Kazakh Humanitarian and Legal Innovative University
Faculty of Information Technology and Economics
Department of Informatics and Mathematics

5B071800 – ELECTRIC POWER

ELECTIVE DISCIPLINES CATALOG

year revenue - 2018

Semey, 2016

Awarded degree: Bachelor of engineering and technology in specialty 5B071800 – Electric power

Sequence number of the course of choice	Name of the discipline	Amount of credits		Prerequisites	Postrequisites	Brief description indicating the purpose of the study, executive summary, and expected result of the study (knowledge, skills, competences)
		RK	ECTS			
GENERAL DISCIPLINES						
Optional components (OC)						
1	Ecology with the basics of safety	2	3	School courses: biology, geography, chemistry, mathematics, physics	Electrical safety, labor Protection in electric power industry	**Purpose:** disciplines to form a holistic view of the basic laws of sustainable development of nature and society. **Contents:** the study of the basic laws of interaction in the system "biosphere-society-technogenic environment", and the formation of ideas about economic approaches to solving environmental problems. **Expected result:** to Know: labor legislation of the Republic of Kazakhstan; rules of industrial safety, rules and norms of labor protection; safety requirements and methods of first aid in case of accidents; basic methods of protection of production personnel and the population from possible consequences of accidents, disasters, natural disasters, the ability to make decisions in terms of risk; methods of environmental assessment; the basis of protection of natural resources, flora and fauna; the main legislative, legal and regulatory documents in the field of nature protection and rational use of natural resources; the environmental situation in the region, Kazakhstan, the world; the economic mechanism of environmental protection. To be able to: choose technical means and technologies taking into account ecological consequences of their application; to carry out control of parameters and level of negative influences on their compliance to regulatory requirements; to effectively apply means of protection against negative influence; to develop actions for increase of safety and ecological compatibility of production activity; to plan and implement measures to improve the sustainability of production systems and facilities; to plan measures to protect production personnel and the population in emergency situations and, if necessary, to participate in rescue and other emergency operations in the aftermath of emergency situations; to conduct a competent analysis of the causality of various situations in the field of environmental protection; to implement a reasonable system of measures in the field of agriculture; to solve specific problems in the field of nature protection. to link the solution of production tasks with compliance with the relevant environmental requirements; to plan and organize environmental work. Possess skills: methods of knowledge to solve professional problems, the ability to professionally solve problems, work in a team,

						knowledge of safe working conditions in the workplace.
1	Psychology	2	3	Self-knowledge (school course)		**Purpose:** formation of a holistic view of psychological science and modernity. **Content:** Psychology-an objective inner world of man, mediating its interaction with the outside world. It is characterized by a form of active reflection of the subject of objective reality, occurs in highly organized living beings in the process of interaction with the outside world and carries out their behavior regulatory function. This is the highest form of the relationship of living beings with the objective world, expressed in their ability to realize their motives and act on the basis of the information received about the world. **Expected result:** to Know: the Essence of the basic psychological processes and properties, mental States that provide a person with his life; the basic methods of psychology and be able to use them in practice, taking into account its economic specifics; psychological theories of personality,group and team. Be able to: use the knowledge of p psychology in their practice; organize individual and group activities of people taking into account their psychological characteristics and compatibility; competently use communicative competence in the process of group joint activities. To own skills: methods of development of memory, thinking, analyzing, and summarizing information
2	Political science	2	3	Modern history of Kazakhstan	Philosophy	**Purpose:** the political Science course gives the student the necessary minimum knowledge of political realities, norms of political behavior, political values, teaches to operate a modern internationally recognized categorical and conceptual apparatus, develops the ability to critically analyze and predict the political situation, develops interest and respect for national traditions, promotes cooperation between **Nations.** The acquisition of such knowledge and focused teaching of political science as a compulsory subject. **Content:** political Science is a branch of knowledge about politics in all its manifestations and interrelations with other areas of social life. Political science studies the relations of various social, ethnic, religious and other groups with regard to power, political institutions and, above all, the state and parties, political consciousness and culture, political actors: individuals, elites, leaders, Nations, States, etc., domestic and interstate political processes. Expected result: as a result of studying the discipline, students should know: the subject and objectives of the course; the main content of the course " political science"; master the fundamental knowledge of political theory; the range of achievements of historical thought in the study of ancient culture. To be able: to work independently with the literature of General humanitarian character, to be able to find key world Outlook problems and their solutions; logically, systemically and critically to think; to use

						the received Luggage of philosophical erudition for formulation and the proof of own judgments on various questions of daily. Competence: General education
3	Sociology	2	3	Man and society (school course)		**Purpose:** to Form students ' ideas about society, the systems that make up it, the laws of its functioning and development, social institutions, relationships and communities **Contents:** Sociology (from lat. societas-Greek society. Λόγος — science) is the science of society, systems, components of it, the regularities of its functioning and development, social institutions, relationships, and communities. Sociology studies society, revealing the internal mechanisms of its structure and development of its structures. **Expected result:** as a result of the study of this course, the student must know: the laws of development and functioning of society; features of the analysis of the modern system of social inequality, social mobility and stratification; possess: practical skills of independent analysis of the current state of society. to use basic knowledge in the field of Humanities and economic Sciences in cognitive and professional activities. Be able to: correlate knowledge of the basics of sociology with professional activity; own: practical skills of applying the knowledge gained in the analysis of real social situations. Competence: General education
4	Culturology	2	3	Modern history of Kazakhstan , Philosophy		**Goal:** the Main goal of the course is the idea of cultural studies as an integral expression of the Humanities. The teaching of the course "cultural studies" should take into account that it is an independent and specific area of human culture, a "living system" included in the modern socio - cultural context. **Contents:** cultural Studies " is associated with a cycle of social and humanitarian disciplines: history, political science, philosophy, sociology. Cultural studies performs the functions of the knowability of the world. **Expected result:** as a result of studying the discipline, students should know: the structure and composition of modern cultural knowledge; cultural studies and philosophy of culture; sociology of culture, cultural anthropology; cultural studies and history of culture; be Able to: distinguish the basic concepts of cultural studies: the dynamics of culture, language and symbols of culture, cultural codes, intercultural communication, cultural values and norms, cultural traditions, cultural picture of the world, social institutions of culture. Competence: General education
4	Fundamentals of anti-corruption culture	2	3	Modern history of Kazakhstan		**Objective:** to create a professional culture, improve the image, optimize interaction with the external environment and within our culture, improve the management structure, i.e. ensure sustainable development in the context of modern changes. **Contents:** a set of basic moral and ethical norms and rules of social behavior, following which we strengthen the high reputation of culture, maintaining

						its authority and traditions. **Expected result:** to know: the concept of anti-corruption culture of government; to be able to: determine the set of basic moral and ethnic norms; to have skills: to work with normative documents.
5	Religious studies	3	5	Philosophy		**Purpose:** formation of tolerance to traditions and culture of other peoples of the world. **Contents:** components of religion as a subject, the concept of religion, religion and ritual, religion and mythology, religion and magic, religion and mysticism, religion and esotericism, the concept of religious experience, religion and faith, religion and its role in society, national and world religions. **Expected result:** to Know: the names of world religions and their main branches, the largest historical national religions and new religious movements, the conceptual and categorical apparatus of modern religious science, the terms denoting the basic elements of the religious worldview and the internal structure of religious organizations, the basic scientific concepts relating to the essence of religion and its origin, the most important characteristics of the religious worldview and its differences from the non-religious, history of development of religious beliefs of mankind from primitive cults to the great world religions. Be able to: competently use religious terminology and basic concepts related to the internal religious (theological) sphere, to present their own point of view on the existing scientific, philosophical and theological approaches to religion, as well as the concepts of its origin. Possess skills: comprehensively and critically analyze the required amount of information. Independently draw conclusions, analyze and process the required amount of diverse information of religious processes and phenomena of different levels.
BASIC DISCIPLINES						
Optional components (OC)						
1	Engineering and computer graphics	4	6	Drawing (school course), computer Science (school course)	Electrical drawings and diagrams, design of power plants	**Purpose:** to form students ' primary skills in graphic representation of technical ideas with the help of drawing, as well as understanding of the design of the technical product and the principle of operation of the depicted object. **Contents:** theory of drawing. Projection methods. Monge's Plot. How to convert the orthogonal projections. Positional and metric problems. Polyhedrons. Surface of revolution. Axonometric projections. General rules for execution of drawings. Images: views, sections, sections. Types of connections. Reading and detailing Assembly drawings. Circuitry. Fundamentals of computer graphics system AutoCAD. Execution of drawings and diagrams. 3D-modeling. **Expected result:** to Know: the main projection models of space mapping on a plane, the apparatus of two, three-sided complex drawing of Monge, the laws of formation of flat and spatial forms, ways of constructing their images the basic requirements of ESKD (unified system of design documentation); to be Able to: perform on the basis of computer

						graphics system schemes and drawings AutoCAD; read, solve the problem of mutual affiliation and mutual intersection of geometric shapes; determine the geometric shapes of simple parts by their images and perform these images both from nature and from the drawing of the Assembly unit; read drawings of Assembly units. To possess skills: practical work with drawing tools; reading images of objects, drawings of parts and Assembly units of medium complexity; execution of sketches and working drawings of parts, Assembly drawings and General drawings; measurement of parts and dimensioning in drawings of parts and Assembly units; use of information and reference materials and sources; perception of design documentation as a production document; thinking spatial images.
1	Fundamentals of computer drawing	4	6	Drawing (school course), computer Science (school course)	Graphic means in power industry, Design of power supply systems	**Purpose:** formation of students ' primary skills in graphic display of technical ideas with the help of drawing **Contents:** projection Methods. How to convert the orthogonal projections. The standards ESKD. Rules for the implementation of drawings of parts, subassemblies, and circuits. Basics of working in AutoCAD. Three-dimensional modeling in AutoCAD. **Expected result:** to Know: the main projection models of space mapping on a plane, the apparatus of two, three-sided complex drawing of Monge, the laws of formation of flat and spatial forms, ways of constructing their images the basic requirements of ESKD (unified system of design documentation); to be Able to: perform on the basis of computer graphics system schemes and drawings AutoCAD; read, solve the problem of mutual affiliation and mutual intersection of geometric shapes; determine the geometric shapes of simple parts by their images and perform these images both from nature and from the drawing of the Assembly unit; read drawings of Assembly units. To possess skills: practical work with drawing tools; reading images of objects, drawings of parts and Assembly units of medium complexity; execution of sketches and working drawings of parts, Assembly drawings and General drawings; measurement of parts and dimensioning in drawings of parts and Assembly units; use of information and reference materials and sources; perception of design documentation as a production document; thinking spatial images.
2	Engineering and computer graphics	2 (У)	3	Drawing (school course), computer Science (school course)	Electrical drawings and diagrams, design of power plants	**Purpose:** to form students ' primary skills in graphic representation of technical ideas with the help of drawing, as well as understanding of the design of the technical product and the principle of operation of the depicted object. **Contents:** theory of drawing. Projection methods. Monge's Plot. How to convert the orthogonal projections. Positional and metric problems. Polyhedrons. Surface of revolution. Axonometric projections. General rules for execution of drawings. Images: views, sections, sections. Types of connections. Reading and detailing Assembly

						drawings. Circuitry. Fundamentals of computer graphics system AutoCAD. Execution of drawings and diagrams. 3D-modeling. **Expected result:** to Know: the main projection models of space mapping on a plane, the apparatus of two, three-sided complex drawing of Monge, the laws of formation of flat and spatial forms, ways of constructing their images the basic requirements of ESKD (unified system of design documentation); to be Able to: perform on the basis of computer graphics system schemes and drawings AutoCAD; read, solve the problem of mutual affiliation and mutual intersection of geometric shapes; determine the geometric shapes of simple parts by their images and perform these images both from nature and from the drawing of the Assembly unit; read drawings of Assembly units. To possess skills: practical work with drawing tools; reading images of objects, drawings of parts and Assembly units of medium complexity; execution of sketches and working drawings of parts, Assembly drawings and General drawings; measurement of parts and dimensioning in drawings of parts and Assembly units; use of information and reference materials and sources; perception of design documentation as a production document; thinking spatial images.
2	Fundamentals of computer drawing	2 (У)	3	Drawing (school course), computer Science (school course)	Graphic means in power industry, Design of power supply systems	**Purpose:** formation of students ' primary skills in graphic display of technical ideas with the help of drawing **Contents:** projection Methods. How to convert the orthogonal projections. The standards ESKD. Rules for the implementation of drawings of parts, subassemblies, and circuits. Basics of working in AutoCAD. Three-dimensional modeling in AutoCAD. **Expected result:** to Know: the main projection models of space mapping on a plane, the apparatus of two, three-sided complex drawing of Monge, the laws of formation of flat and spatial forms, ways of constructing their images the basic requirements of ESKD (unified system of design documentation); to be Able to: perform on the basis of computer graphics system schemes and drawings AutoCAD; read, solve the problem of mutual affiliation and mutual intersection of geometric shapes; determine the geometric shapes of simple parts by their images and perform these images both from nature and from the drawing of the Assembly unit; read drawings of Assembly units. To possess skills: practical work with drawing tools; reading images of objects, drawings of parts and Assembly units of medium complexity; execution of sketches and working drawings of parts, Assembly drawings and General drawings; measurement of parts and dimensioning in drawings of parts and Assembly units; use of information and reference materials and sources; perception of design documentation as a production document; thinking spatial images.
3	Fundamentals of standardization in	3	5	Mathematics I,	Electrical measureme	**Purpose:** Familiarization with the basics of standardization and the formation of skills in the

	the power industry			Physics (school course)	nt	practical application of standards in the field of electrical engineering in the design, creation, testing, operation of electrical installations and electrical power supply systems. **Contents:** goals and objectives of standardization. Organization of standardization works. Categories of normative documents and types of standards. Methodical bases of standardization. Rules of electrical circuits. Parametric series and characteristics of the degree of protection of electrical equipment and products. Requirements for the quality of electrical energy. System of occupational safety standards. International standardization system. **Expected result:** to Know: legislation and standards of the Republic of Kazakhstan in the field of standardization, Metrology, certification and international ISO standards; verification, standardization, quality control of products in one industry in the context of modern development of production, distribution and use of all types of energy; metrological assurance of measurements; development of methods and measuring instruments; to be able to study the results of measurement and control, reliability and accuracy of measuring instruments and systems. Be able to: methods of processing of results of measurements; be able to estimate the measurement error. Possess skills: types of measurements, measuring instruments and measurement errors; General principles and methods of measurement of measurement results and measurements of thermal values; master the basics of evaluation and verification of measuring instruments in accordance with the standards and technical regulations of the Republic of Kazakhstan.
3	Basic Metrology	3	5	Mathematics I, Physics (school course)	Measurement of electrical and non-electrical quantities	**Purpose:** to provide students with the necessary knowledge on the theory and methods of measurement, methods of assessing the accuracy and reliability of measuring instruments and systems, the state system of standardization, methods of assessing the quality of products. **Contents:** Basic concepts of 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 normalization. **Expected result:** to know: terms and definitions, the international system of SI units of measurement, General laws and rules of measurement, methods and means of measurement, measurement errors and the laws of their distribution, methods of processing of measurement results, technological processes. Be able to: analyze measurement schemes of different physical quantities, determine measurement errors and creatively apply knowledge in the learning process. To possess skills: work with control and measuring equipment for control; determination of metrological security of production; use of reference literature.

4	Electrical drawings and diagrams	3	5	Engineering and computer graphics	Design of power stations	**Purpose:** formation of students ' reading skills and self-preparation of schemes drawings of electrical devices. **Contents:** basic standards ESKD; graphic symbols of commonly-used elements. **Expected result:** to know: development trends, principles of construction and features of application of modern computer technologies in electric power industry and electrical engineering; to be able to: perform analysis of possibilities of applied software tools and effectively apply electric power industry in professional activity. Own skills: work with software raster, two-dimensional and three-dimensional vector graphics to use the basic functionality of modern graphics systems; organization of dialogue in graphics systems.
4	Graphical tools in the power industry	3	5	Fundamentals of computer drawing	Design of power supply systems	**Purpose:** Acquisition of fundamental and applied knowledge and development of skills in the construction and study of geometric models of objects and processes, instilling skills in the use of graphic models of objects and processes, instilling skills in the use of graphic information technology, two - and three-dimensional geometric information resources and systems in all subject areas. **Contents:** General rules of drawing execution. Images: views, sections, sections. Types of connections. Reading and detailing Assembly drawings. Circuitry. Fundamentals of computer graphics system AutoCAD. Execution of drawings and diagrams. 3D-modeling. **Expected result:** to know: development trends, principles of construction and features of application of modern computer technologies in electric power industry and electrical engineering; to be able to: perform analysis of possibilities of applied software tools and effectively apply electric power industry in professional activity. Own skills: work with software raster, two-dimensional and three-dimensional vector graphics to use the basic functionality of modern graphics systems; organization of dialogue in graphics systems.
5	Electrical apparatus	4	6	Physics	Electric machines, Automated electric drive in electric power industry, electric stations and substations	**Purpose:** Formation of students ' knowledge in the field of electrical apparatus. **Contents:** Fundamentals of the theory of electrical apparatus. Electric apparatus kinematic switching. Electric devices of static switching. Electrical apparatus of high voltage: disconnectors, switches, short-circuit breakers, reactors. **Expected result:** to know: physical phenomena occurring in electrical apparatus; device and design features of various electrical apparatus, the principle of their operation; the main characteristics and parameters of electrical apparatus. Be able to: analyze and describe the physical processes occurring in electrical circuits; evaluate the effectiveness and choose the type of electrical apparatus for specific conditions; independently carry out elementary tests of electrical apparatus; make a preliminary calculation of the parameters and the choice of electrical apparatus. To own skills:

						performing calculations; selection of equipment; maintenance equipment; research on the study of modes of operation.
5	Electrical and electronic devices	4	6	Physics	Electric machines, Regulated electric drive in electric power industry, electric Equipment of stations and substations	**Purpose:** training of highly qualified specialists capable of performing the main tasks related to reliable and economical supply of electricity to consumers. **Contents:** classification of electrical apparatus and the requirements for them. Electrodynamic forces in electric vehicles. Heating of electrical apparatus. Electrical contact. Electromagnets. Fundamentals of the theory of combustion and quenching of the electric arc. Insulation of electrical apparatus. Contactors and magnetic starters, thyristor starters. Controllers, commands, devices and rheostats. Circuit breakers and fuses. Electromagnetic current and voltage relays. Thermal relay, time relay, polarized, pointing relays. Magnetic amplifiers. Semiconductor electrical devices. High voltage circuit breakers. Disconnectors, separators and short-circuit breakers. Reactors, dischargers. Current and voltage measuring transformers. **Expected result:** to know: physical phenomena occurring in electrical apparatus; device and design features of various electrical apparatus, the principle of their operation; the main characteristics and parameters of electrical apparatus. Be able to: analyze and describe the physical processes occurring in electrical circuits; evaluate the effectiveness and choose the type of electrical apparatus for specific conditions; independently carry out elementary tests of electrical apparatus; make a preliminary calculation of the parameters and the choice of electrical apparatus. To own skills: performing calculations; selection of equipment; maintenance equipment; research on the study of modes of operation.
6	Electrical apparatus	3 (У)	5	Physics	Electric machines, Automated electric drive in electric power industry, electric stations and substations	**Purpose:** Formation of students ' knowledge in the field of electrical apparatus. **Contents:** Fundamentals of the theory of electrical apparatus. Electric apparatus kinematic switching. Electric devices of static switching. Electrical apparatus of high voltage: disconnectors, switches, short-circuit breakers, reactors. **Expected result:** to know: physical phenomena occurring in electrical apparatus; device and design features of various electrical apparatus, the principle of their operation; the main characteristics and parameters of electrical apparatus. Be able to: analyze and describe the physical processes occurring in electrical circuits; evaluate the effectiveness and choose the type of electrical apparatus for specific conditions; independently carry out elementary tests of electrical apparatus; make a preliminary calculation of the parameters and the choice of electrical apparatus. To own skills: performing calculations; selection of equipment; maintenance equipment; research on the study of modes of operation.
6	Electrical and	3	5	Physics	Electric	**Purpose:** training of highly qualified specialists

	electronic devices	(У)			machines, Regulated electric drive in electric power industry, electric Equipment of stations and substations	capable of performing the main tasks related to reliable and economical supply of electricity to consumers. **Contents:** classification of electrical apparatus and the requirements for them. Electrodynamic forces in electric vehicles. Heating of electrical apparatus. Electrical contact. Electromagnets. Fundamentals of the theory of combustion and quenching of the electric arc. Insulation of electrical apparatus. Contactors and magnetic starters, thyristor starters. Controllers, commands, devices and rheostats. Circuit breakers and fuses. Electromagnetic current and voltage relays. Thermal relay, time relay, polarized, pointing relays. Magnetic amplifiers. Semiconductor electrical devices. High voltage circuit breakers. Disconnectors, separators and short-circuit breakers. Reactors, dischargers. Current and voltage measuring transformers. **Expected result:** to know: physical phenomena occurring in electrical apparatus; device and design features of various electrical apparatus, the principle of their operation; the main characteristics and parameters of electrical apparatus. Be able to: analyze and describe the physical processes occurring in electrical circuits; evaluate the effectiveness and choose the type of electrical apparatus for specific conditions; independently carry out elementary tests of electrical apparatus; make a preliminary calculation of the parameters and the choice of electrical apparatus. To own skills: performing calculations; selection of equipment; maintenance equipment; research on the study of modes of operation.
7	Electrical measurement	3	5	Mathematics I, II, Physics, Theoretical foundations of electrical engineering I	Electric machines, Automated electric drive in electric power industry	**Purpose:** to give students knowledge of the theoretical foundations of Metrology; device, principle of operation, scope and rules of safe operation of measuring instruments; methods of measuring the parameters of the electrical circuit. **Contents:** processes of Electromechanical energy conversion. Design of electrical devices, their properties, characteristics, operating rules. The principle of operation and the device of various types of electrical devices. Physical phenomena occurring in electrical devices when they are included in electrical circuits under different operating conditions and their mathematical description; the main characteristics of electrical machines and transformers'. **Expected result:** to know: the structure of measuring devices, methods of measuring electrical quantities (small and large currents and voltages, phase angle, power, energy); the theory of measurement errors; the basic concepts of processing the data obtained in the measurement in order to obtain reliable results. Be able to: choose measuring instruments, organize measurement and evaluate the result of measurement of various electrical quantities; use modern measuring instruments. Possess the skills to determine the main characteristics and parameters of electrical circuits and signals; removal of the main

						characteristics of electronic devices and chips, the main characteristics of amplifiers (amplitude-frequency, phase-frequency, amplitude) and determine the parameters of various analog circuits, select the element base, the use of measuring instruments in various practical areas
7	Measurement of electrical and non-electrical quantities	3	5	Mathematics I, II, Physics, Theoretical foundations of electrical engineering I	Electrical machines, variable speed drive in the power industry	**Purpose:** training of highly qualified specialists capable of performing the main tasks associated with reliable and economical supply of electricity to consumers with its standardized quality, reliability and efficiency. **Contents:** the main types of devices and circuits used in 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; the principle of operation and devices of converters of non-electrical quantities in electrical; principles of construction of measuring equipment, measuring information systems and complexes. **Expected result:** to know: the structure of measuring devices, methods of measuring electrical quantities (small and large currents and voltages, phase angle, power, energy); the theory of measurement errors; the basic concepts of processing the data obtained in the measurement in order to obtain reliable results. Be able to: choose measuring instruments, organize measurement and evaluate the result of measurement of various electrical quantities; use modern measuring instruments. Possess the skills to determine the main characteristics and parameters of electrical circuits and signals; removal of the main characteristics of electronic devices and chips, the main characteristics of amplifiers (amplitude-frequency, phase-frequency, amplitude) and determine the parameters of various analog circuits, select the element base, the use of measuring instruments in various practical areas
8	Electrical safety	4	6	Ecology with the basics of safety, Physics	Labor protection in electric power industry	**Purpose:** Preparation for production activities in the field of operation, installation and commissioning, maintenance and testing, diagnosis and monitoring of electrical and electrical equipment. **Contents:** Theoretical foundations of electrical safety; legal, regulatory, technical and organizational foundations of electrical safety; basics of physiology and rational conditions of activity; anatomical and physiological consequences of human exposure to traumatic, harmful and damaging factors; means and methods of improving electrical safety. **Expected result:** to know: about the hazardous effect of electric current on the body; the means of collective and individual protection of the worker; to learn to apply the acquired knowledge in practice; to be able to work with normative and reference literature; to obtain knowledge corresponding to at least the second qualifying group tolerance for electrical safety; be skilled in: application of

						regulatory materials on the issues of electrical safety. use of basic and additional insulating dielectric protection means; first aid in case of electric shock.
8	Safety in electrical installations	4	6	Ecology with the basics of safety, Physics	Labor protection in electrical installations	**Purpose:** to provide students with knowledge about the legislation in the field of safety and causes of electrical injuries in industrial enterprises, knowledge of basic protective measures and means of electrical safety in General-purpose electrical installations and the basic requirements for electrical personnel, as well as first aid measures for personnel electrical injury. **Contents:** the Organization of health and safety responsibility for violation of TB. The electrical injuries, classification, types and the act of investigation, electrocution, ways to reduce electrical injuries. The action of electric current on the human body and the degree of danger. The parameters of the electrical circuit, the effect of voltage, current, frequency, time of action, the resistance of the human body and the current loop on the severity of the outcome of electrical injuries. The state Committee for standardization on electrical safety. Danger of networks with grounded and isolated neutral. The risk of ground fault. Protective measures, the role of isolation. The application of low voltage, security lock, protection when switching higher voltage network low. Protective shutdown and automatic capacity compensation. Electrical safety devices, assisting with the defeat of electrocution. **Expected result:** know: possible sources of electric shock and their hazard assessment. the most important technical requirements that ensure the work associated with electricity; basics of electrical safety organizational and technical measures to ensure the safety of work in the ES; classification of insulating means of protection; be Able to: perform engineering calculations on electrical safety. to analyze the risk of electric networks; to implement a permit to work at UE up to 1000 V; Possess skills: application of regulatory materials on electrical safety. use of basic and additional insulating dielectric means of protection; first aid in case of electric shock.
9	Electrical safety	3 (У)	5	Ecology with the basics of safety, Physics	Labor protection in electric power industry	**Purpose:** Preparation for production activities in the field of operation, installation and commissioning, maintenance and testing, diagnosis and monitoring of electrical and electrical equipment. **Contents:** Theoretical foundations of electrical safety; legal, regulatory, technical and organizational foundations of electrical safety; basics of physiology and rational conditions of activity; anatomical and physiological consequences of human exposure to traumatic, harmful and damaging factors; means and methods of improving electrical safety. **Expected result:** to know: about the hazardous effect of electric current on the body; the means of collective and individual protection of the worker; to learn to apply the acquired knowledge in practice; to be able to work with normative and reference literature; to obtain knowledge corresponding to at

						least the second qualifying group tolerance for electrical safety; be skilled in: application of regulatory materials on the issues of electrical safety. use of basic and additional insulating dielectric protection means; first aid in case of electric shock.
9	Safety in electrical installations	3 (У)	5	Ecology with the basics of safety, Physics	Labor protection in electrical installations	**Purpose:** to provide students with knowledge about the legislation in the field of safety and causes of electrical injuries in industrial enterprises, knowledge of basic protective measures and means of electrical safety in General-purpose electrical installations and the basic requirements for electrical personnel, as well as first aid measures for personnel electrical injury. **Contents:** the Organization of health and safety responsibility for violation of TB. The electrical injuries, classification, types and the act of investigation, electrocution, ways to reduce electrical injuries. The action of electric current on the human body and the degree of danger. The parameters of the electrical circuit, the effect of voltage, current, frequency, time of action, the resistance of the human body and the current loop on the severity of the outcome of electrical injuries. The state Committee for standardization on electrical safety. Danger of networks with grounded and isolated neutral. The risk of ground fault. Protective measures, the role of isolation. The application of low voltage, security lock, protection when switching higher voltage network low. Protective shutdown and automatic capacity compensation. Electrical safety devices, assisting with the defeat of electrocution. **Expected result:** know: possible sources of electric shock and their hazard assessment. the most important technical requirements that ensure the work associated with electricity; basics of electrical safety organizational and technical measures to ensure the safety of work in the ES; classification of insulating means of protection; be Able to: perform engineering calculations on electrical safety. to analyze the risk of electric networks; to implement a permit to work at UE up to 1000 V; Possess skills: application of regulatory materials on electrical safety. use of basic and additional insulating dielectric means of protection; first aid in case of electric shock.
9	General energy	3	5	Physics, Mathematics I, II	Alternative energy	**Purpose:** formation of students ' strong knowledge on the trends of development and legal framework of power, energy resources of the Republic of Kazakhstan, methods and means of converting them into electricity, principles of transmission, distribution of energy, methods of automatic elimination of damage and abnormal modes in the electrical part of power systems. **Content:** 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 electric 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 impact of technology and energy in the biosphere. **Expected result:** to Know: the structure of the power industry, the relationship between its various links, the technological process of electricity production at the power plant; the main equipment of power plants and substations; the design of power lines; the purpose and the element base of relay protection; the composition of consumers in various industries; the principles of construction of external and internal power supply schemes; voltage modes in industrial networks. Be able to: assess the status and prospects of development of power plants; it is correct to choose cable production, the protective equipment, the required schemes of power supply. To own skills: the problems of analysis of modern technologies of conservation of energy.
9	World energy	3	5	Physics, Mathematics I, II	Alternative energy source	**Purpose:** formation of students ' knowledge in the field of development prospects and existing international and domestic experience in the development of energy sources alternative to traditional ones used in thermal and nuclear power. **Contents:** Hydropower, Wind energy, Solar energy, Geothermal energy, Biofuels, Secondary energy resources and energy conservation. **Expected result:** to know: technology of energy production on the basis of renewable energy sources; program of development of non-traditional energy of Kazakhstan; to be able 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 implementation of the main devices of energy conversion. To own skills: the problems of analysis of modern technologies of conservation of energy.
10	Mathematical problems and computer modeling in power industry	3	5	Mathematics i, II	Design of power plants, relay protection and automation	**Purpose:** to Link mathematics as a General theoretical course with its practical applications in the work of a specialist in the field of electricity and to give a specific mathematical apparatus for applied research. **Contents:** Classical optimization methods. The tasks of the power industry, requiring the search for optimal solutions. Application of iterative methods for solving systems of linear and nonlinear equations; linear programming; closed and open models of the transport problem. Nonlinear programming; probabilistic and statistical methods in power supply problems. Modeling of electrical systems. Application of simulation to study the dynamics of electric power systems. **Expected result:** to Know: mathematical problems of power engineering and computer modeling in the volume necessary for the solution of production, practical and research problems; methods of development of the generalized options of the solution of problems, the analysis of options, forecasting of consequences, search of optimum

						decisions in the conditions of multi-criteria, planning, implementation of projects; methods, ways of the solution of the main problems of power industry; basic concepts of mathematical programming and its application in power industry; methods of technical calculations and determination of the effectiveness of research and development; achievements of science and technology, advanced and foreign experience in solving mathematical problems of energy and computer modeling. Be able to: use mathematical methods in the calculation of normal modes of power systems; explore statistical and dynamic stability; apply the concept of functional analysis to study the equations of steady state; conduct research, process and analyze the results; apply modern computer technology. Possess skills: use of modern computer technologies, mathematical packages and programming.
10	Probability theory and mathematical statistics	3	5	Mathematics i, II	Design of power supply systems, relay protection of electrical equipment	**Purpose:** to provide students with the knowledge and skills necessary for the successful development of General technical and special disciplines. **Contents:** Algebra of events. Classical definition of probability. Conditional probability. The formula of total probability. Bayes formula. Formulas in the Bernoulli scheme. Random variables and their numerical characteristics. Distribution density of a random variable, properties. The normal law of probability distribution of a random variable. Numerical characterization of a continuous random variable. Based concepts and elements of selective theory. Sampling method. Estimation of unknown parameters of distributions. Statistical estimates of distribution parameters. Statistical hypothesis testing. Interval estimation. Confidence probability. Confidence interval. **Expected result:** to Know: mathematical problems of power engineering and computer modeling in the volume necessary for the solution of production, practical and research problems; methods of development of the generalized options of the solution of problems, the analysis of options, forecasting of consequences, search of optimum decisions in the conditions of multi-criteria, planning, implementation of projects; methods, ways of the solution of the main problems of power industry; basic concepts of mathematical programming and its application in power industry; methods of technical calculations and determination of the effectiveness of research and development; achievements of science and technology, advanced and foreign experience in solving mathematical problems of energy and computer modeling. Be able to: use mathematical methods in the calculation of normal modes of power systems; explore statistical and dynamic stability; apply the concept of functional analysis to study the equations of steady state; conduct research, process and analyze the results; apply modern computer technology. Possess skills: use of modern computer technologies, mathematical packages and programming.

11	Automated electric drive in electric power industry	3	5	Theoretical foundations of electrical engineering I, II	Diploma design	**Purpose:** the study of modern theoretical knowledge in the field of automated electric drive, joint operation of electric drive systems and electrical systems of industrial enterprises, as well as the acquisition of practical skills in the design, calculation and study of automated electric drive systems, taking into account the characteristics of control objects and features of the applied technical means. **Contents:** Definition and structure of the automated electric drive. Mechanics of automated electric drive. Electromechanical properties of DC and AC motors. Ways of regulation of coordinates. Automated electric drive systems. Generalized system driven Converter motor (up-D). Speed control in the open system of the electric drive. DC motor speed control systems. Features of automatic speed control of asynchronous electric drive. Frequency control of the asynchronous electric drive speed. The torque control in open-loop Electromechanical system. Regulation of the position of the working body of the Executive mechanism. Multi-motor Electromechanical systems. The choice of the drive system. The main questions and sequence of design of the automated electric drive. **Expected result:** to know: properties of separate elements of the automated electric drive and system as a whole; to know control systems of speed, the moment, position of the working body of the mechanism and other coordinates of electric drives of a direct and alternating current; to be able: to perform calculations at the choice of the automated electric drive system; to perform calculations of static and dynamic indicators of regulation of the electric drive; to apply analog and digital computer equipment; independently solve various issues in the field of automated electric drive in its design and operation in the workplace; own methods of safety in the design, installation and operation of an automated electric drive.
11	Adjustable electric drive of the electric power industry	3	5	Theoretical foundations of electrical engineering I, II	Diploma design	**Objective:** to acquire knowledge and experience in the development and design of electric drive systems for production machines and mechanisms. **Contents:** electric drive system thyristor Converter with short-circuited 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:** to know: the composition of the electric drive; electric drive systems; Electromechanical processes in the engine-working machine-the tasks implemented in the electric drive; how to convert the real EP system into a reduced; energy modes of operation in the EP system; methods of starts and brakes of the EP; electrical control circuits of the EP; load modes of operation of the EP; to be Able to: determine the design

						parameters in the EP system; calculate and build static and operating characteristics of machines; make electrical control circuits of the EP; calculate the given moments of inertia and forces in the EP; explain Electromechanical processes in the EP; select the desired type and power of the engine; apply and make load diagrams EP; perform the necessary calculations related to all sections of the EP.
12	Electromagnetic and electrical compatibility of electrical installations	3	5	Mathematics I, II, Theoretical foundations of electrical engineering I, II	Diploma design	**Purpose:** Mastering the theoretical foundations and methods of analyzing the state of electromagnetic compatibility of electric power 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:** to know: methods of minimizing conductive electromagnetic interference in electric power systems, providing electromagnetic compatibility of technical means. Be able to: calculate the regulated levels of electromagnetic compatibility by the steady-state voltage deviation, the distortion coefficient of the sinusoidal voltage curve, the coefficient of temporary switching overvoltage; choose filter-compensating installations and nonlinear surge arresters; place them in power supply systems for General and local purposes. Possess skills: to solve problems of electromagnetic compatibility; on issues of electromagnetic compatibility in the power industry.
12	Electromagnetic compatibility of technical means	3	5	Mathematics I, II, Theoretical foundations of electrical engineering I, II	Diploma design	**Purpose:** formation of students ' knowledge about electromagnetic compatibility of technical means in General-purpose power supply systems. **Contents:** Processes and phenomena in electrical networks that cause violations of the quality of electrical energy. Information and measurement support of power quality analysis and control system. Conductive electromagnetic interference from nonlinear load in General-purpose power supply systems. The influence of harmonics on the General-purpose power supply system. 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:** to know: the influence of higher harmonics on electrical networks of 6-10 kV, static equipment, electrical machines, phase-to-earth currents, levels of electromagnetic compatibility of technical means in General-purpose electrical networks; to 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; to possess the skills: the necessary skills for determining higher harmonics in networks with nonlinear loads.
13	Power stations and substations	4	6	Electric machines, Electric machines	Diploma design	**Objective:** to Study the physical, electrical and Electromechanical properties of power plants, substations and their equipment. **Contents:** General information about electrical

						installations. The main equipment of power stations and substations. Short circuits in electrical installations. Electrical apparatus and live parts. The main schemes of power plants and substations. Design of switchgear, auxiliary devices. **Expected result:** to know: the structure and operation of the main electrical equipment of stations and substations, the basics of the theory of electrical apparatus. To be able to: perform the analysis of schemes of electrical connections of RP at various operating modes; to make calculation and the choice of the main elements of electric part of stations and substations; to carry out rational arrangement of electric equipment of the open and closed distributive devices. To possess skills: calculation of technical characteristics and parameters of electrical equipment, selection of optimal circuit solutions in the design of power plants and substations.
13	Electrical equipment of stations and substations	4	6	Electrical and electronic devices, Electric machines	Diploma design	**Purpose:** formation of knowledge about electrical equipment, schemes of electrical connections of stations and substations and their modes of operation. **Contents:** low voltage Switching devices hours. Switches, contactors, starters; purpose, requirements, parameters, design. Circuit breakers and fuses; purpose, requirements, parameters, design. Selection and testing of devices. High voltage switching equipment. Disconnectors, short-circuit breakers and separators; purpose, scope, classification, requirements, basic parameters and designs. High voltage switching equipment. Load switches, high voltage switches, high voltage fuses; purpose, scope, requirements, classification, parameters, design. Selection and testing of devices. Design of switchgear. General information. Device rules, requirements, basic structural elements and equipment layout of closed switchgears. Open switchgear; requirements, elements, layout. Complete switchgear and substations. **Expected result:** to Know: the device and the operation of the main electrical stations and substations, foundations of the theory of electrical devices; to be able to: perform analysis of schemes of electric connections of RU when different modes of operation; to make the calculation and selection of main elements of the electrical part of stations and substations; to carry out rational layout of electrical equipment of open and closed distribution devices; to own skills: calculation of the technical characteristics and parameters of electrical equipment, selection of optimal circuit solutions in the design of electrical stations and substations.
14	Power stations and substations	3 (У)	5	Electric machines, Electric machines	Diploma design	**Objective:** to Study the physical, electrical and Electromechanical properties of power plants, substations and their equipment. **Contents:** General information about electrical installations. The main equipment of power stations and substations. Short circuits in electrical installations. Electrical apparatus and live parts. The main schemes of power plants and substations. Design of switchgear, auxiliary devices.

						Expected result: to know: the structure and operation of the main electrical equipment of stations and substations, the basics of the theory of electrical apparatus. To be able to: perform the analysis of schemes of electrical connections of RP at various operating modes; to make calculation and the choice of the main elements of electric part of stations and substations; to carry out rational arrangement of electric equipment of the open and closed distributive devices. To possess skills: calculation of technical characteristics and parameters of electrical equipment, selection of optimal circuit solutions in the design of power plants and substations.
14	Electrical equipment of stations and substations	3 (У)	5	Electrical and electronic devices, Electric machines	Diploma design	**Purpose:** formation of knowledge about electrical equipment, schemes of electrical connections of stations and substations and their modes of operation. **Contents:** low voltage Switching devices hours. Switches, contactors, starters; purpose, requirements, parameters, design. Circuit breakers and fuses; purpose, requirements, parameters, design. Selection and testing of devices. High voltage switching equipment. Disconnectors, short-circuit breakers and separators; purpose, scope, classification, requirements, basic parameters and designs. High voltage switching equipment. Load switches, high voltage switches, high voltage fuses; purpose, scope, requirements, classification, parameters, design. Selection and testing of devices. Design of switchgear. General information. Device rules, requirements, basic structural elements and equipment layout of closed switchgears. Open switchgear; requirements, elements, layout. Complete switchgear and substations. **Expected result:** to Know: the device and the operation of the main electrical stations and substations, foundations of the theory of electrical devices; to be able to: perform analysis of schemes of electric connections of RU when different modes of operation; to make the calculation and selection of main elements of the electrical part of stations and substations; to carry out rational layout of electrical equipment of open and closed distribution devices; to own skills: calculation of the technical characteristics and parameters of electrical equipment, selection of optimal circuit solutions in the design of electrical stations and substations.
15	Labor protection in electric power industry	3	5	Ecology with the basics of safety, Electrical safety	Diploma design	**Purpose**: training of engineers who need to know the scientific and engineering basis of labor protection and be able to apply them in practice in addressing the issues of ensuring safe and harmless working conditions, prevention of industrial injuries, occupational diseases, accidents. **Contents:** the Organization of work on labor protection at the enterprise; dangerous and harmful production factors; functional capabilities of a person and its compatibility with the production environment; the psychology of safety, vibration, noise and microclimate conditions in the working area; the electromagnetic field of transmission lines of electricity; industrial lighting; the basics of

						electrical safety; fire safety in industrial buildings and facilities. **Expected result**: to Know: legislative and normative acts of labour protection and preservation of human health in the course of his employment; equipment and technological processes, as well as to ensure their safe operation; methods of analysis of hazards and ensuring the stable operation and the order of actions upon detection of a failure of technical systems. Be able to: improve the technological safety of systems and anticipate and eliminate emergencies; assess the levels of risk when working on the equipment and on the production lines; eliminate technological failures when working equipment. Possess skills: analyze the causes of hazards and identify and eliminate failures of technical systems.
15	Labor protection in electrical installations	3	5	Ecology with the basics of safety, Safety in electrical installations	Diploma design	**Purpose:** formation of knowledge to create and maintain safe and harmless living conditions when working in electrical installations **Content:** organization of labor protection, duties of officials and their responsibility for the creation of healthy and safe working conditions **Expected result:** to Know: legislative and normative acts of labour protection and preservation of human health in the course of his employment; equipment and technological processes, as well as to ensure their safe operation; methods of analysis of hazards and ensuring the stable operation and the order of actions upon detection of a failure of technical systems. Be able to: improve the technological safety of systems and anticipate and eliminate emergencies; assess the levels of risk when working on the equipment and on the production lines; eliminate technological failures when working equipment. Possess skills: analyze the causes of hazards and identify and eliminate failures of technical systems.
16	Business in the electric power industry	3	5	Mathematics III, General energy	Diploma design	**Purpose:** formation of students ' holistic understanding of the logic of entrepreneurial activity in the energy sector. Particular attention is paid to practical issues of implementation of entrepreneurial ideas, planning the activities of the entrepreneur, the development of pricing policy, reducing production costs, as well as forms and methods of production and commercial activities used in energy activities. **Contents:** Subject and objectives of the course. Business environment and business qualities. Conditions and factors of entrepreneurial activity. The entrepreneurial decision and business structure. Organizational and legal forms of entrepreneurial activity and entrepreneurial contract in the energy sector. **Expected result:** to Know: current trends in the development of organization and production planning, enterprise management, as well as the tasks of further improvement of organizational and economic training of specialists; history of entrepreneurship in Kazakhstan; economic policy of the state in relation to entrepreneurship 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 for carrying out entrepreneurial activity; motivation of entrepreneurial decision and comparison with opportunities. Be able to: give the economic characteristics of the types of production; perform analysis and calculation of the duration of the production cycle; build graphs of the organization of series-parallel, parallel Assembly of products during synchronization and without synchronization of Assembly units; perform calculations of the economic efficiency of the production line; organize maintenance of production; organize technical training and control of the production process; perform analysis of production and economic activities. To own skills: to implement the calculation of the economic efficiency of mass production, cost, pricing, profitability; development of the production process.
16	Organization and planning of energy enterprises	3	5	Mathematics III, World energy	Diploma design	**Objective:** to Study the problems in the field of organization and planning and production management, 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 General production structure. Types of production structure. The structure of the main production, the principles of its construction. **Expected result:** to Know: current trends in the development of organization and production planning, enterprise management, as well as the tasks of further improvement of organizational and economic training of specialists; history of entrepreneurship in Kazakhstan; economic policy of the state in relation to entrepreneurship 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 for carrying out entrepreneurial activity; motivation of entrepreneurial decision and comparison with opportunities. Be able to: give the economic characteristics of the types of production; perform analysis and calculation of the duration of the production cycle; build graphs of the organization of series-parallel, parallel Assembly of products during synchronization and without synchronization of Assembly units; perform calculations of the economic efficiency of the production line; organize maintenance of production; organize technical training and control of the production process; perform analysis of production and economic activities. To own skills: to implement the calculation of the economic efficiency of mass production, cost, pricing, profitability; development of the production process.

17	Electrosupply	3	5	Mathematics I, II; Physics, Theoretical foundations of electrical engineering I, II	Diploma design	**Objective:** it is Necessary to develop knowledge, skills and abilities in the field of power 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:** to Know: terminology, basic concepts and definitions; basic information about electrical receivers and power sources of industrial enterprise; methods of calculation of electrical loads of electricity consumers; schemes, design and protective equipment for shop networks up to 1000 V; purpose and features of electrical networks of internal power supply voltage above 1000 V; basic electrical equipment of industrial enterprises; to be Able to: determine the design electrical loads and choose standard electrical equipment; perform calculations of working and post-emergency modes of power supply schemes of industrial enterprises; perform technical and economic calculations of various options of power supply schemes of industrial enterprises. To 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.
17	Power supply of electric power facilities	3	5	Mathematics I, II; Physics, Theoretical foundations of electrical engineering I, II	Diploma design	**Purpose:** mastering the basic information about the principles, methods and technical means of rational use of electricity and reduce 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 the quality of electricity and their permissible values. Effects of voltage quality on the operation of electrical energy 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. Frequency deviation. Influence of frequency deviation on the operation of electrical equipment, ways to reduce the frequency deviation. Voltage fluctuation. The influence of voltage fluctuations on the operation of the main industrial receivers of electric energy. Sources of higher harmonics in power supply systems. **Expected result:** to know: the whole list of tasks related to the provision of electricity consumers with standardized quality, reliability and efficiency; methods of voltage regulation to improve the quality of electricity; various aspects of electromagnetic compatibility; the main directions of reducing energy losses in power grids in the design and operation; principles of rationing power consumption; to be able

						to: calculate various indicators of voltage quality; measure the quality of voltage; determine the damage from the interruption of power supply; to make the electric power balance in enterprises. To possess skills: in the latest achievements of digital technology of protection and automation of elements of the power system; methods and principles of construction of power lines.
18	Relay protection and automation	3	5	Electrical safety, power plants and substations	Diploma design	**Aim:** to Acquire knowledge of the fundamental principles of ensuring the reliability of power supply systems by means of relay protection and automation (RPA); the formation of abilities to use technical means of relay protection and automation in solving problems of professional activity. **Contents:** Sources and circuits of operating current. Electromechanical relay. Relay protection equipment based on semiconductor and microelectronic technology. Current transformer. Maximum current protection (MTZ). Current cutoff. Earth fault protection in networks with dead-earthed neutral. MTZ zero sequence. Voltage transformers. Earth fault protection in networks with isolated or earthed neutral through arc-quenching reactors. Differential line protection. Distance protection. Relay protection of transformers and autotransformers. Protection of busbars. Protection of asynchronous and synchronous motors above 1000V and compensators. Protection of capacitor banks. Auto power on again (APV). Automatic reserve switch-on (AVR). Automatic frequency discharge (ACR). Automatic activation of synchronous generators for parallel operation. Switching-off and switching-on of parallel transformers to reduce power losses. Automatic voltage regulation at substations. The redundant actions of relay protection and circuit breakers. **Expected result:** to know: the causes of abnormal power system modes and ways of their automatic detection and rapid elimination of the impact on the power system equipment: design, principle of operation, properties, scope of the main elements of protection and automation devices. Be able to: perform typical electrical calculations and determine the set points for various types of protection and automation; for specific electrical networks, select the sufficient and necessary number and type of relay protection devices; compile and analyze relay protection schemes, perform maintenance, control and verification of relay protection devices. Possess the skills: checking the protection and setting the set points of panels, cabinets and terminals of protection with the help of modern means of verification and adjustment.
18	Relay protection of electrical equipment	3	5	Safety in electrical installations, electrical equipment of stations and substations	Diploma design	**Purpose:** students gain knowledge in the field of principles of construction of relay protection (RZ) of the main electrical equipment of power supply systems and applied modern methods and means to perform relay protection. **Contents:** expansion of ideas about the possibilities of RS; consolidation and specification of theoretical material concerning the principles of action and the

						device of RS, their basic properties, methods of application; obtaining skills of calculation of the settings necessary for the setup of RS; the correct choice of methods and means of RS; assessment of efficiency and reliability selected RS. **Expected result:** to know: the causes of abnormal power system modes and ways of their automatic detection and rapid elimination of the impact on the power system equipment: design, principle of operation, properties, scope of the main elements of protection and automation devices. Be able to: perform typical electrical calculations and determine the set points for various types of protection and automation; for specific electrical networks, select the sufficient and necessary number and type of relay protection devices; compile and analyze relay protection schemes, perform maintenance, control and verification of relay protection devices. Possess the skills: checking the protection and setting the set points of panels, cabinets and terminals of protection with the help of modern means of verification and adjustment.
PROFILING DISCIPLINES						
Optional components (OC)						
1	Lighting engineering and light sources	3	5	Mathematics II, Physics	Industrial electronics	**Purpose:** formation of the student's modern ideas about 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. 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. The transformation of the optical radiation. Color and color calculations. **Expected result:** to know the basic laws of interference and diffraction of light; patterns 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; to be able to: produce lighting and colorimetric calculations and measurements; to choose the necessary methods for measurements; to have skills: work with literary sources and Internet sites; work with graphic programs; information on the main parameters and characteristics of the radiation frequency analyzers; the main methods of processing and presentation of experimental data; experience of lighting and colorimetric calculations
1	Lighting equipment and lighting	3	5	Mathematics II, Physics	Industrial electronics	**Objective:** learning the basics of lighting, techniques of designing lighting systems with requirements on energy saving, the skills of operating the lighting systems. **Contents:** Characteristics of measuring instruments.

						An overview of the measurement technique. Static and dynamic characteristics of measuring instruments. Errors of measuring instruments. Processing of measurement results. Measuring transducers of physical (electrical and non-electrical) quantities. General concept. The structure of the transducers. Classification of measuring transducers. Principle of operation, properties and scope of resistive, piezoelectric, electrostatic, electromagnetic, galvanomagnetic, electrochemical, thermal, optoelectric converters. **Expected result:** to know the basic laws of interference and diffraction of light; patterns 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; to be able to: produce lighting and colorimetric calculations and measurements; to choose the necessary methods for measurements; to have skills: work with literary sources and Internet sites; work with graphic programs; information on the main parameters and characteristics of the radiation frequency analyzers; the main methods of processing and presentation of experimental data; experience of lighting and colorimetric calculations
2	Electrical materials science	3	5	Physics, fundamentals of standardization in the power industry	Installation and operation of electrical equipment, Design of power plants	**Purpose:** 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:** basic concepts. Classification of electrical materials. Physical processes in dielectrics. Polarization and electrical conductivity of dielectrics. Physical processes in dielectrics. Dielectric losses and breakdown of dielectrics. Physical and mechanical properties of electrical insulating materials. Dielectric material. Conductor materials. Semiconductors. Magnetic material. **Expected result:** To 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 methods and determination of the main characteristics of the most common electrical materials. Be able to: correctly assess the appropriateness of the choice and use of electrical materials, work on laboratory equipment. Possess the skills: on laboratory equipment to determine certain properties of electrical insulating materials; laboratory equipment for determination of various properties of dielectric materials; laboratory equipment for the determination of certain properties of electrically conductive materials; laboratory equipment for the determination of certain properties of semiconductor materials; laboratory equipment for the determination of certain properties of magnetic materials; the task of defining the parameters of electrical materials.
2	Materials in the	3	5	Physics,	Repair and	**Purpose:** Formation of students ' knowledge about

	power industry			Basic Metrology	operation of electrical equipment, Design of power supply systems	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. **Contents:** Physical fundamentals of materials science; physical processes in dielectric materials; electrical insulating liquids, solid organic and inorganic materials; conductor, superconductor, semiconductor and magnetic materials. **Expected result:** To 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 methods and determination of the main characteristics of the most common electrical materials. Be able to: correctly assess the appropriateness of the choice and use of electrical materials, work on laboratory equipment. Possess the skills: on laboratory equipment to determine certain properties of electrical insulating materials; laboratory equipment for determination of various properties of dielectric materials; laboratory equipment for the determination of certain properties of electrically conductive materials; laboratory equipment for the determination of certain properties of semiconductor materials; laboratory equipment for the determination of certain properties of magnetic materials; the task of defining the parameters of electrical materials.
3	Electrical materials science	2 (У)	3	Physics, fundamentals of standardization in the power industry	Installation and operation of electrical equipment, Design of power plants	**Purpose:** 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:** basic concepts. Classification of electrical materials. Physical processes in dielectrics. Polarization and electrical conductivity of dielectrics. Physical processes in dielectrics. Dielectric losses and breakdown of dielectrics. Physical and mechanical properties of electrical insulating materials. Dielectric material. Conductor materials. Semiconductors. Magnetic material. **Expected result:** To 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 methods and determination of the main characteristics of the most common electrical materials. Be able to: correctly assess the appropriateness of the choice and use of electrical materials, work on laboratory equipment. Possess the skills: on laboratory equipment to determine certain properties of electrical insulating materials; laboratory equipment for determination of various properties of dielectric materials; laboratory equipment for the determination of certain properties of electrically conductive materials; laboratory equipment for the determination of certain properties of semiconductor materials; laboratory equipment for the determination of certain properties of magnetic

						materials; the task of defining the parameters of electrical materials.
3	Materials in the power industry	2 (У)	3	Physics, Basic Metrology	Repair and operation of electrical equipment, Design of power supply systems	**Purpose:** 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. **Contents:** Physical fundamentals of materials science; physical processes in dielectric materials; electrical insulating liquids, solid organic and inorganic materials; conductor, superconductor, semiconductor and magnetic materials. **Expected result:** To 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 methods and determination of the main characteristics of the most common electrical materials. Be able to: correctly assess the appropriateness of the choice and use of electrical materials, work on laboratory equipment. Possess the skills: on laboratory equipment to determine certain properties of electrical insulating materials; laboratory equipment for determination of various properties of dielectric materials; laboratory equipment for the determination of certain properties of electrically conductive materials; laboratory equipment for the determination of certain properties of semiconductor materials; laboratory equipment for the determination of certain properties of magnetic materials; the task of defining the parameters of electrical materials.
4	Automation of electric power facilities	3	5	Physics, Electrical drawings and diagrams	Power stations and substations , relay protection and automation	**Purpose:** formation of students ' knowledge, practical skills in the field of design, development and organization of automated control systems (ACS) 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 simulation of automatic control and regulation devices in power systems using modern achievements of science, technology, international and domestic experience in this field. **Contents:** 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, process control systems of electric power systems, power plants and substations. Emergency automation of power systems. **Expected result:** to know: the basic principles of construction of control and management circuits of electrical installations; the main essence of the control and tasks solved within the ACS electrical installations; General information about the ACS TP, functions, composition and structure of the ACS TP; problems of ensuring static stability of parallel operation of power plants in steady-state normal and

						post-accident modes and the need to maintain dynamic stability during electromagnetic and Electromechanical transients in emergency mode; history of development, scope and innovative trends in improving the automation of power plants, substations and electric power systems; be able to: use Electromechanical, electronic and microprocessor automation tools to control the values of electrical quantities to control electric power facilities; use modern information and telecommunication technologies in the design and technological preparation of production of automation systems to improve the reliability, sensitivity and selectivity of automation; to choose and implement effective modes of operation of automation equipment according to the specified methods; to operate correctly means of automation of power facilities; to possess skills: methods of calculation of parameters and characteristics of means of automation of electric power systems; application of modern computer technologies for obtaining information in the field of automation of electric power systems; methods of design of subsystems of automation of electric power systems; work with reference literature and normative and technical materials; carrying out standard tests and regulation of automation of electric power systems; practical preparation of technical specifications for the design of automation systems (including automatic control systems) of electric power systems, power plants and substations.
4	Automatic control theory	3	5	Physics, Graphic means in electric power industry	Electrical equipment of stations and substations, relay protection of electrical equipment	**Purpose:** formation of students ' knowledge of the basics of construction and operation of automated systems of energy management 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:** to know: methods of analytical and experimental research of static and dynamic characteristics of control objects; methods of compilation and linearization of mathematical models of dynamic systems; methods of analysis of stability of dynamic systems. Be able to: simulate and explore the dynamic system using analog and digital computing; analyze the stability and quality performance of the automatic control system. To possess skills: on the principles of automatic control; on the main types of control systems; about the purposes, tasks and methods of the analysis and synthesis of systems of automatic control.
5	Transients in the power industry	4	6	Physics, Theoretical bases of electrical engineering I, II	Diploma design	**Purpose:** students master the basics of the theory of Electromechanical processes in the power system, methods of calculation of short-circuit currents in power systems over 1000V, assessing the stability of the mode of operation of the power system. students master the basics of the theory of Electromechanical processes in the power system, methods of calculation of short-circuit currents in electric power

						systems over 1000V, evaluation of the stability of the electric power system. **Contents:** Electromechanical transients, analysis of static stability of the electrical system, dynamic stability of the electrical system, transients in the load nodes, measures to improve the stability of energy systems. **Expected result:** to Know: the basics of the theory of transients arising in the power system and power supply system both in normal operation (switching on and off loads, power supplies, individual circuits, etc.) and in emergency situations (short circuit, break of the loaded circuit or its separate phase, loss of synchronous machine from synchronism, etc.). Be able to: calculate short-circuit currents in networks up to and above 1000 V Own skills: assessment of the impact of transients on the stability of the energy system, the principles of transformation of electrical circuits of power supply systems
5	Electromagnetic and Electromechanical processes	4	6	Physics, Theoretical bases of electrical engineering I, II	Diploma design	**Purpose:** the study of transients due to changes in the electromagnetic state of the system elements and the imbalance between the moments on the shaft of each rotating machine and the electromagnetic torque. The transition process is characterized by a set of electromagnetic and Electromechanical changes in the system **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 earth fault. Algorithm for calculation of asymmetric short-circuit current. **Expected result:** to Know: the basics of the theory of transients arising in the power system and power supply system both in normal operation (switching on and off loads, power supplies, individual circuits, etc.) and in emergency situations (short circuit, break of the loaded circuit or its separate phase, loss of synchronous machine from synchronism, etc.). Be able to: calculate short-circuit currents in networks up to and above 1000 V acquire practical skills: assessing the impact of transients on the stability of the energy system. To possess skills: principles of transformation of electric schemes of power supply systems
6	Installation and operation of electrical equipment	3	5	Electrical appliances, Electrical safety	Electromagnetic and electrical compatibility of electrical installations, power Supply	**Purpose:** Formation of theoretical knowledge and mastery of organizational and technical issues of rational operation and advanced industrial methods of installation, commissioning and operation of electrical power supply systems of industrial enterprises. **Contents:** issues of installation, commissioning, operation and repair of electrical equipment. Installation of indoor and outdoor electrical wiring. Installation of wiring in pipes, trays and boxes. Installation of lighting networks. **Expected result:** to Know: technical and organizational issues of installation, commissioning

						and operation of electrical installations of industrial enterprises; purpose, the device of basic materials, tools and technical means used in the installation and operation of electrical equipment and electrical installations; to be Able to: choose power electrical equipment and control circuits of electrical installations in accordance with environmental conditions; to make installation, commissioning, ensure effective use and maintenance of means and systems of power supply; To possess skills: in selection, installation, commissioning and operation of electrical installations of industrial enterprises; quality control and performance of electrical installation and commissioning; to identify the causes and violations in the operation of electrical equipment and electrical installations and eliminate their consequences.
6	Repair and operation of electrical equipment	3	5	Electrical and electronic devices, safety In electrical installations	Electromagnetic compatibility of technical means, Power supply of electric power facilities	**Purpose:** formation of a system of knowledge about the scientific and technical basis of operation and repair of all types of electrical equipment of industrial and agricultural enterprises. **Contents:** the principle of operation of electric motors, generators and transformers; methods of protection of electrical equipment; existing types and types of electrical and electronic devices. **Expected result:** to Know: technical and organizational issues of installation, commissioning and operation of electrical installations of industrial enterprises; purpose, the device of basic materials, tools and technical means used in the installation and operation of electrical equipment and electrical installations; to be Able to: choose power electrical equipment and control circuits of electrical installations in accordance with environmental conditions; to make installation, commissioning, ensure effective use and maintenance of means and systems of power supply; To possess skills: in selection, installation, commissioning and operation of electrical installations of industrial enterprises; quality control and performance of electrical installation and commissioning; to identify the causes and violations in the operation of electrical equipment and electrical installations and eliminate their consequences.
7	Alternative energy	4	6	General energy	Business in the electric power industry	**Purpose:** formation of students ' knowledge in the field of development prospects and existing international and domestic experience in the development of energy sources alternative to traditional ones used in thermal and nuclear power. **Contents:** Hydropower, Wind energy, Solar energy, Geothermal energy, Biofuels, Secondary energy resources and energy conservation. **Expected result:** to know: technology of energy production on the basis of renewable energy sources; program of development of non-traditional energy of Kazakhstan to be able 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 implementation of the main devices of energy conversion. To own skills: the

						problems of analysis of modern technologies of conservation of energy.
7	Alternative energy source	4	6	World energy	Organization and planning of energy enterprises	**Purpose:** formation of students ' knowledge in the field of development prospects and existing international and domestic experience in the development of energy sources alternative to traditional ones used in thermal and nuclear power. **Contents:** Hydropower, Wind energy, Solar energy, Geothermal energy, Biofuels, Secondary energy resources and energy conservation. **Expected result:** to know: technology of energy production on the basis of renewable energy sources; program of development of non-traditional energy of Kazakhstan to be able 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 implementation of the main devices of energy conversion. acquire practical skills: in the calculation of modern energy conservation technologies. be competent: in the issues of modern technologies of transformation of non-traditional renewable energy sources.
8	Alternative energy	3 (У)	5	General energy	Business in the electric power industry	**Purpose:** formation of students ' knowledge in the field of development prospects and existing international and domestic experience in the development of energy sources alternative to traditional ones used in thermal and nuclear power. **Contents:** Hydropower, Wind energy, Solar energy, Geothermal energy, Biofuels, Secondary energy resources and energy conservation. **Expected result:** to know: technology of energy production on the basis of renewable energy sources; program of development of non-traditional energy of Kazakhstan to be able 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 implementation of the main devices of energy conversion. To own skills: the problems of analysis of modern technologies of conservation of energy.
8	Alternative energy source	3 (У)	5	World energy	Organization and planning of energy enterprises	**Purpose:** formation of students ' knowledge in the field of development prospects and existing international and domestic experience in the development of energy sources alternative to traditional ones used in thermal and nuclear power. **Contents:** Hydropower, Wind energy, Solar energy, Geothermal energy, Biofuels, Secondary energy resources and energy conservation. **Expected result:** to know: technology of energy production on the basis of renewable energy sources; program of development of non-traditional energy of Kazakhstan to be able 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 implementation of the main devices of energy conversion. acquire practical skills: in the calculation of modern energy conservation technologies. be competent: in the issues of modern technologies of transformation of non-traditional renewable energy sources.

9	Design of power stations	4	6	Fundamentals of standardization in the power industry, Electrical drawings and diagrams	Diploma design	**Purpose:** to acquaint students with the history of design, the content of design work, design methods and calculation of the main parameters, and the choice of equipment. **Contents:** history of design in the power industry. The content of the design work and the basics of equipment layout. 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:** to Know: the content and design features of power plants; basic principles of selection of thermal and mechanical equipment; basic principles of layout of power plants; method of selection of main circuits; methods of limiting short-circuit currents; methods of calculation of short-circuit currents and conditions of selection of switching equipment and electrical devices; features of power supply circuits for own needs; design features of switchgears and design of control systems. To be able to work with the original data in the design; to make technical and economic calculations on the choice of schemes of power supply and the main and auxiliary equipment; to count currents of short circuit and to make check of the equipment on thermal and electrodynamic stability; to make the analysis and the choice of the main schemes of electric stations, schemes of switchgears and schemes of own needs of electric stations; to choose electric motors for working mechanisms and to check them under the conditions of start-up and self-start. To possess skills: practical application of the acquired knowledge; use of methods of analysis of power supply systems; application of modern computer-aided design; application of graphic programs to create design and technical documentation.
9	Design of power supply systems	4	6	Fundamentals of Metrology, Graphical tools in the power industry	Diploma design	**Objective:** to Master the theoretical and practical foundations in the design of power supply systems. **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:** to know: the main normative and technical documents adopted to the leadership 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; power quality indicators. Be able to: determine electrical loads, reactive power compensation, technical and economic calculations, short-circuit currents, grounding; select the optimal option of power supply; develop and execute project technical documentation. To possess skills: practical application of the acquired knowledge; use of methods of analysis of power supply systems; use of modern computing design tools; use of graphic

						programs to create design and technical documentation.
10	Design of power stations	3 (У)	5	Fundamentals of standardization in the power industry, Electrical drawings and diagrams	Diploma design	**Purpose:** to acquaint students with the history of design, the content of design work, design methods and calculation of the main parameters, and the choice of equipment. **Contents:** history of design in the power industry. The content of the design work and the basics of equipment layout. 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:** to Know: the content and design features of power plants; basic principles of selection of thermal and mechanical equipment; basic principles of layout of power plants; method of selection of main circuits; methods of limiting short-circuit currents; methods of calculation of short-circuit currents and conditions of selection of switching equipment and electrical devices; features of power supply circuits for own needs; design features of switchgears and design of control systems. To be able to work with the original data in the design; to make technical and economic calculations on the choice of schemes of power supply and the main and auxiliary equipment; to count currents of short circuit and to make check of the equipment on thermal and electrodynamic stability; to make the analysis and the choice of the main schemes of electric stations, schemes of switchgears and schemes of own needs of electric stations; to choose electric motors for working mechanisms and to check them under the conditions of start-up and self-start. To possess skills: practical application of the acquired knowledge; use of methods of analysis of power supply systems; application of modern computer-aided design; application of graphic programs to create design and technical documentation.
10	Design of power supply systems	3 (У)	5	Fundamentals of Metrology, Graphical tools in the power industry	Diploma design	**Objective:** to Master the theoretical and practical foundations in the design of power supply systems. **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:** to know: the main normative and technical documents adopted to the leadership 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; power quality indicators. Be able to: determine electrical loads, reactive power compensation, technical and economic calculations, short-circuit currents, grounding; select the optimal option of power supply; develop and execute project technical documentation. To possess skills: practical application of the acquired knowledge; use of

						methods of analysis of power supply systems; use of modern computing design tools; use of graphic programs to create design and technical documentation.
11	Power converters	3	5	Physics, Theoretical foundations of electrical engineering I, II, Electrical apparatus	Diploma design	**Purpose:** is to teach students the basics of design and operation of devices of Converter power electronics, such as switching power supplies, inverters and frequency converters, AC and DC drives, which are the most common elements of many systems of automatic control and regulation, 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. **The expected result:** to Know: the device and the principle of operation of modern power semiconductor elements; the device and the principle of operation of semiconductor converters used in the electric drive; physical phenomena occurring semiconductor converters; the main parameters characterizing the work 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; means of programming of modern microcontrollers. Be able to: calculate and select the main elements of the power Converter circuits; make a preliminary calculation of the parameters and the choice of the serial Converter for a specific application; evaluate the possibilities and choose a 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. To possess skills: in fixing and specification of the theoretical material concerning the principles of action and the device of various electric measuring devices, their basic properties, a technique of application, processing of results of supervision.
11	Energy saving and quality of electric power	3	5	Physics, Theoretical foundations of electrical engineering I, II, Electrical and electronic devices	Diploma design	**Purpose:** to Use methods of effective use of resources, to provide energy-saving technology. **Contents:** the Main trends in the development of energy in the world and the Republic of Kazakhstan and the General problems of energy conservation. Legislative base of energy saving. Energy source. Energy saving. Intensification of energy saving. The main technical and economic indicators of installations of non-traditional and renewable energy sources. The main direction and importance of the use of non-traditional and renewable energy sources. Use of waste heat.

						Expected result: to Know: the main legislative and regulatory documents of the Republic of Kazakhstan on energy saving; traditional and alternative types of energy; on ways to obtain new types of energy resources; on the energy balance of the industrial enterprise, the basics of tariff policy when using electric energy, on the regulation of energy consumption; on ways to reduce the consumption of electric loads; rules for the rational use of electric energy. Be able to: describe and explain on the basis of certain legislative and regulatory acts the state policy on the efficient use of energy resources in Kazakhstan. describe and explain the various processes underlying energy-saving technologies, give examples of energy-saving technologies in various industries, the economy. To possess skills: to use and analyze the use of resource-saving technologies in the organization of construction production.

Note*: У – Discipline for accelerated learning (On the basis of the second higher, secondary special education)*

DISCIPLINE LIST
elective courses

Form of training: Full-time
Training period: 4 years

Name of the discipline	Code of discipline	Number of credits		Semester
		RK	ECTS	
GENERAL DISCIPLINES				
Component of choice 1				
Ecology with the basics of safety	EWBS 1106	2	3	1
Psychology	Psy 1106	2	3	1
Component of choice 2				
Political Science / Sociology / Culturology	PS/Soc/Cul 2107	2	3	3
The fundamentals of anti-corruption culture	FAC 2107	2	3	3
Component of choice 3 (Discipline established by the university)				
Religious Studies	Rel 3108	3	5	5
BASIC DISCIPLINES				
Component of choice 1				
Engineering and computer graphics	ECG 1208	4	6	1
Fundamentals of computer drawing	FCD 1208	4	6	1
Component of choice 2				
Basics of standardization in the electric power industry	BSEPI 1209	3	5	2
Fundamentals of metrology	FM 1209	3	5	2
Component of choice 3				
Electrical drawings and diagrams	EDD 2210	3	5	3
Graphic means in electric power industry	GMEI 2210	3	5	3
Component of choice 4				
Electrical apparatus	EA 2211	4	6	3
Electrical and electronic devices	EED 2211	4	6	3
Component of choice 5				
Electrical measurements	EM 2212	4	6	4
Measurement of electrical and non-electrical quantities	MENQ 2212	4	6	4
Component of choice 6				
Electrical safety	ES 2213	3	5	3
Safety in electrical installations	SEI 2213	3	5	3
Component of choice 7				
General Power Engineering	GPE 3214	3	5	5
World energy	WE 3214	3	5	5
Component of choice 8				
Mathematical problems and computer modeling in the electric power industry	MPCMEI 3215	3	5	5
Theory of Probability and Mathematical Statistics	TPMS 3215	3	5	5
Component of choice 9				
Automated electric drive in electric power industry	AEDEI 3216	3	5	6
Adjustable electric drive in electric power industry	AEDEI 3216	3	5	6
Component of choice 10				
Electromagnetic and electrical compatibility of electrical installations	EECEI 3217	3	5	6
Electromagnetic compatibility of technical means	ECTM 3217	3	5	6
Component of choice 11				
Electric stations and substations	ESS 3218	4	6	6
Electrical equipment of stations and substations	EESS 3218	4	6	6

Component of choice 12				
Labor protection in the electric power industry	LPEI 4219	3	5	7
Labor protection in electrical installations	LPEI 4219	3	5	7
Component of choice 13				
Entrepreneurship in the electric power industry	EEI 4220	3	5	7
Organization and planning of energy enterprises	OPEE 4220	3	5	7
Component of choice 14				
Power supply	PS 4221	3	5	7
Electricity supply of electric power facilities	ESEF 4221	3	5	7
Component of choice 15				
Relay protection and automation	RPA 4222	3	5	7
Relay protection of electrical equipment	RPEE 4222	3	5	7
PROFILING DISCIPLINES				
Component of choice 1				
Lighting and light sources	LLS 2303	3	5	3
Lighting technology and lighting	LTL 2303	3	5	3
Component of choice 2				
Electrotechnical aterials science	EMS 2304	3	5	4
Materials in the electric power industry	MEI 2304	3	5	4
Component of choice 3				
Automation of electric power facilities	AEF 2305	3	5	4
Basics of automatic control	BAC 2305	3	5	4
Component of choice 4				
Transient processes in the electric power industry	TPEI 3306	4	6	5
Electromagnetic and electromechanical processes	EEP 3306	4	6	5
Component of choice 5				
Installation and operation of electrical equipment	IOEE 3307	3	5	5
Repair and maintenance of electrical equipment	RMEE 3307	3	5	5
Component of choice 6				
Alternative energy	AE 3308	4	6	6
Alternative energy sources	AES 3308	4	6	6
Component of choice 7				
Designing of power plants	DPP 4309	4	6	7
Designing of power supply systems	DPSS 4309	4	6	7
Component of choice 8				
Power converters	PC 4310	3	5	7
Energy saving and quality of electric energy	ESQE 4310	3	5	7

DISCIPLINE LIST
elective courses

Form of training: Correspondence
Training period: 3 years

Name of the discipline	Code of discipline	Number of credits		Semester
		RK	ECTS	
BASIC DISCIPLINES				
Component of choice 1				
Engineering and computer graphics	ECG 1208	2	3	2
Fundamentals of computer drawing	FCD 1208	2	3	2
Component of choice 2				
Basics of standardization in the electric power industry	BSEPI 1209	3	5	3
Fundamentals of metrology	FM 1209	3	5	3
Component of choice 3				
Electrical drawings and diagrams	EDD 1210	3	5	3

Graphic means in electric power industry	GMEI 1210	3	5	3
Component of choice 4				
Electrical apparatus	EA 1211	3	5	3
Electrical and electronic devices	EED 1211	3	5	3
Component of choice 5				
Electrical safety	ES 2212	3	5	4
Safety in electrical installations	SEI 2212	3	5	4
Component of choice 6				
Electrical measurements	EM 2213	4	6	4
Measurement of electrical and non-electrical quantities	MENQ 2213	4	6	4
Component of choice 7				
General Power Engineering	GPE 2214	3	5	5
World energy	WE 2214	3	5	5
Component of choice 8				
Mathematical problems and computer modeling in the electric power industry	MPCMEI 2215	3	5	5
Theory of Probability and Mathematical Statistics	TPMS 2215	3	5	5
Component of choice 9				
Automated electric drive in electric power industry	AEDEI 2216	3	5	6
Adjustable electric drive in electric power industry	AEDEI 2216	3	5	6
Component of choice 10				
Electromagnetic and electrical compatibility of electrical installations	EECEI 2217	3	5	6
Electromagnetic compatibility of technical means	ECTM 2217	3	5	6
Component of choice 11				
Electric stations and substations	ESS 3218	4	6	7
Electrical equipment of stations and substations	EESS 3218	4	6	7
Component of choice 12				
Labor protection in the electric power industry	LPEPI 3219	3	5	8
Labor protection in electrical installations	LPEI 3219	3	5	8
Component of choice 13				
Entrepreneurship in the electric power industry	EEI 3220	3	5	8
Organization and planning of energy enterprises	OPEE 3220	3	5	8
Component of choice 14				
Power supply	PS 3221	3	5	9
Electricity supply of electric power facilities	ESEF 3221	3	5	9
Component of choice 15				
Relay protection and automation	RPA 3222	3	5	9
Relay protection of electrical equipment	RPEE 3222	3	5	9
PROFILING DISCIPLINES				
Component of choice 1				
Lighting and light sources	LLS 2303	3	5	5
Lighting technology and lighting	LTL 2303	3	5	5
Component of choice 2				
Electrotechnical aterials science	EAS 2304	2	3	6
Materials in the electric power industry	MEI 2304	2	3	6
Component of choice 3				
Automation of electric power facilities	AEF 3305	4	6	7
Basics of automatic control	BAC 3305	4	6	7
Component of choice 4				
Transient processes in the electric power industry	TPEPI 3306	4	6	7
Electromagnetic and electromechanical processes	EEP 3306	4	6	7
Component of choice 5				
Installation and operation of electrical equipment	IOEE 3307	3	5	8
Repair and maintenance of electrical equipment	RMEE 3307	3	5	8
Component of choice 6				
Alternative energy	AE 3308	3	5	8
Alternative energy sources	AES 3308	3	5	8

Component of choice 7				
Designing of power plants	DPP 3309	3	5	9
Designing of power supply systems	DPSS 3309	3	5	9
Component of choice 8				
Power converters	PC 3310	3	5	9
Energy saving and quality of electric energy	ESQEE 3310	3	5	9

DISCIPLINE LIST
elective courses

Form of training: Correspondence
Training period: 2 years

Name of the discipline	Code of discipline	Number of credits		Semester
		RK	**ECTS**	
BASIC DISCIPLINES				
Component of choice 1				
Engineering and computer graphics	ECG 1108	4	6	1
Fundamentals of computer drawing	FCD 1108	4	6	1
Component of choice 2				
Basics of standardization in the electric power industry	BSEPI 1109	3	5	1
Fundamentals of metrology	FM 1109	3	5	1
Component of choice 3				
Electrical apparatus	EA 1110	3	5	2
Electrical and electronic devices	EED 1110	3	5	2
Component of choice 4				
Electrical measurements	EM 1111	3	5	2
Measurement of electrical and non-electrical quantities	MENQ 1111	3	5	2
Component of choice 5				
Electrical safety	ES 1112	3	5	3
Safety in electrical installations	SEI 1112	3	5	3
Component of choice 6				
Automated electric drive in electric power industry	AEDEI 2113	3	5	4
Adjustable electric drive in electric power industry	AEDEI 2113	3	5	4
Component of choice 7				
Electric stations and substations	ESS 2114	3	5	5
Electrical equipment of stations and substations	EESS 2114	3	5	5
Component of choice 8				
Labor protection in the electric power industry	LPEPI 2115	3	5	5
Labor protection in electrical installations	LPEI 2115	3	5	5
Component of choice 9				
Power supply	PS 2116	3	5	6
Electricity supply of electric power facilities	ESEF 2116	3	5	6
Component of choice 10				
Relay protection and automation	RPA 2117	3	5	6
Relay protection of electrical equipment	RPEE 2117	3	5	6
PROFILING DISCIPLINES				
Component of choice 1				
Lighting and light sources	LLS 1203	3	5	3
Lighting technology and lighting	LTL 1203	3	5	3
Component of choice 2				
Electrotechnical aterials science	EMS 1204	2	3	3
Materials in the electric power industry	MEI 1204	2	3	3
Component of choice 3				
Installation and operation of electrical equipment	IOEE 2205	3	5	5
Repair and maintenance of electrical equipment	RMEE 2205	3	5	5
Component of choice 4				
Alternative energy	AE 2206	3	5	6

Alternative energy sources	AES 2206	3	5	6
Component of choice 5				
Power converters	PC 2207	3	5	6
Energy saving and quality of electric energy	ESQEE 2207	3	5	6