

Kazakh Humanitarian Law Innovation University

MODULAR EDUCATIONAL PROGRAM  
EDUCATIONAL PROGRAM - 6B07125 "ELECTRIC POWER"

Semey, 2021

## EXPLANATORY NOTE

The Modular Educational Program (MEP) is based on the “State Compulsory Standard of Higher Education of the Republic of Kazakhstan. Undergraduate. General Provisions”, approved by Decree of the Government of the Republic of Kazakhstan dated May 13, 2016 No. 292, Rules for organizing the educational process on credit technology of education, approved by Order of the Minister of Education and Science of the Republic of Kazakhstan No. 152 dated April 20, 2011 (as amended and supplemented as of January 28, 2011) .2016). The model curriculum of the educational program 6B07125 "Power Engineering" approved by order of the Ministry of Education and Science of the Republic of Kazakhstan No. 425 dated 05.08.2016, in accordance with intra-university documents with P.01.04/2012 "Regulations on the formation of the trajectory of students' education", form No. 26 "Structure of the modular educational program ".

The modules of the OOD block include disciplines of the compulsory component (OK) - 51 credits and elective components (EC) - 5 credits common to all educational programs of education, in the study of which the graduate must master the following competencies: knowledge of the laws of development of society and its socio-political , legal, economic, environmental foundations, as well as cultural and historical values, the foundations of computer science, language communication and understanding the principles of a healthy lifestyle, possession of information about the political life of the country.

The database block includes disciplines of university components, which is 33 credits; and components of choice (EC), which is 112 credits. The modules of these disciplines make it possible to form a set of key (research), subject and special competencies acquired by the graduate.

The PD block includes disciplines of university components, which is 60 credits; and an elective component (EC), which is 37 credits. The modules of these disciplines make it possible to form a set of key and special (developing, creative, organizational and methodological) competencies acquired by the graduate.

DVO - 12 credits

In total, a student at the end of the MEP must master 240 credits (100%).

A total of 21 modules were compiled on the MEP.

When developing a modular educational program together with the employer (LLP "Partner ENERGO LTD") the following recommendations were taken into account:

Introduce the discipline "Installation and operation of electrical equipment of a power plant" into training, replacing the following discipline "Installation, repair and operation of electrical equipment".

### **Purpose and objectives of the modular educational program**

Target -efficient and safe distribution and use of energy resources. Design of electrical networks, selection, installation and commissioning, diagnostics and maintenance of electrical networks. Development of devices involved in the production and consumption of electricity.

#### *Tasks:*

- Provision of educational services for the development of professional skills;
- Formation of the main professional competencies of future bachelors in the specialty "Power Engineering";
- Acquiring the ability to work with scientific and technical literature, use domestic and foreign experience in professional activities, systematize and summarize the information received;
- Training in the ability to analyze and process the results obtained; analyze the state and dynamics of objects of activity; in the creation of theoretical models that allow predicting the properties and behavior of objects of activity; in the development of plans, programs and methods for testing technological systems and electrical equipment; in the use of computer technologies for processing the results of experimental and theoretical studies; in the development of energy-efficient equipment, installations and complexes.

## **2. Graduate competency model**

The sphere and objects of professional activity of graduates is the field of science and technology, which includes enterprises for the production, transmission, distribution and consumption of electricity.

In modern conditions, the key resource for the country's economic growth is the intellectual and educational potential. In this regard, the system of training highly qualified personnel becomes important in ensuring high competitiveness.

The competitiveness of a specialist is determined by his professional competence, broad social outlook, flexibility of behavior and a high level of individual activity.

The competence-based approach in higher professional education opens up wide opportunities for better training of specialists for real life.

Graduate competence is formed taking into account the needs and satisfaction of the labor market.

A graduate in the educational program 6B07125 Electric Power Industry is awarded the academic degree "Bachelor of Engineering and Technology" in the educational program 6B07125 Electric Power Industry.

The objects of professional activity of graduates are power supply systems of industrial enterprises, power supply systems of autonomous objects.

Competences that a graduate should have after mastering the MEP:

**Competencies in the field of languages:**

**Know:**

- basic definitions in the field of languages that contribute to the formation of a highly educated personality with a broad outlook and a culture of speech;
- scientific vocabulary and scientific constructions of a technical profile;
- rules for producing texts of different genres;
- speech norms of the technical sphere of activity;
- basics of business communication.

**Be able to:**

- freely conduct a conversation on various topics;
- use reference literature in Kazakh, Russian and English (explanatory dictionaries, reference books, encyclopedias, including specialized terminology).

**Master the skills:**

- competent explanation in the state, Russian and English languages;
- competent preparation of current documentation in the state, Russian and foreign languages;
- building a constructive dialogue;
- expressing one's opinion in Kazakh, Russian and English from the point of view of a future specialist in the field of professional activity.
- trilingual education, which contributes to the formation of language competencies in future specialists in the field of information technology.

**Competences of natural sciences:**

**Know:**

- basic definitions in the field of natural sciences that contribute to the formation of a highly educated personality with a broad outlook and thinking;
- basic concepts of higher mathematics and their applications in various fields;
- fundamental concepts, laws and theories of classical and modern mathematics, techniques and methods for solving specific problems;
- mathematical methods, mathematical intuitions, mathematical cultures;
- the essence of the basic ideas, laws, theories of classical and modern physics in their internal relationship and integrity, the concept of physical laws, the limits of their applicability, which allows them to be effectively used in specific situations.

**Be able to:**

- build mathematical models, set mathematical problems, select appropriate mathematical methods and algorithms for solving the problem, apply numerical methods to solve the problem using modern computer technology;
- to conduct qualitative mathematical research on the basis of the conducted mathematical analysis to develop practical recommendations;
- solve generalized typical tasks of the discipline (theoretical and experimental-practical educational tasks) from various areas of physics features;
- solve professional problems;
- simulate physical situations using a computer;
- use methods for analyzing and evaluating the results of experiments.

**Master the skills:**

- solving professional problems;
- evaluating the degree of reliability of the results obtained using experimental or theoretical research methods;
- conducting a physical experiment;
- using the achievement of fundamental science for the successful study of general theoretical and special technical disciplines, the development of mathematical thinking and logic.

**Socio-ethical competencies:****Know:**

- social and ethical values based on public opinion, traditions, customs, social norms and focus on them in their professional activities;
- traditions and culture of the peoples of Kazakhstan;
- fundamentals of the legal system and legislation of Kazakhstan;
- trends in the social development of society.

**Be able to:**

- comply with the norms of business ethics, possess ethical and legal standards of conduct;
- adequately navigate in various social situations;
- find compromises, correlate your opinion with the opinion of the team.

**Master the skills:**

- tolerance for traditions, culture of other peoples of the world;
- work in a team, correctly defend their point of view, offer new solutions;
- striving for professional and personal growth.

## **Information and communication competencies:**

### **Know:**

- principles of building a modern operating system and system software;
- basic models, methods and tools used in computer systems to automate the solution of intellectual problems;
- theoretical and practical problems of computational informatics as a field of knowledge and practical human activity related to the need to analyze information;
- about trends in the development of microelectronics, about promising circuit solutions in the field of digital and analog technology;
- about the current state and trends in the development of computer architectures, computing systems, complexes and networks;
- about architecture and possibilities of microprocessor means;
- about the problems and directions of development of programming technology, about the main methods and means of design automation
- about software, about methods of organizing work in teams of software developers.

### **Be able to:**

- identify problems of a technical, logical nature when analyzing specific situations for programming, suggest ways to solve them and evaluate the expected results;
- systematize and summarize information, prepare references and reviews on professional activities, edit, abstract, review texts; use basic and special methods of information analysis in the field of professional activity; develop and justify options for effective solutions;
- critically evaluate from different angles (production, motivational, institutional, etc.) the development trends of objects in the field of professional activity; apply the knowledge gained in the study of mathematics, physics;
- plan and conduct research, analyze and interpret the data obtained;
- analyze, program, design and operate software and hardware complexes and protection systems;
- use modern technical means necessary in engineering practice.

### **Master the skills:**

- special technical terminology and vocabulary of the specialty, the skills of independent mastery of new knowledge, using modern educational technologies;
- professional argumentation in the analysis of standard situations in the field of future activities;
- work with technical documentation and literature for solving problems of computer technology and telecommunications;
- methods of mathematical, simulation and computer modeling of processes and devices of computer technology;
- organization of individual stages of the process of developing objects of professional activity.

**Competence of general education:****Know:**

- labor legislation of the Republic of Kazakhstan; industrial safety rules;
- rules and norms of labor protection; safety requirements and methods of providing first aid in case of accidents;
- the main methods of protecting production personnel and the population from the possible consequences of accidents, catastrophes, natural disasters, the ability to make decisions under risk;
- methods for assessing the state of the environment;
- fundamentals of protection of natural resources, flora and fauna; main legislative,
- legal and regulatory documents in the field of nature protection and rational use of natural resources;
- ecological situation in the region, Kazakhstan, the world; economic mechanism of environmental protection.

**Be able to:**

- choose technical means and technologies taking into account the environmental consequences of their use; control the parameters and the level of negative impacts on their compliance with regulatory requirements;
- effectively apply means of protection against negative impacts;
- develop measures to improve the safety and environmental friendliness of production activities;
- plan and implement measures to improve the sustainability of production systems and facilities;
- plan measures for the protection of production personnel and the public in emergency situations and, if necessary, take part in rescue and other urgent work in the aftermath of emergency situations;
- conduct a competent analysis of the cause-and-effect conditionality of various situations in the field of environmental protection;
- to implement a reasonable system of measures in the field of the agro-industrial complex;
- solve specific problems in the field of nature protection;
- link the solution of production problems with compliance with the relevant environmental requirements;
- plan and organize conservation work.

**Master the skills:**

- methods of cognition for solving professional problems;
- ability to professionally solve problems, work in a team;
- knowledge of safe working conditions in the workplace

## **Professional competencies:**

### **Know:**

- basic laws of DC electrical circuits; basic laws of electric circuits of sinusoidal current;
- the basic laws that allow analyzing, both qualitatively and quantitatively, transient processes in linear electrical circuits;
- ESKD standards, competently and concisely depict the simplest geometric shapes on a plane.
- structures of the State Standardization System (SSS) methodological foundations of standardization, systems of technical documentation, standards for electrical circuits, electrical machines, transformers, converters and other equipment, general norms in the electric power industry;
- general laws and rules of measurements, methods and means of measurements, measurement errors and the laws of their distribution, methods for processing measurement results, technological processes.
- development trends, principles of construction and features of the use of modern computer technologies in the electric power industry and electrical engineering;
- physical phenomena occurring in electrical apparatus; device and design features of various electrical devices, the principle of their operation; main characteristics and parameters of electrical apparatus;
- about the dangerous and harmful effects of electric current on the body;
- possible sources of electric shock and assessment of their danger;
- structures of measuring devices, methods for measuring electrical quantities (small and large currents and voltages,
- energy production technology based on renewable energy sources; a program for the development of non-traditional energy in Kazakhstan;
- mathematical problems of energy and computer modeling in the amount necessary to solve production, practical and research problems;
- electric drive systems; electromechanical processes in the engine-working machine system;
- legislative and regulatory acts of labor protection and preservation of human health in the course of his labor activity;
- modern trends in the development of the organization and planning of production, enterprise management, as well as the tasks of further improving the organizational and economic training of specialists;
- principle of operation and design features of electronic devices;
- magnetic and electromagnetic processes in electrical machines;
- basic laws of interference and diffraction of light, laws of light propagation in isotropic and anisotropic media;
- basic principles of building control and management circuits for electrical installations;
- classification of modern materials in the electric power industry, their behavior in an electromagnetic field and under the influence of various factors, properties of materials, their application, testing methods and determining the main characteristics of the most common electrical materials;
- methods of analytical and experimental research of static and dynamic characteristics of control objects;
- principles of converting energy from renewable sources into thermal, mechanical and electrical energy.

**Be able to:**

- apply methods for calculating DC and sinusoidal current circuits;
- analyze the occurrence of abnormal modes of the power system and ways to automatically detect them and quickly eliminate the impact on the equipment of the power system
- explore different modes in three-phase circuits; calculate transient processes in linear circuits with one energy storage device;
- read, determine the geometric shapes of simple parts from their images and perform these images both from nature and from a drawing;
- analyze measurement schemes for various physical quantities, determine measurement errors and creatively apply knowledge in the learning process;
- fulfill analysis of the possibilities of applied software tools and effectively apply in the professional activities of the electric power industry;
- analyze and describe the physical processes occurring in electrical circuits
- work with normative and reference literature;
- perform engineering calculations on electrical safety issues;
- choose measuring instruments, organize measurement and evaluate the measurement result of various electrical quantities;
- work in the environment of systems of non-traditional energy sources;
- use mathematical methods in calculations of normal modes of power systems;
- determine the design parameters in the EP system;
- improve man-caused safety of systems and anticipate and eliminate emergencies;
- organize maintenance of production;
- perform typical electrical calculations and determine settings for various types of protection and automation;
- experimentally determine the parameters and characteristics of electronic devices and devices;
- determine the design parameters of electrical machines and transformers;
- make lighting and colorimetric calculations and measurements;
- correctly assess the appropriateness of the choice and use of electrical materials, work on laboratory equipment;
- to use electromechanical, electronic and microprocessor means of automation to control the values of electrical quantities in order to control electric power facilities;
- to model and explore a dynamic system using analog and digital computing technology;
- solve practical problems related to the design of installations of renewable and non-traditional energy sources.

**Master the skills:**

- analytical and numerical analysis of electrical circuits under any influences in the time and frequency domain, including the use of modern software.
- drawing up various electrical circuits, analyzing the experimental data obtained and formulating the appropriate conclusions.
- in working with design documentation, in drawing up drawings and diagrams of products for various purposes; work in modern engineering programs;
- practical application of standards to electrical circuits, electrical machines, transformers, converters and other equipment, knowledge of general standards in the electric power industry.
- work with control and measuring equipment for control; determination of metrological security of production; use of reference literature.
- work with raster, two-dimensional and three-dimensional vector graphics software to use the basic functionality of modern graphic systems; organization of dialogue in graphic systems;
- by choice of devices; maintenance of devices;
- application of regulatory materials on electrical safety issues;
- determine the main characteristics and parameters of electrical circuits and signals;
- in matters of calculation of modern energy conservation technologies;
- use in the work of modern computer technologies, mathematical packages and programming.
- about performing typical calculations and determining the parameters and characteristics of individual elements of the electric drive;
- analyze the causes of hazards and identify and eliminate failures of technical systems;
- on the development of the production process;
- checks of protections and setting of settings of panels, cabinets and protection terminals with the help of modern means of checking and adjustment;
- taking the main characteristics of semiconductor devices, amplifiers and determining the parameters of various electronic circuits, choosing the element base;
- information about the main parameters and characteristics of radiation frequency analyzers;
- educational design of electrical machines based on existing designs of general purpose engines;
- on laboratory equipment to determine certain properties of electrical insulating materials;
- analysis of operating modes of electric power equipment and systems;
- methods for calculating the parameters and characteristics of automation equipment for electric power systems;
- designing certain types of renewable and non-traditional energy sources, depending on external conditions.

**Special competencies:****Know:**

- technical and organizational issues of installation, adjustment and operation of electrical installations of industrial enterprises;
- the fundamentals of the theory of transient processes that occur in the power system and the power supply system both during normal operation (switching on and off loads, power sources, individual circuits, etc.) and in emergency situations (short circuit, open circuit of a loaded circuit or its individual phase, machines from synchronism, etc.);
- methods for minimizing conductive electromagnetic interference in electric power systems that ensure the electromagnetic compatibility of technical means;
- normal, emergency and special modes of operation of electrical equipment;
- ways to eliminate abnormal modes and actions of operational personnel in the event of violations in the operation of the main and auxiliary equipment of the EPS;
- the arrangement and operation of the main electrical equipment of stations and substations, the basics of the theory of electrical apparatus;
- physical foundations of electromechanical and electrical energy conversion, device and principle of operation of electric drives of direct and alternating current;
- basic information about electrical receivers and power supplies of an industrial enterprise;
- determine the calculated electrical loads and select standard electrical equipment;
- perform calculations of working and post-emergency modes of power supply schemes for industrial enterprises;
- ways of distribution of electric energy on the territory of the enterprise with a voltage of 6-10 kV;
- basic principles for choosing thermal mechanical equipment;
- device and principle of operation of modern power semiconductor elements;
- device and principle of operation of semiconductor converters used in the electric drive;
- the main legislative and regulatory documents of the Republic of Kazakhstan on energy saving.

**Be able to:**

- select power electrical equipment and control circuits of electrical installations in accordance with environmental conditions;
- calculate the regulated levels of electromagnetic compatibility according to the steady voltage deviation, according to the coefficient of distortion of the sinusoidality of the voltage curve, according to the coefficient of temporary switching overvoltage;
- choose filter-compensating installations and non-linear surge arresters, place them in power supply systems for general and local purposes;
- check the admissibility of switching on generators for parallel operation by methods of precise synchronization and self-synchronization; evaluate the success of self-starting of electric motors;
- perform analysis of electrical connection diagrams of the switchgear under various operating modes;
- test and measure and calculate the characteristics of DC machines, asynchronous motor and synchronous machine;
- determine the adjusting properties of electric motors of various types;
- determine the calculated electrical loads and select standard electrical equipment;
- perform calculations of working and post-emergency modes of power supply schemes for industrial enterprises;

- analyze electricity metering processes;
- to make technical and economic calculations for the choice of power supply schemes and the main and auxiliary equipment;
- calculate and select the main elements of the circuits of power converting devices;
- make a preliminary calculation of the parameters and selection of a serial converter for a specific application;
- describe and explain, on the basis of separate legislative and regulatory acts, the state policy for the efficient use of energy resources in the Republic of Kazakhstan.

**Master the skills:**

- for the selection, installation, adjustment and operation of electrical installations of industrial enterprises;
- principles of transformation of electrical circuits of power supply systems;
- on solving problems of electromagnetic compatibility; on issues of electromagnetic compatibility in the electric power industry;
- on the construction of power diagrams and drawing up a map of the permissible loads of generators;
- calculation of technical characteristics and parameters of electrical equipment, selection of optimal circuit solutions for the design of power plants and substations;
- testing of electrical installations and experimental determination of their characteristics;
- testing and maintenance of electrical installations;
- repair and adjustment of electrical installations.
- methodology for calculating the stability, quality and reliability of electrical systems;
- methodology for calculating electrical loads at the input of consumers;
- the latest achievements of digital protection technology and automation of power system elements;
- use of methods of analysis of power supply systems; application of modern computing design tools;
- use and analyze the use of resource-saving technologies in the organization of construction production.

**Table 2. The sequence of mastering the disciplines of social and professional interaction**

Well	Supporting disciplines	Competencies	Expected Result
<b>General education disciplines</b>			
<b>Required Component</b>			
one	Modern History of Kazakhstan	Socio-ethical competencies	<p><b>Know:</b>about the main sources and historical research; about the most important events of the 20th and early 21st centuries; about the developments of Kazakhstan during the period of civil confrontation and in the conditions of the Soviet system; about important stages in the formation of sovereign and independent Kazakhstan, the main terms of historical science.</p> <p><b>Be able to:</b>correlate general phenomena and single historical facts; independently work with sources and historiography, prepare abstracts, essays and presentations; analyze and be able to evaluate significant historical events; explain their causal relationships; think logically, freely discuss and defend one's own opinion; explain the meaning and significance of basic historical concepts.</p> <p><b>Master the skills:</b>work with sources, historiography and materials of periodicals and the Internet; writing abstracts, reports and essays; preparing and making presentations; compiling comparative tables; performance of test and situational tasks; public speaking, discussion and debate.</p>
1.2	Foreign language	Competences in the field of languages	<p><b>Know:</b>vocabulary for communication within the framework of the subject under study; the structure of the main types of texts;</p> <p><b>Be able to:</b>communicate in a foreign language within the framework of the subject being studied; express their thoughts on the problem under discussion using a variety of language means.</p> <p><b>Master the skills:</b>lexico-grammatical material on the subject; the ability to express their thoughts orally and in writing.</p>
1.2	Kazakh (Russian) language	Competences in the field of languages	<p><b>Know:</b>features of the compositional and semantic organization of a scientific text; basic techniques for isolating the main information of the microtext; language forms of expression of various types of scientific text information for solving problems of educational and professional communication; principles of compiling texts of the main educational and scientific, scientific and professional genres;</p> <p><b>Be able to:</b>formulate a topic, determine the language means of organizing the text and use them in the production of their own speech works; determine the types, volume and types of additional scientific information contained in the text; carry out text compression as a basis for structural and semantic processing; create samples of secondary genres (plan, theses, synopsis, annotation, abstract, review, review) by comprehending and transforming the source text; extract from the primary source (mass media, official documents and scientific literature in the specialty) the necessary information, describe, summarize and interpret it for educational purposes.</p> <p><b>Master the skills:</b>extract the necessary information from the text, describe it, generalize and interpret it in the process of educational and professional communication; develop a system of communication skills; use special vocabulary in the main types of professional activities.</p>
one	Information and Communication Technology (in English)	Information and communication competencies	<p><b>Know:</b>economic and political factors in the development of information and communication technologies; features of various operating systems, architecture.</p> <p><b>Be able to:</b>Determine the main trends in the field of information and communication technologies; use information resources to search and store information; work with spreadsheets, perform data consolidation, build graphs; apply methods and means of information protection.</p> <p><b>Master the skills:</b>development of the database structure; designing and creating presentations; receiving data from the server; creating video files; work with smart-applications; work with services on the e-government website.</p>

2	Philosophy	Socio-ethical competencies	<p><b>Know:</b> the main stages, directions, teachings and problems of philosophy.</p> <p><b>Be able to:</b> competent philosophical thinking, which is manifested in the ability to independently think through the most important philosophical topics.</p> <p><b>Master the skills:</b> the conceptual and categorical apparatus of philosophy, the skills of analytical reading of philosophical texts, critical thinking.</p>
one	Sociology	Socio-ethical competencies	<p><b>Know:</b> laws of development and functioning of society; features of the analysis of the modern system of social inequality, social mobility and stratification; own: practical skills of independent analysis of the current state of society. use basic knowledge in the field of humanities and economic sciences in cognitive and professional activities.</p> <p><b>Be able to:</b> correlate knowledge of the foundations of sociology with professional activities; own: practical skills of applying the acquired knowledge in the analysis of real social situations.</p> <p><b>Master the skills:</b> basic terms and problems of sociology; basic sociological concepts.</p>
one	Political science	Socio-ethical competencies	<p><b>Know:</b> subject and objectives of the course; the main content of the course “political science”; acquire fundamental knowledge of political theory; range of achievements of historical thought in the study of ancient culture.</p> <p><b>Be able to:</b> independently work with literature of a general humanitarian nature, be able to find key worldview problems and their solutions; think logically, systematically and critically; to use the acquired baggage of philosophical erudition to formulate and prove their own judgments on various everyday issues.</p> <p><b>Master the skills:</b> analysis of political statements and programs and political forecasting.</p>
one	Culturology	Socio-ethical competencies	<p><b>Know:</b> the structure and composition of modern cultural knowledge; cultural studies and philosophy of culture; sociology of culture, cultural anthropology; culturology and history of culture;</p> <p><b>Be able to:</b> distinguish between the basic concepts of cultural studies: the dynamics of culture, the language and symbols of culture, cultural codes, intercultural communications, cultural values and norms, cultural traditions, the cultural picture of the world, social institutions of culture.</p> <p><b>Master the skills:</b> ideas about the events of Kazakh and world culture, based on the principle of respect and tolerance; skills in the analysis of cultural sources; methods of conducting discussions and polemics</p>
one	Psychology	Socio-ethical competencies	<p><b>Know:</b> 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 the practice of activity, taking into account its economic specifics; psychological theories of personality, group and collective.</p> <p><b>Be able to:</b> use the acquired knowledge of psychology in their practical activities; 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.</p> <p><b>Master the skills:</b> methods of development of memory, thinking, analysis and generalization of information</p>
<b>Selectable Component</b>			

one	Fundamentals of life safety and ecology	Competence of general education	<p><b>Know:</b> labor legislation of the Republic of Kazakhstan; industrial safety rules, labor protection rules and norms; safety requirements and methods of providing first aid in case of accidents; the main methods of protecting production personnel and the population from the possible consequences of accidents, catastrophes, natural disasters, the ability to make decisions under risk; methods for assessing the state of the environment; fundamentals of protection of natural resources, flora and fauna; main legislative, legal and regulatory documents in the field of nature protection and rational use of natural resources; ecological situation in the region, Kazakhstan, the world; economic mechanism of environmental protection.</p> <p><b>Be able to:</b> choose technical means and technologies taking into account the environmental consequences of their use; control the parameters and the level of negative impacts on their compliance with regulatory requirements; effectively apply means of protection against negative impacts; develop measures to improve the safety and environmental friendliness of production activities; plan and implement measures to improve the sustainability of production systems and facilities; plan measures for the protection of production personnel and the public in emergency situations and, if necessary, take part in rescue and other urgent work in the aftermath of emergency situations; conduct a competent analysis of the cause-and-effect conditionality of various situations in the field of environmental protection; to implement a reasonable system of measures in the field of the agro-industrial complex; solve specific problems in the field of nature protection. link the solution of production problems with compliance with the relevant environmental requirements; plan and organize conservation work.</p> <p><b>Master the skills:</b> methods of cognition for solving professional problems, the ability to professionally solve problems, work in a team, knowledge of safe working conditions in the workplace.</p>
	Fundamentals of market economy and entrepreneurship	Competence of general education	<p><b>Know:</b> the concept of anti-corruption culture of government.</p> <p><b>Be able to:</b> to define a set of basic marolno-ethnic norms.</p> <p><b>Master the skills:</b> work with regulations.</p>
<b>Basic disciplines</b>			
<b>University component</b>			
3	Professional Kazakh (Russian) language	Competences in the field of languages	<p><b>Know:</b> scientific vocabulary and scientific constructions of a technical profile; rules for producing texts of different genres; speech norms of the technical sphere of activity; basics of business communication.</p> <p><b>Be able to:</b> choose language means, build statements taking into account literary norms and the communicative situation; isolate the logical and compositional structure of a scientific text, master oral public statements (message, report), analyze listened public speeches;</p> <p>communicate professionally; use dictionaries and correctly interpret the information received from them about language units; reproduce the text read or listened to from the educational, professional, socio-cultural spheres, highlighting the necessary information and presenting it in a certain sequence.</p> <p><b>Master the skills:</b> work with scientific and technical literature; independent search for scientific and technical information as the basis of professional activity; listening and fully understanding information orally presented at a normal pace, with subsequent transmission of its content; conducting dialogues-questions and dialogues of conversations.</p>
3	Professionally oriented foreign language	Competences in the field of languages	<p><b>Know:</b> functional features of oral and written texts of a scientific and technical nature in the specialty; requirements for the execution of documentation adopted in professional communication; strategies of communicative behavior in situations of professional communication.</p> <p><b>Be able to:</b> understand oral speech within professional topics; participate in the discussion of topics related to the specialty; independently prepare and make oral presentations on professional topics using multimedia technologies; extract the necessary information from foreign language sources created in various sign systems (text, table, graph,</p>

			<p>diagram, audiovisual series, etc.); annotate, abstract and state in the native language the main content of the literature on the specialty, if necessary using a dictionary; write messages, articles, abstracts, abstracts on professional topics.</p> <p><b>Ownskills:</b>the main grammatical structures characteristic of oral and written professionally oriented communication;</p>
one	Mathematics I	Competences of natural sciences	<p><b>Know:</b> basic mathematical definitions, theorems and other theoretical information of the course "Mathematics I", as well as knowledge of the types of problems solved by certain mathematical methods;</p> <p><b>Be able to:</b> formulate applied practical problems by mathematical methods, as well as the use of known methods for solving the formulated problems;</p> <p><b>Ownskills:</b> independent or on the basis of educational educational programs for advanced training in the field of mathematical knowledge in order to meet the modern requirements of the specialty</p>
	Mathematics II		<p><b>Know:</b> properties of a function of several variables: (boundedness, existence of the largest and smallest values, complex functions, partial increments and derivatives, total increments and differentials; basic methods for integrating double and triple integrals (change of variables, calculation in polar coordinates); types of differential equations and methods for their solutions, expansions of functions into power series and Fourier series, basic formulas for calculating the probabilities of random variables;</p> <p><b>Be able to:</b>apply methods for solving differential and integral calculus of a function of several variables in applied problems; apply methods for solving differential equations in solving applied problems; obtain approximate values of solutions by expanding into power series and Fourier series with a given accuracy; determine the optimal methods for solving practical problems;</p> <p><b>Ownskills:</b> solving engineering problems using mathematical methods;</p>
one	Physics	Competences of natural sciences	<p><b>Know:</b> basic physical theories, laws and principles and their mathematical expression; the possibility of using theoretical knowledge to solve specific physical problems and situations; know the basic laws and principles of physics;</p> <p><b>Be able to:</b>mathematically display physical laws; apply theoretical knowledge to solve specific physical problems and situations; identify the physical essence of phenomena and processes in devices of various physical nature and perform simple technical calculations in relation to them; work with measuring instruments, devices and devices; perform graphical representations and perform statistical processing of data obtained during observations and measurement.</p> <p><b>Ownskills:</b> the ability to work with measuring instruments, devices; - perform statistical processing of observation and measurement results and perform graphical representation.</p>
2	Theoretical foundations of electrical engineering I	Professional competencies	<p><b>Know:</b>basic laws of DC electrical circuits; basic laws of electric circuits of sinusoidal current; diagrams and formulas for calculating three-phase circuits;</p> <p><b>Be able to:</b>apply the knowledge gained in the study of the course "Theoretical foundations of electrical engineering 1" to solve applied problems; apply methods for calculating DC and sinusoidal current circuits; explore different modes in three-phase circuits;</p> <p><b>Master the skills:</b>analytical and numerical analysis of electrical circuits under any influences in the time and frequency domain, including the use of modern software.</p>
2	Theoretical Foundations of Electrical Engineering II	Professional competencies	<p><b>Know:</b>the basic laws that allow analyzing, both qualitatively and quantitatively, transient processes in linear electrical circuits; the theory of quadripoles and frequency electric filters; methods for calculating steady state conditions in linear electrical circuits with distributed parameters;</p> <p><b>Be able to:</b>calculate transient processes in linear circuits with one energy storage device; calculate transient processes in linear circuits with two energy storage devices; determine the parameters of quadripoles in various</p>

			operating modes and select the parameters of frequency filters; analyze the transfer of energy along long lines; have an idea: about solving engineering problems using methods for calculating transient processes in linear electrical circuits; about solving engineering problems using the theory of quadripoles; solve engineering problems using methods for calculating steady-state conditions in linear electrical circuits with distributed parameters. <b>Master the skills:</b> drawing up various electrical circuits, analyzing the experimental data obtained and formulating the appropriate conclusions.
<b>Selectable Component</b>			
one	General Energy /world energy	Professional competencies	<b>Know:</b> the structure of the electric power industry, the relationship between its various links, the technological process of generating electricity at a power plant; the main equipment of power stations and substations; designs of lines of electric networks; purpose and element base of relay protection; composition of consumers in various industries; principles of construction of external and internal power supply schemes; voltage modes in networks of industrial enterprises. <b>Be able to:</b> assess the state and prospects for the development of power plants; choose the right cable products, protective equipment, required power supply schemes. <b>Master the skills:</b> in matters of calculation of modern energy conservation technologies. <b>Know:</b> energy production technology based on renewable energy sources; a program for the development of non-traditional energy in Kazakhstan; <b>Be able to:</b> work in the environment of systems of non-traditional energy sources; use modern achievements of science and technology; to navigate in the constructive implementation of the main energy conversion devices. <b>Master the skills:</b> in matters of calculation of modern energy conservation technologies.
one	Descriptive geometry and engineering graphics using computers / Fundamentals of computer drawing	Professional competencies	<b>Know:</b> the main projection models for displaying space on a plane, the apparatus of two, three-sided complex drawing by G. Monge, the laws of formation of flat and spatial forms, methods for constructing their images, the main requirements of ESKD (Unified System for Design Documentation); <b>Be able to:</b> to execute schemes and drawings of AutoCAD on the basis of computer graphic system; read, solve problems for mutual belonging and mutual intersection of geometric shapes; determine the geometric shapes of simple parts from their images and perform these images both from nature and from the drawing of an assembly unit; read drawings of assembly units; <b>Master the skills:</b> 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 arrangement drawings; measuring parts and setting dimensions on drawings of parts and assembly units; use of information and reference materials and sources; perception of design documentation as a production document; thinking in spatial terms.
one	Metrology and standardization / Fundamentals of metrology	Professional competencies	<b>Know:</b> 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 support of measurements; development of methods and means of measurement; be able to study the results of measurement and control, reliability and accuracy of measuring instruments and systems. <b>Be able to:</b> methods for processing measurement results; be able to evaluate the measurement error; <b>Master the skills:</b> types of measurements, measuring instruments and measurement errors; general principles and methods for measuring the results of measurements and measurements of heat engineering quantities; to master the basics of evaluation and verification of measuring instruments in accordance with the standards and technical regulations of the Republic of Kazakhstan.

			<p><b>Know:</b>terms and definitions, the international system of units of measurement SI, general laws and rules of measurements, methods and means of measurement, measurement errors and the laws of their distribution, methods for processing measurement results, technological processes.</p> <p><b>Be able to:</b>analyze measurement schemes for various physical quantities, determine measurement errors and creatively apply knowledge in the learning process.</p> <p><b>Master the skills:</b>work with control and measuring equipment for control; determination of metrological security of production; use of reference literature.</p>
3	Fundamentals of the electric drive / Adjustable electric drive in the electric power industry	Professional competencies	<p><b>Know:</b> the composition of the electric drive; electric drive systems; electromechanical processes in the engine-working machine system; tasks implemented in the electric drive; how to convert a real ES system into a reduced one; energy modes of operation in the EP system; ways of starting and braking EP; operation of electric circuits for EP control; EP load modes.</p> <p><b>Be able to:</b>determine the design parameters in the EP system; calculate and build the static and performance characteristics of machines; draw up electric circuits for EP control; calculate the reduced moments of inertia and forces in the EP; explain electromechanical processes in EP; select the required type and power of the engine; apply and draw up load diagrams of EP; perform the necessary calculations related to all sections of the ES.</p> <p><b>Master the skills:</b>about performing typical calculations and determining the parameters and characteristics of individual elements of the electric drive; to calculate load diagrams.</p>
2	Electrical measurements in electrical installations / Measurement of electrical and non-electrical quantities	Professional competencies	<p><b>Know:</b>structures of measuring devices, methods for measuring electrical quantities (small and large currents and voltages, phase angle, power, energy); theory of measurement errors; basic concepts of data processing during measurement in order to obtain reliable results.</p> <p><b>Be able to:</b>choose measuring instruments, organize measurement and evaluate the measurement result of various electrical quantities; use modern measuring instruments.</p> <p><b>Master the skills:</b>determine the main characteristics and parameters of electrical circuits and signals; taking the main characteristics of electronic devices and microcircuits, the main characteristics of amplifiers (amplitude-frequency, phase-frequency, amplitude) and determining the parameters of various analog circuits, choosing the element base, using measuring instruments in various practical fields</p>
2	Electrical safety in electrical installations / Safety in electrical installations	Professional competencies	<p><b>Know:</b>about the dangerous and harmful effects of electric current on the body; on the means of collective and individual protection of the employee; learn to apply acquired knowledge practically;</p> <p><b>Be able to:</b>work with normative and reference literature; obtain a body of knowledge corresponding to at least the second qualification group of electrical safety admission.</p> <p><b>Master the skills:</b>application of regulatory materials on electrical safety issues. use of basic and additional insulating dielectric protection means; first aid in case of electric shock.</p> <p><b>Know:</b>possible sources of electric shock and an assessment of their danger. the most important technical requirements that ensure work related to electricity; basics of electrical safety organizational and technical measures to ensure the safety of work in the power plant; classification of insulating protective equipment;</p> <p><b>Be able to:</b>perform engineering calculations on electrical safety issues. analyze the danger of electrical networks; carry out access to work in the power plant with voltage up to 1000 V;</p> <p><b>Master the skills:</b>application of regulatory materials on electrical safety issues. use of basic and additional insulating dielectric protection means; first aid in case of electric shock.</p>
2	Switching of electrical devices / Electrical and electronic devices	Professional competencies	<p><b>Know:</b>physical phenomena occurring in electrical apparatus; device and design features of various electrical devices, the principle of their operation; main characteristics and parameters of electrical apparatus.</p> <p><b>Be able to:</b>analyze and describe the physical processes occurring in electrical circuits; evaluate the efficiency and</p>

			<p>choose the type of electrical apparatus for specific conditions; independently conduct elementary tests of electrical devices; make a preliminary calculation of the parameters and the choice of electrical devices.</p> <p><b>Master the skills:</b>for performing calculations; on the choice of devices; on the maintenance of devices; research work on the study of operating modes.</p>
	Electrical systems and networks / Power industry	Professional competencies	
3	Mathematical problems and computer modeling in the electric power industry / Probability theory and mathematical statistics	Professional competencies	<p><b>Know:</b>mathematical problems of energy and computer modeling in the amount necessary to solve production, practical and research problems; methods for developing generalized options for solving problems, analyzing options, predicting consequences, finding optimal solutions in a multi-criteria environment, planning, and implementing projects; methods, methods for solving the main problems of the electric power industry; basic concepts of mathematical programming and its application in the electric power industry; methods for conducting technical calculations and determining the effectiveness of research and development; achievements of science and technology, advanced and foreign experience in the field of solving mathematical problems of energy and computer modeling.</p> <p><b>Be able to:</b>use mathematical methods in calculations of normal modes of power systems; to investigate statistical and dynamic stability; apply the concepts of functional analysis to study the steady state equations; conduct scientific research, process and analyze the results obtained; use modern computer technology.</p> <p><b>Master the skills:</b> use in the work of modern computer technologies, mathematical packages and programming.</p>
4	Labor protection in the electric power industry / Labor protection in electrical installations	Professional competencies	<p><b>Know:</b>legislative and regulatory acts of labor protection and preservation of human health in the course of his labor activity; equipment and technological processes, as well as ensure their safe operation; methods for analyzing hazards and ensuring stable operation and procedures for detecting a failure of technical systems.</p> <p><b>Be able to:</b>improve man-caused safety of systems and anticipate and eliminate emergencies; assess risk levels when working on equipment and production lines; eliminate technological failures in the operation of equipment.</p> <p><b>Master the skills:</b> analyze the causes of hazards and identify and eliminate failures of technical systems.</p>
4	Entrepreneurial business in the electric power industry / Organization and planning of energy enterprises	Professional competencies	<p><b>Know:</b>current trends in the development of the organization and planning of production, enterprise management, as well as the tasks of further improving the organizational and economic training of specialists; history of entrepreneurship development in Kazakhstan; economic policy of the state in relation to entrepreneurial activity in Kazakhstan and in 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 doing business; motivation of an entrepreneurial decision and comparison with opportunities.</p> <p><b>Be able to:</b>give an economic description of the types of production; perform analysis and calculation of the duration of the production cycle; build organization charts in series - parallel, parallel assembly of products with synchronization and without synchronization of assembly units; perform calculations of the economic efficiency of in-line production; organize maintenance of production; organize technical preparation and control of the production process; perform an analysis of production and economic activities.</p> <p><b>Master the skills:</b>to perform calculations of the economic efficiency of in-line production, cost, pricing, profitability; for the development of the production process.</p>
4	Relay protection and automation / Relay protection of electrical equipment	Professional competencies	<p><b>Know:</b> the reasons for the occurrence of abnormal modes of the power system and methods for their automatic detection and quick elimination of the impact on the power system equipment: design, principle of operation, properties, scope of the main elements of protection and automation devices.</p> <p><b>Be able to:</b>perform typical electrical calculations and determine settings for various types of protection and automation; for specific electrical networks, select a sufficient and necessary number and type of relay protection</p>

			devices; draw up and analyze relay protection schemes, maintain, monitor and test relay protection devices. <b>Master the skills:</b> protection checks and setting of panels, cabinets and protection terminals using modern testing and adjustment tools.
<b>Major disciplines</b>			
<b>Required Component</b>			
2	Industrial electronics	Professional competencies	<b>Know:</b> principle of operation and design features of electronic devices; physical phenomena occurring in electronic devices; main characteristics of electronic devices. <b>Be able to:</b> experimentally determine the parameters and characteristics of electronic devices and devices; to measure electrical quantities in semiconductor devices. <b>Master the skills:</b> taking the main characteristics of semiconductor devices, amplifiers and determining the parameters of various electronic circuits, choosing the element base
3	Electric cars	Professional competencies	<b>Know:</b> purpose and design of collector and non-collector machines; excitation systems, switching circuits for DC machines; equivalent circuits of asynchronous machines; magnetic and electromagnetic processes in electrical machines; ways to start electrical machines; performance characteristics of electrical machines; normal, emergency, experimental modes of operation; electromagnetic processes, design of transformers; the history of the development of electrical machines; <b>Be able to:</b> determine the design parameters of electrical machines and transformers; calculate and build the static and performance characteristics of machines; draw up an electrical circuit for switching on machines; calculate the magnetic circuits of electrical machines; explain the nature of electromagnetic processes; apply the latest achievements of science in the study of the discipline; use technical information materials. <b>Master the skills:</b> educational design of electrical machines based on existing designs of general purpose engines; to perform calculations of operating parameters of machines and transformers; research work on the study of modes, analysis of the modes of machines and transformers; according to the calculation of energy costs.
<b>Selectable Component</b>			
2	Lighting technology and light sources / Lighting technology and lighting	Professional competencies	<b>Wnat:</b> basic laws of interference and diffraction of light; laws of light propagation in isotropic and anisotropic media; basic terms used in light and optical measurements; basic principles and methods of lighting engineering and optical measurements; prospects for improving measurement methods; <b>Be able to:</b> make lighting and colorimetric calculations and measurements; choose the methods you need for measurements; <b>Master the skills:</b> work with literary sources and Internet sites; work with graphic programs; information about the main parameters and characteristics of radiation frequency analyzers; the main methods of processing and presenting experimental data; experience in lighting and colorimetric calculations
2	Electrotechnical materials science / Materials in the electric power industry	Professional competencies	<b>Know:</b> classification of modern materials in the electric power industry, their behavior in an electromagnetic field and under the influence of various factors, properties of materials, their application, testing methods and determining the main characteristics of the most common electrical materials. <b>Be able to:</b> correctly assess the appropriateness of the choice and use of electrical materials, work on laboratory equipment. <b>Master the skills:</b> on laboratory equipment to determine certain properties of electrical insulating materials; on laboratory equipment to determine certain properties of dielectric materials; on laboratory equipment to determine certain properties of conductive materials; on laboratory equipment to determine certain properties of semiconductor materials; on laboratory equipment to determine certain properties of magnetic materials; when solving problems to determine the parameters of electrical materials.

2	Automation of electric power facilities / Fundamentals of automatic control	Professional competencies	<p><b>Know:</b>basic principles of building control and management circuits for electrical installations; the main essence of management and tasks solved within the framework of automated control systems for electrical installations; general information about APCS, functions, composition and structure of APCS; problems of ensuring the static stability of the parallel operation of power plants in the established normal and post-emergency 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;</p> <p><b>Be able to:</b>to use electromechanical, electronic and microprocessor means of automation to control the values of electrical quantities in order to control electric power facilities; use modern information and telecommunication technologies in the design and technological preparation of the production of automation systems to increase the reliability, sensitivity and selectivity of automation equipment; select and implement effective modes of operation of automation equipment according to specified methods; properly operate the automation equipment of energy facilities;</p> <p><b>Master the skills:</b>methods for calculating the parameters and characteristics of automation equipment for electric power systems; application of modern computer technologies to obtain information in the field of automation of electric power systems; methods for designing automation subsystems of electric power systems; work with reference literature and regulatory and technical materials; carrying out standard tests and adjustment of automation of electric power systems; practical preparation of technical specifications for the design of automation systems (including process control systems) of electric power systems, power stations and substations.</p>
2			<p><b>Know:</b>methods of analytical and experimental research of static and dynamic characteristics of control objects; methods for compiling and linearizing mathematical models of dynamic systems; methods for analyzing the stability of dynamic systems.</p> <p><b>Be able to:</b>to model and explore a dynamic system using analog and digital computing technology; analyze the stability and quality indicators of the automatic control system.</p> <p><b>Master the skills:</b>about the principles of automatic control; about the main varieties of control systems; about the goals, objectives and methods of analysis and synthesis of automatic control systems.</p>
3	Alternative Energy / Alternative Energy Sources	Professional competencies	<p><b>Know:</b>energy production technology based on renewable energy sources; program for the development of non-traditional energy in Kazakhstan.</p> <p><b>Be able to:</b>work in the environment of systems of non-traditional energy sources; use modern achievements of science and technology; to navigate in the constructive implementation of the main energy conversion devices.</p> <p><b>Master the skills:</b>in matters of calculation of modern energy conservation technologies.</p>