit; read drawings of assembly units; **Possess skills:** : practical work with drawing tools; reading images of objects, drawings of parts and assembly units of medium complexity; making sketches and working drawings of parts, assembly drawings and general drawings; measuring parts and dimensioning on drawings of parts and assembly units;
2	Computer drawing basics	5	Technical drawing (high-school), computer science (school course)	Design of power supply systems, Drawing and design of electrical circuits	**Objective:** The purpose of the discipline is for students to acquire knowledge of the theoretical foundations of the construction and transformation of a projection drawing as a graphical model of spatial figures, followed by the application of skills in the practice of technical drawings, their design according to the rules of state standards, including using artificial intelligence (AI). **Contents:** Theory of drawing construction. Projection methods. The Monge plot. Ways to transform orthogonal projections. Positional and metric problems. Polyhedra. Surfaces of rotation. Axonometric projections. General rules for the execution of drawings. Images: views, sections, cross sections. Types of connections. Reading and detailing assembly drawings. Schemes. The basics of the AutoCAD computer graphics system. Execution of drawings and diagrams. Three-dimensional modeling. **Expected Result:** **Know:** construction of drawings; projection methods; Monge plots; methods for converting orthogonal projections; positional and metric tasks; axonometric projections; general rules for drawing

					execution; reading and detailing assembly drawings. The basics of computer graphics programs. Three-dimensional modeling. **Able to:** perform AutoCAD diagrams and drawings based on a computer graphics system; read, solve problems on the mutual affiliation and mutual intersection of geometric shapes; determine the geometric shapes of simple parts from their images and perform these images both from nature and from the drawing of an assembly unit; read drawings of assembly units; **Possess skills:** practical work with drawing tools; reading images of objects, drawings of parts and assembly units of medium complexity; making sketches and working drawings of parts, assembly drawings and general drawings; measuring parts and dimensioning on drawings of parts and assembly units;
3	Metrology and standardization	5	Mathematics, I, II, Physics	Electrical measurements in electrical installations, Electrical machines, Fundamentals of entrepreneurship in the electric power industry	**Objective:** theoretical and practical training of students in the field of Metrology, standardization and certification, development of their ability to independently deepen and develop their knowledge. **Contents:** A basic understanding of the theoretical metrology. The theory of unity of measurements. Measurement errors and statistical processing of measurement results. Means of measurement. Metrological characteristics of measuring instruments and their regulation. Organization of works on standardization. Categories of normative documents and types of standards. Methodical bases of standardization. Rules for the implementation of electrical circuits. Parametric series and characteristics of the degree of protection of electrical equipment and products. Requirements for the quality of electrical energy. The system of occupational safety standards. International standardization system **Expected Result:** **Know:** basic concepts and definitions of Metrology, measurement errors; means of measuring electrical and non-electrical quantities; basic tasks, concepts and algorithms of standardization and certification; methods and means of measurement automation. **Able to:** to choose measuring means and to use them; to use receptions of definition of errors of measuring means. **Possess skills**: to formulate requirements to algorithms and structure of devices and systems at automation of measurements.
3	Basics of metrology	5	Mathematics, I, II, Physics	Measurement of electrical and non-electrical quantities	**Objective:** theoretical and practical training of students in the field of Metrology, standardization and certification, development of their ability to independently deepen and develop their knowledge. **Content:** A basic understanding of the theoretical Metrology. The theory of unity of measurements. Measurement errors and statistical processing of measurement results. Means of measurement. Metrological characteristics of measuring instruments and their regulation. **Expected Result:** **Know:** basic concepts and definitions of Metrology, measurement errors; means of measuring electrical and non-electrical quantities; basic tasks, concepts and algorithms of standardization and certification; methods and

					means of measurement automation. **Able to:** to choose measuring means and to use them; to use receptions of definition of errors of measuring means. **Possess skills**: to formulate requirements to algorithms and structure of devices and systems at automation of measurements.
4	Electric drive basics	5	Physics, Mathematics, I , Mathematics, II	Transients in the electric power industry, Power conversion devices,	**Purpose:** in the formation of knowledge of the theory, characteristics and design of Electromechanical (electric machines) and electromagnetic (transformers) energy converters. **Contents:** Definition and structure of the automated electric drive. Mechanics of automated electric drive. Electromechanical properties of AC and DC motors. Methods of regulation of coordinates. Automated electric drive systems **Expected Result:** **Know:** device, theory of operation and characteristics of electrical machines and transformers, design, parameters and types of electrical machines for various purposes; **Able to:** choose from catalogs the optimal type of motor and frequency Converter in accordance with the technical specifications and make the necessary calculations **Possess skills:** methods of diagnosing malfunctions of electric drive units.
4	Adjustable electric drive of the electric power industry	5	Physics, Theoretical foundations of electrical engineering II, Electrical machines	Electromagnetic and Electromechanical processes, energy Saving and quality of electric energy	**Objective** in the formation of knowledge of the theory, characteristics and design of Electromechanical (electric machines) and electromagnetic (transformers) energy converters **Contents:** Electric drive system thyristor converter with squirrel cage rotor. The main elements of the electric drive. Unmanaged or controlled rectifier. The structure of the electric drive. Analysis of the main elements, methods of forming the characteristics of the engine. Energy-saving properties of modern electric drive: improving the quality of technological processes **Expected Result:** **Know:** device, theory of operation and characteristics of electrical machines and transformers, design, parameters and types of electrical machines for various purposes. **Able to:** choose from catalogs the optimal type of motor and frequency Converter in accordance with the technical specifications and make the necessary calculations. **Possess skills:** methods of diagnosing malfunctions of electric drive units.
5	Electrical measurements in electrical installations	4	Physics, Metrology and standardizatio n	Electrical equipment	**Purpose:** formation of professional competence of future specialists in the field of methods and means of measurement of electric, magnetic and non-electric quantities. **Content:** Processes of electromechanical energy conversion. Design of electrical measuring devices, their properties, characteristics, operating rules. The principle of operation and the device of various types of electrical measuring devices. Physical phenomena occurring in electrical measuring devices when they are included in electrical circuits under different operating conditions. **Expected result:** **Know:** theoretical bases of technical measurements; the main types of electrical measuring instruments and their classification; the

					procedure for selecting the type of electrical measuring device. **Able to:** select the type of electrical measuring device; to change the limits of measurement; to measure electrical resistances and resistance of grounding devices, power and energy of electric current; to measure non-electrical quantities by electrical methods. **Skills:** use normative, reference and other information sources when choosing the means and method of measurement.
5	Measurement of electrical and non-electrical quantities	4	Physics, Fundamentals of Metrology	Energy saving and quality of electric energy	**Purpose:** formation of professional competence of future specialists in the field of methods and means of measurement of electric, magnetic and non-electric quantities **Expected result:** The main types of devices and circuits used in the Converter technology; the principle of operation and features of rectifiers, inverters and other electrical energy converters: basic concepts and definitions of measuring equipment; measuring instruments and their classification, as well as the principle of operation and devices of various measuring instruments; types and methods of measurement; principle of operation and devices of converters of non-electrical quantities in electrical; principles of construction of measuring equipment, measuring information systems and complexes.. **Know:** theoretical bases of technical measurements; the main types of electrical measuring instruments and their classification; the procedure for selecting the type of electrical measuring device. **Able to:** select the type of electrical measuring device; to change the limits of measurement; to measure electrical resistances and resistance of grounding devices, power and energy of electric current; to measure non-electrical quantities by electrical methods. **Skills:** use normative, reference and other information sources when choosing the means and method of measurement.
6	Electrical drawings and diagrams	4	Descriptive geometry and engineering graphics using computer technology	Design of power stations and substations	**Purpose:** The purpose of the discipline is to instill the skills of performing and reading drawings, teach students to use appropriate standards and reference materials, prepare them for the competent execution of drawings and diagrams. **Contents:** Types and types of circuits; general provisions on circuits; General rules for the execution of circuits; features of circuit design; structural electrical circuits, their purpose; functional electrical circuits and indications thereof; schematic diagrams, images of individual elements, filling in the list, designations and indications on circuits; electrical wiring diagrams, conventional graphic designations on the diagrams; general electrical diagrams, the location of graphic symbols, indications on the diagrams; electrical diagrams of the location, the image of the components and their location, indications on the diagrams. Expected result: To know: rules of graphic representation of elements of electrical circuits; electrical terminology; types of electrical circuits; basic elements of electrical networks; power supply

					circuits; Be able to: read schematic, electrical and wiring diagrams; calculate the parameters of electrical circuits; assemble electrical circuits. Possess the skills of: design and reading design and technological documentation; rules for the execution of drawings, technical drawings, sketches and diagrams, geometric constructions and rules for drawing technical details ; Graphical representation of technological equipment and execution of technological schemes in manual and machine graphics; read drawings, technological schemes, specifications and technological documentation on the specialty profile.
6	Drawing and design of electrical circuits	4	The basics of computer drawing	Design of power stations and substations	**Purpose:** The purpose of the discipline is to form techniques for reading and performing various images that allow you to navigate in the modern world of graphic information media, join graphic culture, master graphic language as a means of communication for people of various professions. **Contents:** Inscriptions on diagrams; types and types of diagrams; conditionally graphical designations for electrical circuits; conditionally graphical designations for working drawings; explanatory diagrams, interaction diagrams, switching tables; techniques for reading and analyzing circuits; common electrical installation nodes; hidden errors in circuits, false circuits. Drawings of electrical installations and power grids. Schematic diagrams of the electric drive. Expected result: To know: designations for electrical circuits and rules of their application; the content and purpose of structural, functional, schematic and wiring diagrams; Be able to: read and perform structural, basic, functional and wiring diagrams of electrical devices; use regulatory and guidance documents when drawing up electrical circuits, use schematic diagrams for correct installation and troubleshooting; Possess the skills of: designing and tracing electrical circuits.
7	Switching of electric devices	5	Physics, Theoretical foundations of electrical engineering I	Electrical stations and substations, electromagnetic compatibility in the electric power industry, relay protection and automation	**Purpose:** formation of knowledge about electrical and electronic devices as a means of operating modes control, protection and regulation of electrical and electric power systems parameters. **Contents:** Fundamentals of the theory of electrical apparatus. Electric apparatus kinematic switching. Electric static switching devices. Electrical devices of high voltage: disconnectors, switches, short-circuit breakers, reactors. **Expected result:** **Know:** electrical devices as means of control of operating modes, protection and regulation of parameters of electrotechnical and electric power systems; **Able to:** calculate and design the main parts and assemblies of electrical devices, their layout and circuits of electronic devices. **Possess skills:** calculation of thermal processes, electrodynamic stability, magnetic systems, contact

					connections of electrical and electronic devices.
7	Electrical and electronic devices	5	Physics, Theoretical foundations of electrical engineering I	Electrical equipment of stations and substations, electromagnetic compatibility of technical means, relay protection of electrical equipment	**Purpose:** study of design and calculation of electrical and electronic devices based on the theory of electrical and electronic devices. **Contents:** Classification of electrical devices and the requirements for them. Electrodynamic forces in electric vehicles. Heating of electrical apparatus. Electrical contact. Electromagnets. Fundamentals of theory of combustion and extinguishing electric arc. Insulation of electrical apparatus. Contactors and magnetic starters, thyristor starters. **Expected result:** **Know:** electrical devices as means of control of operating modes, protection and regulation of parameters of electrotechnical and electric power systems. **Able to:** calculate and design the main parts and assemblies of electrical devices, their layout and circuits of electronic devices. **Possess skills:** calculation of thermal processes, electrodynamic stability, magnetic systems, contact connections of electrical and electronic devices.
8	Electrical systems and networks	5	General energy, Basics of electric drive,	Electric stations and substations, The basics of electric lighting, Transmission and distribution of electricity Rules of technical safety and operation	**Purpose:** programming Technology is to teach students a systematic understanding of the principles of construction and design of software systems. **Contents:** General characteristics of electric power transmission and distribution systems. Modeling of elements of electrical systems. Bases of construction of schemes and systems of transfer and distribution of electric energy; Modes of neutrals of electric networks. **Expected result:** **To know**: schemes of electric power systems and networks, constructive performance of air and cable power lines; the basic mathematical relations characterizing work of electric power systems; **To be able**: to apply, operate and make a choice of the equipment of electric power systems and networks. **To possess skills**: methods of analysis of modes of operation of electric power systems; methods of calculation of parameters of electric power networks and systems, skills of research work.
8	Electric power industry	5	World energy, Regulated electric drive in the electric power industry	Electrical equipment of stations and substations, Lighting equipment and lighting, transmission of electricity by direct and alternating current	**Purpose:** formation of students ' knowledge on development trends and legislative base of electric power industry, energy resources of the Republic of Kazakhstan, ways and means of converting them into electric energy, principles of energy transmission and distribution. **Contents:** Technological process of electric power production at power plants; condition, prospects of development of electric stations; the main equipment of electric stations and substations; technological process of electric power transmission; electric power systems and networks; condition, prospects of development of electric power industry; designs of lines of electric networks; air power lines; wires and cables; insulators and linear fittings; design of cables and cable lines. **Expected result:** **Know:** design and principles of operation of the main elements of electric power systems; block diagrams of power stations and substations; the main issues of design and calculation of modes of

					power stations and substations; the main indicators that determine the quality of power supply to consumers. **Able to:** perform calculations of power flows through power transformers; calculate power and energy losses; calculate voltage drops and losses in electrical networks; choose the parameters of the simplest current protection of distribution electrical networks. **Possess skills:** work with reference literature and normative and technical documentation; calculation of steady-state regimes, carry out instrumental control of energy consumption regimes, make energy balances of enterprises and make their analysis.
9	Transients in the electric power industry	4	Basics of electric drive	Electromagnetic compatibility in the electric power industry, Power converter devices	**Objective**: formation of students ' basic knowledge in the field of physical bases of transient processes at various perturbations of the electric power system regime. **Content:** Electromechanical transients, the analysis of static stability of electric system, dynamic stability of electric system, transients in nodes of loading, actions for increase of stability of power systems. **Expected result:** **know:** modes of operation of electric power systems; methods and means of regulation of voltage, active and reactive power in electric networks, methods of calculation of currents at short circuits and inclusion in a network of transformers and electric motors. **Able to:**to calculate short-circuit currents, to calculate the processes of starting and self-starting of electric motors, to determine the level of static and dynamic stability of the electric power system **Possess skills:** methods of calculation of Electromechanical and electromagnetic transients in electric power systems.
9	Electromagnetic and electromechanical processes	4	Adjustable electric drive in electric power industry	Electromagnetic compatibility of technical means, energy Saving and quality of electric energy	**Purpose:** formation of students ' basic knowledge in the field of physical bases of transient processes at various perturbations of the electric power system regime. **Contents:** Overview of the transition process. General instructions for the calculation of short-circuit currents. Electromagnetic transients while maintaining symmetry in a three-phase circuit. Electromagnetic transients in violation of the symmetry of the three-phase circuit. Two-phase ground fault. The algorithm for calculating the current asymmetric short circuit. **Expected Result:** **Know:** modes of operation of electric power systems; methods and means of regulation of voltage, active and reactive power in electric networks, methods of calculation of currents at short circuits and inclusion in a network of transformers and electric motors. **Able to:** to calculate short-circuit currents, to calculate the processes of starting and self-starting of electric motors, to determine the level of static and dynamic stability of the electric power system **Possess skills:** methods of calculation of Electromechanical and electromagnetic transients in electric power systems..
10	Fundamentals of business activity in the electric	4	Mathematics II, Metrology	Diploma design	**Objective:** formation of students ' holistic view of the logic of entrepreneurial activity in the energy

	power industry		and Standardization		sector. Special attention is paid to practical issues of implementation of entrepreneurial ideas, planning of the entrepreneur's activity, development of price policy, reduction of production costs, as well as forms and methods of production and commercial activities used in the energy sector. **Contents:** Production system. The role and place of enterprises in the formation of market relations. Foreign experience in the organization and management of production. The concept of the overall production structure. Types of production structure. The structure of the main production, the principles of its construction. **Expected result:** **Know:** current trends in the development of the organization and planning of production, enterprise management, as well as the tasks of further improvement of organizational and economic training of specialists; the history of business development in Kazakhstan; the economic policy of the state in relation to business in Kazakhstan and other countries. subjects and objects of entrepreneurial activity in the energy sector; types and forms of entrepreneurial activity; external and internal business environment; conditions of entrepreneurial activity; motivation of entrepreneurial decisions and comparison with opportunities **Able to:** to get the economic characteristics of production types; perform analysis and calculation of the length of the production cycle; to build graphic organization series – parallel, parallel Assembly of products for synchronization and without synchronization of Assembly units; to perform calculations of the economic efficiency of mass production; to organize the maintenance of production; to organize technical training and control of the production process; perform analysis of production and economic activity **Possess skills:** on performance of calculations of economic efficiency of flow production, Prime cost, pricing, profitability; on development of production process;
10	Organization and planning of energy enterprises	4	Unconventional energy	Diploma design	**Objective** The study of problems in the field of organization and planning and management of production, necessary for practical activities in a market economy and management decisions that ensure the effective operation of production systems. **Contents:** The purpose and objectives of the discipline: Production system. The role and place of enterprises in the formation of market relations. Foreign experience in the organization and management of production. The concept of the overall production structure. Types of production structure. The structure of the main production, the principles of its construction. **Expected result:** **Know:** current trends in the development of the organization and planning of production, enterprise management, as well as the tasks of further improvement of organizational and economic training of specialists; the history of business development in Kazakhstan; the economic policy of the state in relation to business in Kazakhstan and other countries. subjects and objects of

					entrepreneurial activity in the energy sector; types and forms of entrepreneurial activity; external and internal business environment; conditions of entrepreneurial activity; motivation of entrepreneurial decisions and comparison with opportunities **Able to:** to get the economic characteristics of production types; perform analysis and calculation of the length of the production cycle; to build graphic organization series – parallel, parallel Assembly of products for synchronization and without synchronization of Assembly units; to perform calculations of the economic efficiency of mass production; to organize the maintenance of production; to organize technical training and control of the production process; perform analysis of production and economic activity **Possess skills:** on performance of calculations of economic efficiency of flow production, Prime cost, pricing, profitability; on development of production process;
11	Electrical equipment	5	Electrical measurements in electrical installations,	Overvoltage and isolation in power supply systems, Power Converter devices	**Purporse:** acquisition of knowledge by students on the basics and trends of electromechanics and electrical equipment. **Contents:** Physical fundamentals of electromechanical and electrical energy conversion, design and operation of DC and AC electric machines, electromechanical properties of DC and AC electric motors, design and principles of electromechanical systems **Expected result:** **Know:** the physical basis for Electromechanical and electrical energy conversion device and operation principle of electric machines of direct and alternating current, Electromechanical properties of electric motors AC and DC, the device and principles of electromechatronic systems; types and condition of electrical isolation, classification and device high-voltage insulating structures, the classification of cable products and materials used in cables. **Able to:** perform calculation of induction heating installations, determine the optimal operating modes of the arc steel furnace; perform color calculations, thermal calculation of lighting devices, calculation of lighting systems **Possess skills:** to make the generalized calculations of the scheme of mechanical part of the electric drive; to make a choice of system of the electric drive for production mechanisms, a choice of power of engines of various operating modes.
11	Electro mechanics and electrical equipment	5	Measurement of electrical and non-electrical quantities,	Isolation and overvoltage in electric power systems, energy Saving and quality of electric energy	**Purpose:** acquisition of knowledge by students on the basics and trends of electromechanics and electrical equipment; **Contents:** Asynchronous and synchronous motors, DC motors, transformers, their control, purpose and application; cable products as a means of transmitting electromagnetic energy; classification of cable products according to the composition of structural elements, insulation material, purpose and scope of application; electrical, magnetic and thermal field in cables; technical characteristics of cables and wires. **Expected result:** **Know:** technologies of development of algorithms and programs; methods of debugging and solving

					problems on a computer in different modes; basics of object-oriented approach to programming; **Able to:** perform calculation of induction heating installations, determine the optimal operating modes of the arc steel furnace; perform color calculations, thermal calculation of lighting devices, calculation of lighting systems **Possess skills: -** to make the generalized calculations of the scheme of mechanical part of the electric drive; to make a choice of system of the electric drive for production mechanisms, a choice of power of engines of various operating modes.
12	Power stations and substations	6	Switching of electrical apparatus, Electrical systems and networks	Design of power stations and substations, Power Converter devices	**Purpose:** The purpose of the discipline is to study electrical equipment and circuits of electrical connections of power plants and substations, to prepare students for various activities aimed at improving the reliability of their work. **Contents:** Main equipment of power plants and substations. Short-circuits in electrical installations. Electrical apparatuses and current carrying parts. Main circuits of power plants and substations. Switchgear constructions, auxiliary devices. **Expected result:** At the end of the course, students are formed: **Know:** the device and operation of the main electrical equipment of stations and substations, the basics of the theory of electrical devices **Able to:** to carry out the analysis of schemes of electric connections of RU at various operating modes; to make calculation and a choice of the main elements of an electric part of stations and substations; to carry out rational arrangement of electric equipment of open and closed switchgear. **Possess skills:** calculation of technical characteristics and parameters of electrical equipment, selection of optimal circuit solutions in the design of power stations and substations**.**
12	Electrical equipment of stations and substations	6	Electric and electronic devices, electric power industry	Design of power supply systems, energy Saving and quality of electric energy	**Purpose:** The purpose of the discipline is to form students' knowledge, skills and abilities necessary for the calculation, selection, operation of electrical equipment, as well as its repair at power plants and electric grid enterprises. **Contents:** Low voltage switchgear of the hour. Switches, contactors, starters; purpose, requirements, parameters, designs. Circuit breakers and fuses; purpose, requirements, parameters, designs. Selection and testing of devices. High voltage switchgear. **Expected result:** At the end of the course, students are formed: **Know:** the device and operation of the main electrical equipment of stations and substations, the basics of the theory of electrical devices. **Able to:** to carry out the analysis of schemes of electric connections of RU at various operating modes; to make calculation and a choice of the main elements of an electric part of stations and substations; to carry out rational arrangement of electric equipment of open and closed switchgear **Possess skills:** calculation of technical characteristics and parameters of electrical equipment, selection of optimal circuit solutions in the design of power stations and substations**.**
13	Basics of electric lighting	4	Electrical systems and networks	Diploma design	**Purpose:** formation of the student's modern ideas about the corpuscular and wave properties of light, light phenomena, the nature of light propagation in

					optical systems, energy values and units of optical radiation, the system of effective and light values and units, thermal radiation, luminescence and laser radiation, optical radiation receivers, practical colorimetric systems and calculations. **Contents:** Energy values and units of optical radiation. Receivers and effective characteristics of optical radiation. The eye as a radiation receiver. Light values and units. Thermal radiation, luminescence and laser radiation. Fundamentals of photometric calculations. Fundamentals of the theory of calculation of optical systems. Conversion of optical range radiation. Color and color calculations **Expected result:** **Know:** basic laws of light interference and diffraction; laws of light propagation in isotropic and anisotropic media; basic terms used in light and optical measurements; basic principles and methods of lighting and optical measurements; prospects for improving measurement methods; **Able to:** to make lighting and colorimetric calculations and measurements; to choose the methods necessary for measurements; **Possess skills:** work with literature sources and Internet-sites; work with graphic programs; information about the main parameters and characteristics of radiation frequency analyzers; basic methods of processing and presentation of experimental data; experience in lighting and colorimetric calculations;
13	Lighting equipment and lighting	4	Electroenergetics	Diploma design	**Purpose:** the study of the basics of lighting engineering, methods of design of lighting systems, taking into account the requirements for energy conservation, skills of operation of lighting systems. **Contents:** Optical radiation, sources and scope of optical radiation. The main types of radiation spectra. Light values and their units of measurement. Calculation methods and units of measurement. Classification of lighting devices. Design of lighting installations. The main methods of calculating lighting. **Expected result:** **Know:** basic laws of light interference and diffraction; laws of light propagation in isotropic and anisotropic media; basic terms used in light and optical measurements; basic principles and methods of lighting and optical measurements; prospects for improving measurement methods; **Able to:** to make lighting and colorimetric calculations and measurements; to choose the methods necessary for measurements; **Possess skills:** work with literature sources and Internet-sites; work with graphic programs; information about the main parameters and characteristics of radiation frequency analyzers; basic methods of processing and presentation of experimental data; experience in lighting and colorimetric calculations.
14	Electromagnetic compatibility in the electric power industry	5	Switching of electric devices, Transients in electric power industry	Power converters	**Purpose:** Mastering the theoretical foundations and methods of analyzing the state of electromagnetic compatibility of electric power systems **Contents:** Processes and phenomena in electrical networks that cause violations of the quality of electrical energy. Conductive electromagnetic

					interference from non-linear load in General-purpose power supply systems. The influence of harmonics on the power system for general use. Power in the electrical network in non-sinusoidal mode. Ensuring the normalized level of electromagnetic compatibility of technical means in general-purpose power supply systems. **Expected result:** **Know:** methods of minimization of conductive electromagnetic interference in electric power systems, providing electromagnetic compatibility of technical means. **Able to:** to calculate regulated levels of electromagnetic compatibility according to the steady-state voltage deviation, the coefficient of distortion of the sinusoidal voltage curve, the coefficient of temporary switching overvoltage; to choose filter-compensating installations and nonlinear overvoltage limiters; to place them in power supply systems for General and local purposes; **Possess skills:** on solving problems of electromagnetic compatibility; on issues of electromagnetic compatibility in the electric power industry.
14	Electromagnetic compatibility of technical means	5	Electrical and electronic apparatus, Electromagnetic and Electromechanical processes	Energy saving and quality of electric energy	**Purpose:** formation of students ' knowledge about electromagnetic compatibility of technical means in General purpose power supply systems. **Contents:** Physical basis of electromagnetic radiation, methods of calculation of electric fields and induced voltages, methods and means of protection against electric fields of induced voltages. **Expected result:** **Know:** influence of higher harmonics on electrical networks 6-10kV, static equipment, electrical machines, phase-to-earth fault currents, levels of electromagnetic compatibility of technical means in General-purpose electrical networks; **Be able to:** calculate the higher harmonics of current and voltage generated by a nonlinear load, select and specify filter-compensating installations and place them in public power supply systems; **Possess skills:** the necessary skills to determine the higher harmonics in networks with nonlinear loads.
15	Transmission and distribution of electricity	5	General energy, Electrical systems and networks	Power converters	**Purpose:** principles of construction and functioning of systems of transmission and distribution of electric energy, methods of calculation and analysis of electric networks. **Contents:** types and design features of overhead lines over high voltage; the main parameters characterizing the electrical network at high voltages; calculation and analysis of the modes of operation of electric power transmission line of super-high voltage; Technical characteristics and fundamentals of long-distance transmission. **Expected result:** **Know:** influence of higher harmonics on electrical networks 6-10kV, static equipment, electrical machines, phase-to-earth fault currents, levels of electromagnetic compatibility of technical means in General-purpose electrical networks; **Be able to:** calculate the higher harmonics of current and voltage generated by a nonlinear load, select and specify filter-compensating installations and place them in public power supply systems;

					Possess skills: the necessary skills to determine the higher harmonics in networks with nonlinear loads.
15	Transmission of electricity by direct and alternating current	5	World energy, electric power industry	Energy saving and quality of electric energy	**Purpose:** formation of students ' knowledge about electromagnetic compatibility of technical means in General purpose power supply systems. **Content:** Technical specifications and framework for the transmission of electricity over long distances. The dependence of the voltage and transmitted power of the length of the line. Power and energy losses in the lines high voltage. Transmission capacity and ways to improve it. Compensating devices for overhead AC power transmission line. Basic design solutions in ultra-high voltage power transmission. Compact high voltage power lines. **Expected result:** **Know:** influence of higher harmonics on electrical networks 6-10kV, static equipment, electrical machines, phase-to-earth fault currents, levels of electromagnetic compatibility of technical means in General-purpose electrical networks; **Be able to:** calculate the higher harmonics of current and voltage generated by a nonlinear load, select and specify filter-compensating installations and place them in public power supply systems; **Possess skills:** the necessary skills to determine the higher harmonics in networks with nonlinear loads.
16	Relay protection and automation	6	Switching of electric devices, automation of electric power facilities	Diploma design	**Purpose:** Acquisition of knowledge of the fundamental principles of ensuring the reliability of power supply systems by means of relay protection and automation (REA); formation of abilities to use technical means of REA in solving problems of professional activity. **Contents:** Relay protection of transformers and autotransformers. Protection of busbars. Protection of asynchronous and synchronous motors above 1000V and compensators. Protection of capacitor banks. Automatic re-enable (ARE). Automatic reserve switch-on (ARS). Automatic frequency unloading (AFU). Automatic activation of synchronous generators for parallel operation. Switching off and switching on the mode of parallel transformers to reduce power losses. Automatic voltage regulation at substations. The redundant actions of relay protection and circuit breakers. **Expected result:** **Know:** causes of abnormal modes of the power system and methods of their automatic detection and rapid elimination of the impact on the equipment of the power system: design, principle of operation, properties, scope of application of the main elements of protection devices and automation. **Able to:** perform typical electrical calculations and determine the setpoints for different types of protection and automation; for specific electrical networks to choose a sufficient and necessary number and type of relay protection devices; make and analyze the relay protection circuit, perform maintenance, control and inspection of relay protection devices. **Possess skills:** protection checks and setting of protection panels, cabinets and terminals with the help of modern means of checking and adjustment.
16	Relay protection of electrical equipment	6	Electrical and electronic	Diploma design	**Purpose:** obtaining students knowledge in the field of principles of construction of relay protection

			devices, Basics of automatic control		(RZ) of the main electrical equipment of power supply systems and applied modern methods and means to perform relay protection. **Contents:** Expanding ideas about the possibilities of RP; consolidation and specification of theoretical material relating to the principles of operation and the device of RP, their basic properties, methods of application; obtaining the skills of calculating the settings necessary to configure the RP; the correct choice of methods and means of RP; evaluation of the effectiveness and reliability of the selected RP. **Expected result:** **Know:** causes of abnormal modes of the power system and methods of their automatic detection and rapid elimination of the impact on the equipment of the power system: design, principle of operation, properties, scope of application of the main elements of protection devices and automation; **Able to:** perform typical electrical calculations and determine the setpoints for different types of protection and automation; for specific electrical networks to choose a sufficient and necessary number and type of relay protection devices; make and analyze the relay protection circuit, perform maintenance, control and inspection of relay protection devices. **Possess skills:** protection checks and setting of protection panels, cabinets and terminals with the help of modern means of checking and adjustment.
17	The rules of technical safety and operation	4	Electrical systems and networks,	Diploma design	**Objective:** Training of engineers who should know the scientific and engineering fundamentals of labor protection and be able to apply them in practice in addressing issues of safe and harmless working conditions, prevention of industrial injuries, occupational diseases, accidents. **Content:** Dangerous and harmful production factors; human functionality and its compatibility with the working environment; psychology of safety, vibration, noise and microclimatic conditions in the working area; electromagnetic fields of power transmission lines; industrial lighting; fundamentals of electrical safety; fire safety in industrial buildings and structures. **Expected result:** **Know:** legislative and regulatory acts of labor protection and preservation of human health in the course of his work; equipment and technological processes, as well as to ensure their safe operation; methods of hazard analysis and ensuring sustainable operation and the procedure for the detection of failure of technical systems. **Able to:** to increase technological safety of systems and to anticipate and eliminate emergencies; to assess risk levels when working on equipment and on technological lines; to eliminate technological failures when operating equipment. **Possess skills:** analysis of the causes of hazards and identify and eliminate failures of technical systems.
17	Labor protection in power industry	4	Electric power industry	Diploma design	**Objective:** to develop students ' professional competencies related to the ability to develop applications for the Internet and develop skills in building and researching distributed applications and interactive web pages **Contents:** Organization of work on labor protection at the enterprise; dangerous and harmful production

					factors; human functionality and its compatibility with the production environment; occupational safety psychology, vibration, noise and microclimatic conditions in the work area; electromagnetic fields of power transmission lines; industrial lighting; fundamentals of electrical safety; fire safety in industrial buildings and structures. **Expected result:** **Know:** modern electrical equipment and its characteristics, the main schemes of electrical connections of power plants and substations, features of designs of switchgear of different types. **Able to:** design and operation of the electrical part of power plants and substations, as well as research of physical processes occurring in electrical equipment during its operation **Possess skills:** ability to calculate currents and voltages for simple circuits in steady-state and transient modes; ability to develop simple designs of electric power and electrical facilities; ability to calculate operating modes of electric power plants for various purposes, to determine the composition of equipment and its parameters, schemes of electric power facilities.
PROFILING DISCIPLINES					
Optional components (OC)					
1	Electrical materials science	3	Physics, Metrology and standardizatio n.	Design of power stations and substations	**Objective:** The study of physical phenomena that occur in materials when they are introduced into the electromagnetic field, as well as the study of the properties of materials, applications in electrical structures and production technology. **Contents:** Classification of electrical materials. Physical processes in dielectrics. Polarization and electrical conductivity of dielectrics. Physical processes in dielectrics. Dielectric loss and breakdown of dielectrics. Physical and mechanical properties of insulating materials. Dielectricmaterial. Conductormaterials. Semiconductors. Magneticmaterial. **Expected result:** At the end of the course, students are formed. **Know:** classification of modern materials in the electric power industry, their behavior in the electromagnetic field and under the influence of various factors, properties of materials, their application, testing methodology and determination of the main characteristics of the most common electrical materials. **Able to:** correctly assess the appropriateness of the choice and use of electrical materials, work on laboratory equipment. **Possess skills:** on laboratory equipment to determine certain properties of insulating materials; on laboratory equipment to determine certain properties of dielectric materials; on laboratory equipment to determine certain properties of conductive materials; on laboratory equipment to determine certain properties of semiconductor materials; on laboratory equipment to determine certain properties of magnetic materials; in solving problems to determine the parameters of electrical materials.
1	The materials in the power industry	3	Physics Fundamentals of Metrology	Design of power supply systems	**Objective:** Formation of students ' knowledge about the physical properties of electrical materials, their main operational and technological

					characteristics and the nature of changes in these properties under the influence of external factors. **Content:** Physical fundamentals of materials science; physical processes in dielectric materials; insulating liquids, solid organic and inorganic materials; conductive, superconducting, semiconductor and magnetic materials. **Expected result:** **Know:** classification of modern materials in the electric power industry, their behavior in the electromagnetic field and under the influence of various factors, properties of materials, their application, testing methodology and determination of the main characteristics of the most common electrical materials. **Able to:** correctly assess the appropriateness of the choice and use of electrical materials, work on laboratory equipment. **Possess skills:** on laboratory equipment to determine certain properties of insulating materials; on laboratory equipment to determine certain properties of dielectric materials; on laboratory equipment to determine certain properties of conductive materials; on laboratory equipment to determine certain properties of semiconductor materials; on laboratory equipment to determine certain properties of magnetic materials; in solving problems to determine the parameters of electrical materials.
2	Alternative and renewable energy sources	5	General energy	Industry electricity supply, Transmission and distribution of electricity	**Objective:** Formation of theoretical knowledge and mastering organizational and technical issues of rational operation and advanced industrial methods of installation, adjustment and operation of electrical equipment of power supply systems of industrial enterprises. **Contents:** Modern technologies of energy conservation. Methods of calculation in the field of energy conservation. Technical and economic indicators of renewable energy sources. Hydropower, Wind energy, Solar energy, Geothermal energy, Biofuels, Secondary energy and energy conservation. **Expected result:** **Know:** technology of energy production on the basis of renewable energy sources; program of development of non-traditional energy of Kazakhstan. **Able to:** to work in the environment of systems of non-traditional energy sources; to use modern achievements of science and technology; to be guided in constructive performance of the main devices of energy conversion. **Possess skills:** in the calculation of modern energy conservation technologies. to be competent: in the issues of modern technologies of transformation of non-traditional renewable energy sources.
2	Unconventional energy	5	World energy, Organization and planning of energy enterprises	Power supply of electric power facilities, transmission of electric power by direct and alternating current	**Objective:** formation at students of knowledge in the field of prospects of development and available world and domestic experience of development of the energy sources alternative in relation to the traditional applied in thermal and nuclear power. **Content:** Solar energy converters. The concentrators of solar light. Solar heating. History of wind use development. Systems and types of wind turbines. The thermal energy of the Earth. Energy of internal waters. Energy of natural

					disasters. Environmental problems of non-traditional and renewable energy sources. **Expected result:** **Know:** technology of energy production on the basis of renewable energy sources; program of development of non-traditional energy of Kazakhstan. **Able to:** to work in the environment of systems of non-traditional energy sources; to use modern achievements of science and technology; to be guided in constructive performance of the main devices of energy conversion. **Possess skills:** in the calculation of modern energy conservation technologies. to be competent: in the issues of modern technologies of transformation of non-traditional renewable energy sources.
3	Automation of electric power facilities	6	Descriptive geometry and engineering graphics with the use of computers	Design of power stations and substations relay protection and automation	**Objective:** formation of students ' knowledge, practical skills in the field of design, development and organization of automated control systems (ACS) of electrical equipment of power plants and substations, automation subsystems of power plants and substations as components of electric power systems, as well as in the field of modeling of automatic control and regulation devices in power systems using modern achievements of science, technology, international and domestic experience in this field. **Content:** Automation, automatic control, automation of electric power systems. Automation devices of power stations and substations. Programming of controllers. Development of the user interface of the APCS of the electric power system (power plant, substation). Operational efficiency of automation devices, automatic control systems of electric power systems, power plants and substations. Emergency automation of power systems. **Expected result:** **know:** control and management of electrical installations; the main essence of management and tasks solved within the ACS electrical installations; General information about the ACS TP, functions, composition and structure of the ACS TP; problems of static stability of parallel operation of power plants in the established normal and post-accident modes and the need to maintain dynamic stability during electromagnetic and Electromechanical transients in emergency mode; history, scope and innovative trends in improving automation of power plants, substations and electric power systems; **Able to:** apply to Electromechanical, electronic and microprocessor-based automation means for monitoring the values of electrical quantities for the purpose of controlling electric power facilities; the use of modern information and telecommunication technologies in the design and technological preparation of production of complexes of automation to improve the reliability, sensitivity and selectivity of automation; to choose and implement efficient modes of automation according to the specified methods; correctly operate automation equipment of power objects. **Possess skill:** methods of calculation of

					parameters and characteristics of automation of electric power systems; applications of modern computer technologies to obtain information in the field of automation of electric power systems; methods of designing subsystems of automation of electric power systems; work with reference books and standard technical materials, standard tests and adjustment of automatics of electric power systems; practical preparation of technical specifications for the design of complexes of automation (including APCS) electric power systems, electric power stations and substations.
3	Basics of automatic control	6	Fundamentals of computer drawing	Design of power supply systems	**Purpose:** formation of students ' knowledge of the basics of construction and operation of automated energy management systems of industrial enterprises. **Contents:** Types of automatic control systems in power supply, static and dynamic characteristics of control systems, the concept of stability and methods of studying the stability of power supply systems. **Expected result:** **Know:** methods of analytical and experimental study of static and dynamic characteristics of control objects; methods of compilation and linearization of mathematical models of dynamic systems; methods of stability analysis of dynamic systems. **Able to:**to simulate and investigate the dynamic system using analog and digital computer technology; to analyze the stability and quality performance of the automatic control system. **Possess skills:** on the principles of automatic control; on the main varieties of control systems; on the goals, objectives and methods of analysis and synthesis of automatic control systems.
4	Power supply	7	Mathematics 1,2, Theoretical foundations of electrical engineering I, II	DC and AC power transmission, Isolation and overvoltage in electric power systems	**Objective:** It is necessary to form knowledge, skills and abilities in the field of electricity supply. **Contents:** Systems of internal and external power supply of industrial enterprises. Methods of calculation of electrical loads, means and methods of reactive power compensation, determination of the number and power of transformer substations of industrial enterprises, preparation of electrical schemes of electricity supply, accounting and control of electricity. A study of schemes of automation of power supply of existing power supply schemes. **Expected result:** **Know:** terminology, basic concepts and definitions; basic information about electrical receivers and power supplies of industrial enterprises; methods of calculation of electrical loads of electricity consumers; schemes, design and protective equipment for shop networks with voltage up to 1000 V; purpose and features of electrical networks in-plant power supply voltage above 1000 V; basic electrical equipment of industrial enterprises. **Able to:** to determine the calculated electrical loads and choose standard electrical equipment; to perform calculations of working and post-accident modes of power supply schemes of industrial enterprises; to perform technical and economic calculations of various variants of power supply schemes of industrial enterprises. **Possess skills:** methods of calculation of stability,

					quality and reliability of electrical systems; methods of calculation of electrical loads at the input of consumers; methods of electrical calculation of internal wiring, overhead and cable power lines.
4	Power supply of electric power facilities	5	Mathematics 1,2, Theoretical foundations of electrical engineering I, II	DC and AC power transmission, Isolation and overvoltage in electric power systems	**Objective:** mastering the basic information about the principles, methods and technical means of rational use of electricity and reducing energy losses in the power supply system of an industrial enterprise, as well as providing consumers with electric energy with standardized quality, reliability and efficiency. **Contents:**The main indicators of power quality and their permissible values. Effects of voltage quality on the operation of electric power receivers and process plants. Voltage deviation. Influence of voltage deviations on the operation of the main industrial receivers of electric energy. Sources of higher harmonics in power supply systems. **Expected result:** **Know:** the whole list of tasks related to providing consumers with electricity at the normalized quality, reliability and efficiency; methods of voltage regulation to improve the quality of electricity; various aspects of electromagnetic compatibility; the main directions of reducing electricity losses in power networks in the design and operation; principles of rationing of electricity consumption; **Able to:** to make calculation of various indicators of quality of tension; to measure indicators of quality of tension; to define damage from interruption of power supply; to make the electric balance at the enterprises; **Possess skills:** in the latest achievements of digital technology of protection and automation of power system elements; methods and principles of construction of power lines.
5	Overvoltage and insulation in power supply systems	5	Transients in the electric power industry, Electrical equipment, Power supply	Diploma design	**Purpose:** Formation at students of professional knowledge about properties of isolation of installations of high voltage, methods of testing and control of isolation, mastering of methods and means of protection against overvoltage of EU in systems of power supply. **Contents:** Basic properties and electrical characteristics of external insulation. Atmospheric air as a dielectric. Regulation of electric fields in external insulation of electrical installations. Discharge in the air gap at lightning and switching pulses. Discharges in the air along the surface of the solid dielectric. The definition of internal insulation. the main types of electrical characteristics of internal insulation. **Expected result:** **Know:** main operational characteristics of EC insulation; methods of protection of various electrical equipment from external and internal overvoltages. **Able to:** to calculate the electrical strength of the simplest insulation structures. **Possess skills:** on the choice of protection of EC from overvoltage, in matters of protection of power lines and substations.
5	Insulation and overvoltage in power systems	5	Electromagnetic and Electromechan	Diploma design	**Purpose:** Formation at students of professional knowledge about properties of isolation of installations of high voltage, methods of testing and

			ical processes, Electromechanics and electrical equipment, Power supply of electric power facilities		control of isolation, mastering of methods and means of protection against overvoltage of EU in systems of power supply. **Contents:** General information on electrophysical processes in gases. General information about dielectrics. Electrical conductivity, polarization of diodes. Main properties and electrical characteristics of external insulation. Atmospheric air as a dielectric. Regulation of electric fields in external insulation of electrical installations. Basic concepts of streamer thorium in gases. Discharges in air spaces in homogeneous and heterogeneous electric fields. **Expected result:** **Know:** main operational characteristics of EC insulation; methods of protection of various electrical equipment from external and internal overvoltages. **Able to:** to calculate the electrical strength of the simplest insulation structures. **Possess skills:** on the choice of protection of EC from overvoltage, in matters of protection of power lines and substations.
6	Design of electrical networks and substations	5	Descriptive geometry and engineering graphics using computer technology, Electrical drawings and diagrams, Switching of electrical devices, Electrical systems and networks, Power stations and substations, Automation of electric power facilities	Diploma design	**Objective:** Mastering the theoretical and practical foundations in the field of design of power supply systems. **Contents:** The content of the design and basic layout of the equipment. Layout of various types of power stations and substations. Features of technological schemes of power plants of various types. Feasibility study of decisions. **Expected result:** **Know:** the main normative and technical documents adopted for management in the territory of the Republic of Kazakhstan; the main stages and sequence of design of systems and power supply units; modern methods of calculation in the design; requirements for technical documentation; indicators of power quality **Able to:** to determine the electrical loads, reactive power compensation, technical and economic calculations, short-circuit currents, grounding; to select the optimal option of power supply; to develop and execute project technical documentation. **Possess skills:** practical application of the acquired knowledge; the use of methods of analysis of power supply systems; the use of modern computational design tools; the use of graphical programs to create design and technical documentation.
6	Design of power supply systems	5	Basics of computer drawing, Electrical and electronic devices, electric power industry, Electrical equipment of stations and substations, Basics of automatic control	Diploma design	**Purpose:** to acquaint students with the history of design, the content of design works, design methods and calculation of the main parameters, and the choice of equipment. **Contents:** The main normative and technical documents in the design, the concept of optimal solutions in the design, the choice of the optimal variant of power supply, the requirements of standards for the execution of design and technical documentation of power supply systems. **Expected result:** **Know:** the contents and design features of power plants; basic principles of selection of mechanical equipment; basic principles for the layout of power plants; the methodology of the main circuit;

					methods of limiting short circuit currents; calculation methods short-circuit currents and selection conditions of switching equipment and electrical devices; features of schemes of power supply of own needs; the design features of the switchgear and design of control systems **Able to:** to work with the source data for the design; to produce a feasibility study on the choice of power supply circuits and main and auxiliary equipment; calculate short-circuit currents and to verify the equipment on thermal and electrodynamic stability; to analyze and select the main schemes of power plants, arrangement of switchgear and schemes of own needs of power stations; choose the motors for the working mechanisms and test them in terms of starting and self-starting. **Possess skills:** the practical application of the knowledge gained; the use of methods of analysis of power supply systems; the use of modern computer design tools; the use of graphical programs to create design and technical documentation.
7	Power converters	5	Fundamentals of electric drives, Electric measurement electrical Transients in power industry, Electrical equipment, Electrical station and substation, electromagnetic compatibility in power generation, Transmission and distribution of electricity	Diploma design	**Purporse:** Is to teach students the basics of design and operation of devices of converting power electronics, such as switching power supplies, inverters and frequency converters, DC and AC drives, which are the most common elements of many automatic control and regulation systems, and made on the basis of modern element base. **Contents:** Power converter devices, their role in modern production. Classification of electrical energy converters. Types of electrical energy conversion. Types of power valves, their classification, symbol. Parameters and characteristics of power semiconductor devices. Electrical properties and characteristics of thyristor and triac diodes. Thermal characteristics of semiconductor valves. Electrical properties and characteristics of power transistors. Thermal characteristics of power transistors. **Expected result:** **Know:** device and principle of operation of modern power semiconductor elements; device and principle of operation of semiconductor converters used in electric drive; physical phenomena occurring in semiconductor converters; main parameters characterizing the operation of semiconductor converting devices; control methods to improve the quality of the output voltage; methods of protection of semiconductor converters in emergency modes; principles of construction and operation of microprocessor control systems; programming tools of modern microcontrollers; **Able to:** calculate and select the main elements of the circuits of power converting devices; make a preliminary calculation of parameters and selection of serial Converter for a specific application; evaluate the capabilities and select the microcontroller for process control; make an algorithm and a program for process control; make a connection diagram of the microcontroller to perform the automation task; **Possess skills:** C fixing and specification of the theoretical material concerning the principles of operation and the device of various electrical

					measuring devices, their basic properties, methods of application, processing of results of observations.
7	Energy saving and quality of electrical energy	5	Adjustable electric drive in electric power industry, Measurement of electric and non-electric quantities, Electromagnetic and Electromechanical processes, Electromechanics and electrical equipment, electrical equipment of stations and substations, electromagnetic compatibility of technical means, transmission of electric power by direct and alternating current	Diploma design	**Purpose:** To use methods of effective use of resources, to provide energy-saving technology. **Expected result:** **Know:** main legislative and normative documents of the RK on energy saving; traditional and alternative energy sources; on methods of obtaining new types of energy resources; energy balance of industrial enterprise, the basics of the tariff policy in the use of electrical energy, the rationing of energy consumption; on ways of reducing consumption of electrical loads; rules of rational use of electric energy **Able to:** to describe and explain on the basis of separate legislative and regulatory acts the state policy on the effective use of energy resources in the Republic of Kazakhstan. describe and explain the various processes underlying energy-saving technologies, give examples of energy-saving technologies in various industries, the national economy. **Possess skills:** use and analyze the use of resource-saving technologies in the organization of construction production.

LIST OF DISCIPLINES
components of choice for educational program
6B07125 «Electroenergetics»
Term of study: full-Time 4 years

Group of educational programs: B062Electrical and power engineering

Name of discipline	Code of discipline	Number of credits	Semester
Component of choice 1			
Module of economic and legal knowledge		5	2
Fundamentals of market economy and entrepreneurship	FMEE1111	3	
Fundamentals of law and anti-corruption culture	FLACC1112	2	
Component of choice 2		2	
Module of economic and natural knowledge		5	2
Fundamentals of market economy and entrepreneurship	FMEE111	3	
Fundamentals of safety and life	FSL1112	2	
Basic disciplines			
Component of choice 1			
General energy	GE 2211	3	3
World energy	WE 2211		
Component of choice 2			

Descriptive geometry and engineering graphics using computer technology	DGEGUCT 2212	5	3
Computer drawing basics	CDB 2212		
Component of choice 3			
Metrology and standardization	MS 2213	5	3
Basic Metrology	BM 2213		
Component of choice 4			
Electric drive basics	EDB 2214	5	3
Adjustable electric drive of the electric power industry	AEDEPI 2214		
Component of choice 5			
Electrical measurements in electrical installations	ESEI 2216	4	4
Measurement of electrical and non-electrical quantities	SEI 2216		
Component of choice 6			
Electrical drawings and diagrams	EDD 2216	4	4
Drawing and design of electrical circuits	DDEC 2216		
Component of choice 7			
Switching of electric devices	SED 3217	5	5
Electrical and electronic devices	EED 3217		
Component of choice 8			
Electrical systems and networks	ESN 3218	5	5
Electric Power	EP 3218		
Component of choice 9			
Transients in the electric power industry	TEPI 3219	4	5
Electromagnetic and Electromechanical processes	EEP 3219		
Component of choice 10			
Fundamentals of business activity in the electric power industry	FBAEP 3220	4	6
Organization and planning of energy enterprises	OPEE 3220		
Component of choice 11			
Electrical equipment	EE 3221	5	6
Electromechanics and electrical equipment	EEE 3221		
Component of choice 12			
Power stations and substations	PSS 3222	6	6
Electrical equipment of stations and substations	EESS 3222		
Component of choice 13			
Basics of electric lighting	BEL 4223	4	7
Lighting equipment and lighting	LEL 4223		
Component of choice 14			
Electromagnetic compatibility in the electric power industry	ECEPI 4224	5	7
Electromagnetic compatibility of technical means	ESTM 4224		
Component of choice 15			
Transmission and distribution of electricity	TDE 4225	5	7
Transmission of electricity by direct and alternating current	TEDAC 4225		
Компонент по выбору 16			
Relay protection and automation	RPA 4226	6	7
Relay protection of electrical equipment	RPEE 4226		
Component of choice 17			

Rules of technical safety and operation	RTSO 4227	4	8
Labor protection in power industry	LPPI 4227	4	
Profiling disciplines			
Component of choice 1			
Electrical materials science	EMS 2306	3	4
The materials in the power industry	TMP 2306		
Component of choice 2			
Alternative and renewable energy sources	ARES 3307	5	5
Alternative energy	AE 3307		
Component of choice 3			
Automation of electric power facilities	AEPF 3308	6	6
Basics of automatic control	BAC 3308		
Component of choice 4			
Electrosupply	Ele 3309	7	6
Power supply of electric power facilities	PSEPF 3309		
Component of choice 5			
Overvoltage and insulation in power supply systems	OIPSS 4310	5	7
Insulation and overvoltage in power systems	IOPS 4310		
Component of choice 6			
Design of power plants and substations	DPPS 4311	5	7
Design of power supply systems	DPSS 4311		
Component of choice 7			
Power converters	PC 4312	6	8
Energy saving and quality of electrical energy	ESQEE 4312		