[Ministry of Education and Science](https://context.reverso.net/%D0%BF%D0%B5%D1%80%D0%B5%D0%B2%D0%BE%D0%B4/%D0%B0%D0%BD%D0%B3%D0%BB%D0%B8%D0%B9%D1%81%D0%BA%D0%B8%D0%B9-%D1%80%D1%83%D1%81%D1%81%D0%BA%D0%B8%D0%B9/the%2BMinistry%2Bof%2BEducation%2Band%2BScience)OF THE REPUBLIC OF KAZAKHSTAN

M.Auezov South Kazakhstan University

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|  | «APPROVED»Chair of the Board - Rector d.h.s., academician \_\_\_\_\_\_\_\_\_\_ Kozhamzharova D.P. «\_\_\_»\_\_\_\_\_\_\_\_20\_\_ |

[**Education Programme**](https://context.reverso.net/%D0%BF%D0%B5%D1%80%D0%B5%D0%B2%D0%BE%D0%B4/%D0%B0%D0%BD%D0%B3%D0%BB%D0%B8%D0%B9%D1%81%D0%BA%D0%B8%D0%B9-%D1%80%D1%83%D1%81%D1%81%D0%BA%D0%B8%D0%B9/Education%2BProgramme)

**6В07152 – Engineering of electric power systems**

|  |  |
| --- | --- |
| [Registration number](https://context.reverso.net/%D0%BF%D0%B5%D1%80%D0%B5%D0%B2%D0%BE%D0%B4/%D0%B0%D0%BD%D0%B3%D0%BB%D0%B8%D0%B9%D1%81%D0%BA%D0%B8%D0%B9-%D1%80%D1%83%D1%81%D1%81%D0%BA%D0%B8%D0%B9/Registration%2Bnumber) | 6B07100026 |
| Code and classification of the field of education |  6В07 Engineering, processing and construction branches |
| Code and classification of training areas | 6В071 Engineering and engineering business |
| Group of educational programs | В062 Electrical Engineering and Energetics |
| Typeof EP | New  |
| ISCE level | 6 |
| NQF level | 6 |
| SQF of education level | 6  |
| Language of learning | Kazakh, Russian, English |
| Typical duration of study | 4 years |
| Form of study | Full time  |
| The complexity of the EP, not less | 240 credits |
| Distinctive features of EP | - |
| University Partner ( JEP) | - |
| University Partner ( TDEP) | - |
| Social Partner ( DE) | - |

Shymkent, 2021

Authors:

|  |  |  |
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EP was considered by the Academic Commission on “Engineering and engineering business” training direction, Minutes №\_\_3\_\_ from «\_\_06\_\_» \_\_05\_\_\_2021.

Chairman of Academic Commission \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Anarbayev A.A.

Considered and recommended for approval at the meeting of Education and Methodical Council of M. Auezov SKSU.

Minutes № \_\_\_ from \_\_\_\_\_\_\_\_\_\_\_\_202\_\_.

Approved by the decision of the Academic Council of the University

Minutes № \_\_\_\_\_ from \_\_\_\_\_\_\_\_\_\_\_ 202\_\_

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**1 CONCEPT OF THE EDUCATION PROGRAM**

|  |  |
| --- | --- |
| **The university mission** | Generating new competencies, training a leader who translates research and entrepreneurial thinking and culture and capable to work in national and international teams mastering the Lifelong learning strategy |
| **University values** | * Openness – open to change, innovation and cooperation.
* Creativity – generates ideas, develops them and turns them into values.
* Academic freedom - free to choose, develop and act.
* Partnership – builds trust and support in relationships where everyone wins.
* Social responsibility - ready to fulfill obligations, make decisions and be responsible for their results.
 |
| **Graduate Model** | * Deep subject knowledge, its application and constant expansion in professional activity.
* Information and digital literacy and mobility in a rapidly changing environment.
* Research skills, creativity and emotional intelligence.
* Entrepreneurship, independence and responsibility for their activities and well-being.
* Global and national citizenship, tolerance for cultures and languages.
 |
| **The EP uniqueness** | * Practice orientation and orientation to the regional labor market and social order through formation of graduate professional competencies, adjusted to stakeholder’s requirements.
* The uniqueness of EP 6B07140 - "Heat power engineering" lies in the preparation of a harmoniously formed personality capable of successfully acting on the basis of knowledge and skills in the field of heat power engineering, solving heat and power problems and promoting energy-saving policies at industrial enterprises.
 |
| **Academic Integrity and Ethics Policy** | The university has taken measures to maintain academic honesty and academic freedom, protection from any kind of intolerance and discrimination:• Rules of academic integrity (Minutes of the Academic Council No. 3 dated October 30, 2018);• Anti-corruption standard (Order No. 373 n/c dated December 27, 2019).* Code of Ethics (Minutes of the Academic Council No. 8 dated January 31, 2020).
 |
| **Legal framework for EP development** | 1. Law “On Education” of the Republic of Kazakhstan;2. Standard rules for activities of educational organizations implementing educational programs of higher and (or) postgraduate education, approved by an order of the Minister of Education and Science of the RK from October 30, 2018 No. 595;3. State obligatory standards of higher and postgraduate education, approved by an order of the Minister of Education and Science of the Republic of Kazakhstan, October 31, 2018 No. 604;4. Rules for educational process organization on credit training technology, approved by an order of the Minister of Education and Science of the RK on April 20, 2011 No. 152;5. “Qualification directory of positions of heads, specialists and other employees” approved by an order of a Minister of Labour and Social Protection of population of the RK (order № 553 of December, 30, 2020);6. Guidelines for the use of ECTS;7. Guidelines for development of educational programs for higher and postgraduate education, Appendix 1 to anorder of the director of CBP&AM No. 45 o / d dated June 30, 2021. |
| **Organization of the education process** | * Implementation of the Bologna Process principles
* Student-centered learning
* Availability
* Inclusiveness
 |
| **EP quality assurance** | * Internal quality assurance system
* Involvement of stakeholders in the EP development and its evaluation
* Systematic monitoring
* Updating the content
 |
| **Requirements for applicants** | Set according to Standard Rules for admission to training in educational organizations realizing educational programs of higher and postgraduate education (order of MES RK №600 of 31.10.2018). |

1. **PASSPORT OF THE EDUCATION PROGRAM**

|  |  |
| --- | --- |
| **EP goal** | Preparing sought after specialist with cultural and professional competencies that contribute to their social mobility and stability in the labor market on the basis of integrated knowledge in the field of electric power industry |
| **EP objectives**: | * the formation of social and personal qualities and socially responsible behavior in society, understanding the importance of professional ethical standards and adherence to these standards;
* formation of general scientific knowledge and in-depth professional training;
* heoretical and practical training of students based on the achievements of modern science, technology and production, focused on the modern needs of the employer;
* providing basic bachelor's training, which allows continuing education throughout life, successfully adapting to changing realities;
* providing conditions for acquiring a high intellectual level of development, mastering a competent and developed speech, culture of thinking and skills of scientific organization of labor in the field of engineering of electric power systems.
 |
| **EP harmonization** | * Dublin descriptors of the 6th level of Qualifications;
* the 6th level of the National Qualifications Framework of the Republic of Kazakhstan;
* the 1stcycle of the Qualification Framework of the European Higher Education Area;
* the 6th level of the European Qualification Framework for Lifelong Learning
 |
| **EP communication with the professional sphere** | The branch frame of qualifications of "Energetics" approved by the protocol of the sectoral commission on a social partnership and regulation of social and labour relations in the energy sector No. 05-13-3-4/PR of July "25", 2019Professional standards: "Organization and operation of the electrotechnical equipment of thermal power plant" of 18.12.2019, No. 255, appendix 33; "Forecast of electricity consumption and power" of 18.12.2019, No. 255, appendix 38; "Service of power supply of residential and uninhabited buildings" of 26.12.2019, No. 262, appendix 26; "Operation and repair of electric equipment" of 02.05.2019, No. 86. |
| **List of qualifications and positions** | A graduate of this EP is awarded the degree "bachelor of engineering and technology" in EP 6В07152-Engineering of electric power systemsBachelors in EP 6В07152-Engineering of electric power systems can occupy primary positions: shop manager, head of production laboratory, deputy chief of operations, shift supervisor, energy engineer, electrical engineer, electrical measurement engineer, electrical engineer of electrical equipment, engineer for metering and distribution of electricity, development engineer and the introduction of artificial intelligence, a bioenergy engineer, a building manager for an apartment building, a developer-designer of autonomous energy systems, a developer-designer of electric and heat energy storage devices, an engineer for modernizing traditional energy equipment, a smart manager, an operational dispatcher of renewable energy sources. |
| **Professional area** | The sphere of professional activity of the bachelor in EP "6B07152 - Engineering of Electric Power Systems" is the field of science and technology, which includes:- a set of technical means and methods of processes implementation, namely: production, transmission, distribution, transformation, use and control of electrical energy streams;- development, manufacture and quality control of elements, devices, apparatuses and systems and their components implementing the above processes. |
| **Objects of professional activity**  | The objects of professional activity of graduates are enterprises for the production, transmission, distribution and electricity consumption. |
| **Subjects of professional activity**  | Subjects of professional activity of the bachelor by specialty «6В07152-Engineering of electric power systems*»*:- Electric stations and substations;- Electrical power systems and networks;- Systems of power supply of the cities, industrial enterprises, objects;- High-voltage units of different function, electric insulation materials, designs and means of their diagnostics, systems to protect against lightning and overstretching, instrument for ensuring of electromagnetic compatibility of the equipment, high-voltage electrotechnologies;- Relaying and automation of electric utility systems;- Energy installations, electrical power stations and substations, electrical power stations and complexes built on the basis of renewable energy sources- Electrical machines, transformers, electromechanical systems, control systems and regulations;- Electric and electronic devices, automatic devices and control systems of energy flows. |
| **Kinds of professional activity** | A bachelor by specialty «6В07152-Engineering of electric power systems*»* can do the followingtypes of professional activity:- design engineering;- production and technology;- organizational and managerial;- scientific research;- installation and commissioning;- service - operational;- entrepreneurial. |
| **Learning outcomes** | **LO1** Communicate freely in a professional environment and society in Kazakh, Russian and English;**LO2** Demonstrate knowledge in natural science, mathematical, social, socio-economic and engineering in professional activities, based on methods of mathematical data processing, theoretical and experimental research, regulatory documents and elements of economic analysis;**LO3** To possess information and computational literacy, the ability to generalize, analyze and perceive information, set a goal and choose ways to achieve it;**LО4** To optimize power supply systems using the trends of digitalization of intelligent power systems;**LО5** To create theoretical models for the analysis and forecast of the properties and processes of power supply facilities, using the technique of installation, commissioning, operation and testing of the electrical part of the equipment;**LО6** To describe processes in electrical machines, converting devices and power supply systems, using modern methods for calculating electrical circuits, electromagnetic processes and electrical properties of materials;**LО7** To modernize power supply facilities, carry out diagnostic and repair measures for electrical equipment, in accordance with technique and methods applying the modern measuring instruments and information technology;**LО8** To make design electrical equipment and power supply systems based on trends in the development of science and technology;**LО9** To substantiate technical, economic, environmental criteria for assessing electric power complexes and systems during their creation and operation, and to develop measures to increase the efficiency of energy consumption, use of energy resources and reduce of energy losses;**LO10** Can use research and entrepreneurial skills in the face of uncertainty **LO 11** To demonstrate skills of self-education, discipline, healthy lifestyle, teamwork. |

**3 EP GRADUATE COMPETENCIES**

|  |
| --- |
| **GENERAL COMPETENCIES** (SOFT SKILLS). Behavioral and personal skills |
| GC 1. Literacy management  | GC 1.1. The ability to self-educate, self-develop and constantly Up-to-Date knowledge in terms of chosen path with the interdisciplinarity conditions. GC 1.2. The ability to express ideas, feelings, facts, opinions in professional environment and critical thinking skills. |
| GC 2. Language competence  | GC 2.1. The ability to create communication programs in national, Russian and international languages. GC 2.2. The ability for interpersonal, social and professional communication and mobility in intercultural communication. |
| GC 3. Mathematics and science competence.  | GC 3.1. The ability and willingness to apply the educational potential, experience and personal qualities acquired during the study of mathematical, natural science, technical disciplines at the university to solve professional problems. |
| GC 4. Digital competence and technological literacy  | GC 4.1. The ability to demonstrate and develop information literacy through the mastery and use of modern information and communication technologies in all areas of lives and professional activities.GC 4.2. The ability to use various types of information and communication technologies: Internet resources, cloud and mobile services for the search, storage, protection, and dissemination of information.  |
| GC 5. Personal, social and educational competence  | GC 5.1. The ability for physical self-improvement and orientation for a healthy life to ensure full-fledged social and professional activities through methods and means of physical culture.GC 5.2. The ability for socio-cultural development based on the manifestation of citizenship and morality.GC 5.3 The ability to build a personal educational trajectory throughout life for self-development, career growth and professional success. |
| GC 6. Entrepreneurship competence | GC 6.1. The ability to be creative and enterprising in different environments.GC 6.2. The ability to work in the mode of uncertainty and rapid change of task conditions, make decisions, allocate resources, and manage the time.GC 6.3. The ability to work with consumer requests.  |
| GC 7. Cultural awareness and self-expression | GC 7.1. The ability to show ideological, civic, and moral positions.GC 7.2. The ability to be tolerant to the traditions and other people culture in the world, and to possess high spiritual qualities. |
| **PROFESSIONAL COMPETENCIES** (HARD SKILLS). |
| Специфичные для данного направления теоретические знания и практические навыки и умения | PC1 - the ability to demonstrate knowledge of modeling energy facilities, setting the parameters of the optimal operating mode and determining the composition of electrical equipment, ensuring compliance with all required operating modes and conducting a technical, economic and environmental analysis of installations and electrical power systems. |
| PC2 - the ability to apply modern research methods for electrical power systems, analyze and evaluate the technical condition and residual life of electrical equipment, create theoretical models that allow predicting the properties and processes of power supply facilities, develop plans, programs and methods for testing and diagnostics of installations and power supply systems. |
| PC3 - the ability to develop installation, commissioning and repair documentation, to participate in installation and commissioning, repair work; acceptance testing of equipment; modernize and operate facilities of traditional generation and renewable energy sources. |
| PC4 - the ability to apply the principles of functioning of electrical, electronic elements and digital control systems for installations and electric power systems. |
| PC5 - the ability to take part in the design of smart grids and objects of professional activity in accordance with the terms of reference and regulatory and technical documentation, observing technical, energy efficient and environmental requirements, to draw up and execute standard technical documentation. |

**3.1 Matrix of correlating learning outcomes in the EP as a whole with the formed competencies**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **LО1** | **LО2** | **LО3** | **LО4** | **LО5** | **LО6** | **LО7** | **LО8** | **LО9** | **LО10** | **LО11** |
| GC1 | + |  |  | + | + | + |  | + |  |  | + |
| GC2 | + |  | + | + |  |  |  |  |  |  |  |
| GC3 | + | + | + |  | + |  |  |  |  |  | + |
| GC4 |  |  | + |  |  | + |  | + |  |  |  |
| GC5 |  | + |  |  |  | + |  |  |  |  | + |
| GC6 |  | + |  |  |  |  | + |  |  |  | + |
| GC7 | + | + |  |  |  |  |  |  |  |  |  |
| PC1 |  | + |  |  |  |  | + |  |  |  |  |
| PC2 |  |  |  | + | + | + | + |  |  |  |  |
| PC3 |  |  |  |  |  | + |  | + |  |  | + |
| PC4 |  |  |  |  |  | + |  | + |  |  |  |
| PC5 |  | + |  | + |  |  | + | + |  |  | + |

**4 MATRIX OF THE INFLUENCE OF DISCIPLINES ON THE FORMATION OF LEARNING OUTCOMES AND INFORMATION ON LABOR INTENSITY**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **№** | **Module title** | **Cycle** | **UC/EC** | **Component title** | **Brief discipline description** | **Number of credits** | **Formed LО (codes)** |
| **LO1** | **LO2** | **LO3** | **LО4** | **LО5** | **LО6** | **LО7** | **LО8** | **LО9** | **LО10** | **LО11** |
| 1 | Module of the Social Science | GED | OC | Contemporary History of Kazakhstan | The conceptual foundations of national history are studied, the origins, continuity of Kazakh statehood and current problems of the history of modern Kazakhstan are interpreted. The activities of the national intelligentsia in the formation of the ideology of the liberation movement and the stages of socio-economic modernization of Kazakhstan are analyzed. The creation of a democratic legal state is considered. | 5 | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  | **ѵ** |
| 2 | GED | OC | Philosophy | The basics of the emergence of philosophy are considered, the features of the emergence of the culture of thinking are revealed, the concepts of "philosophy", "worldview", the essence and content of the concepts of "being", "consciousness" are revealed. The relationship between the concepts of "cognition" and "creativity" is considered, the essence and content of the category of philosophy of freedom are revealed. The skills of correcting actions to highlight the essence of the philosophical problem of work individually and in a team, critical thinking, the skills of researching philosophical aspects, problems of practice and cognition are developed. | 5 | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  | **ѵ** |
| 3 | Module of Socio-Political Knowledge  | GED | OC | Social and Political Studies | The theory of sociology, social structure and stratification of society are studied, the role and place of politics in society are explained, the main stages of the formation and development of political science, including youth policy, the role of politics in the system of public life, the essence of the state is revealed, the relationship between the state and civil society is revealed. ... The skills of sociological research, analysis of socio-political activities and behavior are developed. | 4 | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  | **ѵ** |
| 4 | GED | OC | Cultural Studies and Psychology  | The socio-ethical values of society are studied as a product of integration processes in the systems of basic knowledge of the disciplines of the socio-cultural and psychological module; the features of psychological institutions are analyzed in the context of their role in the modernization of Kazakhstani society; programs for resolving conflict situations in society, including in the professional society, are formed; skills are taught to correctly express and defend their own opinions. | 4 | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  | **ѵ** |
| 5 | Socio-Ethnic Development Module | GED | HSC | Ecosystem and Law | The state regulation of ecosystems and technologies in the field of civil law, the basic concepts and terms of digitalization in the field of civil law, environmental legislation in Kazakhstan and abroad are studied.The fundamentals of environmental law, specially protected natural areas, global environmental problems, causes and consequences of environmental pollution are considered. The skills of rational nature management and the use of eco-protective equipment and technology are taught. | 5 | **ѵ** | **ѵ** |  |  |  |  |  |  | **ѵ** |  | **ѵ** |
| 5 | BD | EC | Actual Problems and Modernization of Public Consciousness  | The conceptual-categorical apparatus and conceptual foundations of the modernization of public consciousness, the content of the main works of the First President - Elbasy N. Nazarbayev on the modernization of Kazakhstani society, the content of strategic documents of modernization of Kazakhstani society are studied. Considered are global challenges and trends in the development of the world community, the main imperatives of modernizing public consciousness, the value potential and competitive advantages of domestic culture andeducational systems in a global competitive environment. The skills of analyzing strategic documents for the modernization of Kazakhstani society, assessing the potential of national culture in the global civilizationaldevelopment. | 3 | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  | **ѵ** |
|  | BD | EC | Abay Study | The life and creative heritage of Abai, poetry songs are studied.the social image of the Kazakh community in the work of Abai, wisdom in Abai's verses (black words of Abai), the school of translation, Abai, etc. The aesthetic taste of Abai, scientifically grounded integrated learning are considered.The work of the great poet, writer, public figure, founder of modern Kazakh written literature, philosophy, social, aesthetic views of poetry in Kazakh poetry, contribution to the development of poetic language and a wide range of research works on musical heritage are analyzed. | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  | **ѵ** |
|  | BD | EC | Mukhtar Study | The life and work of M.O.Auezov is studied; analyzes the writer's creative laboratory, his biography in context with creativity; as the creator of the science of Abaeology; researcher zhyr "Manas". Acquaintance with M. Auezov as a prominent public figure. The literary heritage of M.Auezov in the world and oriental literature is analyzed. Feelings of patriotism and love for the homeland are instilled. | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  | **ѵ** |
| 6 | Communication and Physical Education Module  | GED | OC | Kazakh (Russian) language  | The basics of the development of cognitive and communicative activity in the Russian (Kazakh) language are studied in the spheres of interpersonal, social, intercultural communication. The skills of discussing ethical, cultural, socially significant norms in discussions, the ability to work in a team, team interaction, flexibility, creativity are taught. practical skills in interpreting text information, explaining their style, genre specifics in various spheres of communication. | 10 | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  | **ѵ** |
| 7 | GED | OC | Foreign Language  | We study modern trends and requirements for training and practical knowledge of foreign languages in everyday communication and professional activity, aimed at increasing the general and communicative culture of future specialists, improving communication skills and skills, as well as improving the quality of vocational education. The fundamental foundations of a foreign language are formed and systematized. | 10 | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  | **ѵ** |
| 8 | GED | OC | Physical training | The historical prerequisites for the formation and development of the physical education system on the territory of Kazakhstan, the role of physical culture and sports in the general education system, the integration of physical education into the world educational space are studied. The skills of a healthy lifestyle are taught, working individually and in a team. | 8 |  |  |  |  |  |  |  |  |  |  | **ѵ** |
| 9 | BD | HSC | Professional Kazakh (Russian) Language  | Extracts from the text of the necessary information, its interpretation in educational and professional communication are formed. The ability to establish contacts at a professional level, to build communications competently, based on the goals and situation of communication, develops. The ability to be creative, innovate, collegial, defend one's point of view in the process of building a program of speech behavior in Russian (Kazakh) in the field of professional communication is instilled. | 3 | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  | **ѵ** |
| 10 | BD | HSC | Professionally Oriented Foreign Language  | Various types of speech activity in the spheres of professional and scientific communication, communicative tasks of the text, microthemes of the scientific text, the role of the sentence in the text, ways of developing information in the text, basic and additional information in the text are studied. A structural and semantic analysis of scientific texts, compression of a scientific text, secondary scientific texts are formed. The skills of creating a plan in the scientific field are instilled. | 3 | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  | **ѵ** |
| 11 | GED | OC | Information and Communication Technologies (in English)  | Computer systems and software are being studied. Skills are formed on the use of information resources for searching and storing information, working with spreadsheets and databases. The skills of applying methods and means of information security, design and creation of websites, multimedia presentations, the use of e-government and electronic textbooks, various cloud mobile technologies, management of SMART technologies are taught. The skills of using digital technology for power supply systems are developed. | 5 | **ѵ** | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  |
| 12 | Mathematical and Natural Science Basics | BD | HSC | Higher Mathematics | The use of determinants for finding the inverse matrix is studied. Optimal variants of solutions of systems of linear equations with two and three unknowns are argued. The ability to use formulas for finding scalar, vector and mixed product of vectors is formed. The skills of knowledge of the basic concepts of the theory of complex numbers are taught, working individually and in a team when finding derivatives and integrals of functions of one variable, solving curvilinear integrals of the 1st and 2nd kind. | 5 |  | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  |
| 13 | BD | EC | Theory of Probability and Mathematical Statistics | The basic concepts of a function of several variables, the ability to find partial derivatives, ordinary differential equations are studied. The ability to study the extremum of functions of several variables is being formed. The skills of computational literacy, solving multiple integrals, equations of different orders and types, theoretical knowledge of series theory for practical research of their convergence are taught, | 4 |  | **ѵ** | **ѵ** |  |  |  |  |  | **ѵ** |  |  |
|  | BD | EC | Discrete Mathematics | Methods for calculating real roots of algebraic equations, solving numerically integrated functions, numerically integrated differential equations, probability theory, distribution laws of random variables, characteristics of a random variable, mathematical statistics, sampling method, methods of statistical data processing are studied. The ability to apply the methods of least squares, the classical definition of probability, is formed. The skills of statistical assessment of distribution parameters are taught. To present modern calculation methods in power supply systems. |  | **ѵ** | **ѵ** |  |  |  |  |  | **ѵ** |  |  |
| 14 | Mathematical and Natural Science Basics | BD | HSC | Physics | Studied are dynamic and statistical laws, changes in physical quantities and fundamental constants of natural science, principles of symmetry and conservation laws, laws and models of mechanics, electricity and magnetism, quantum and statistical physics, thermodynamics, solid-state band theory. Methods of theoretical and experimental research in physics, methods of estimating the orders of physical quantities are considered. Skills of using the apparatus of mathematical physics, processing of experimental data are taught. | 4 |  | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  |
| 15 | BD | EC | Physics 2 | The concepts of the modern physical picture of the world, the essence of the basic concepts, laws of such sections as: magnetism, optics, quantum and nuclear physics are studied. The skills of mastering the logic of the development of physics as a science of real objects of nature are taught, to carry out qualitative and quantitative research in the profile of the specialty with the help of modern physical scientific equipment. | 4 |  | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  |
|  | BD | EC | Solid State Physics  | The structure and foundations of modern solid state physics are studied, including general ideas about the structure of crystals and amorphous substances, methods for studying the structure and various physical properties of solids, methods for determining crystal structures, and electrical conductivity of metals. The types of interatomic bonds, crystal symmetry, magnetic and thermal properties of solids are considered, X-ray structural analysis skills are taught |  | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  |
| 16 | Fundamentals of Engineering and Technical Sciences  | BD | HSC | Engineering and Computer Graphics | Studied computer graphics using modern graphic packages, the basics of computer design in the formation of compositions, creating a single style of design, transferring the image.The principles of creating and processing images using graphic packages, the basics of perception of graphic images, physics of color and light, types of graphics, features of use and principles of forming various types of graphics are considered. The skills of performing general technical and specialized drawings in accordance with GOST in the environment of computer-aided design AutoCAD, 3D modeling, creating theoretical models of power supply objects are taught. | 4 |  | **ѵ** |  |  |  |  |  | **ѵ** |  |  |  |
| 17 | BD | EC | Mathematical Problems and Computer Modelling in the Electric Power Industry | Mathematical issues of the electric power industry and mathematical modeling of steady-state modes of power systems, transient processes using specialized computer and mathematical programs are studied. The skills of applying mathematical programming methods in solving problems of power supply, methods of probability theory and mathematical statistics in problems of power supply, skills of solving optimization problems for various types of power plants and modes of electrical networks are taught. | 5 |  |  | **ѵ** |  | **ѵ** |  |  | **ѵ** |  |  |  |
|  | BD | EC | Mathematical Modelling of Electric Power Facilities | Mathematical models of elements of electric power systems, methods for solving linear equations, nonlinear models of steady modes, modeling of circuits of electrical networks, static and dynamic models are studied.The skills of practical solution of tasks for modeling energy objects, setting their geometry, properties, physical composition, modeling the behavior of an object in various environments, in statics, dynamics and developing recommendations for studying the object are taught. |  |  |  |  |  |  |  | **ѵ** |  | **ѵ** |  |
| 18 | Fundamentals of Electrical Engineering Module | BD | HSC | Applied Mechanics | The basic concepts and axiomatics of mechanics are studied, laws of mechanical movement and methods of its calculation, the main historical stages of development theoretical mechanics, its current state and prospects for its development. Calculation methods are considered mechanical movement for specific tasks, in particular tasks related to the profile of the specialty of students, especially the construction of mechanical links, apparatus and machines and their operation in conditions of low and high temperatures. The skills of choosing the sizes and properties of structural elements and equipment are taught. | 4 |  | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  |
| 19 | BD | HSC | Standardization and Certification  | The basic concepts and methods of mathematical analysis, probability theory and mathematical statistics, technical and software tools for the implementation of information technologies are studied. The article considers the use of external storage media for data exchange between machines, the creation of backup copies and archives of data and programs. The skills of searching and exchanging information in global and local computer networks, carrying out physical measurements, and correctly assessing errors during a physical experiment are taught. | 4 |  |  | **ѵ** |  |  |  |  |  | **ѵ** |  |  |
| 20 | Fundamentals of Electrical Engineering Module | BD | EC | Theoretical Fundamentals of Electrical Technics І | Linear electric circuits of direct current, electric circuits of single-phase sinusoidal current, three-phase circuits, linear electric circuits with non-sinusoidal currents and voltages are studied. The skills of applying calculation methods in circuits of constant, single-phase and three-phase currents are taught. Problems with symmetric and asymmetric operation in three-phase circuits with three-wire and four-wire power supply systems are considered. Methods for solving problems with non-sinusoidal currents are being mastered. The skills of setting up an experiment, drawing up a diagram, working in a team, discussing and summing up the results of the work are instilled. | 5 |  |  | **ѵ** |  |  | **ѵ** |  |  |  |  |  |
|  | BD | EC | Theory of Electrical Circuits I | The basic concepts of electrical circuits and methods for calculating direct current circuits, the influence of harmonic oscillations on electrical circuits, resonance phenomena in electrical circuits, circuits with inductively coupled elements, three-phase circuits, periodic non-sinusoidal currents are studied. The skills of applying calculation methods in circuits of constant, single-phase and three-phase currents are taught. Problems with symmetric and asymmetric operation in three-phase circuits with three-wire and four-wire power supply systems are considered. Methods for solving problems with non-sinusoidal currents are being mastered. The skills of setting up an experiment, drawing up a diagram, working in a team, discussing and summing up the results of the work are instilled. |  |  | **ѵ** |  |  | **ѵ** |  |  |  |  |  |
| 21 | Fundamentals of Electrical Engineering Module | BD | EC | Theoretical Fundamentals of Electrical Engineerig II | Transient processes in linear electrical circuits, quadripoles and frequency electrical filters, circuits with distributed parameters, alternating and direct current circuits with nonlinear elements are studied. Quadripoles and frequency electric filters and nonlinear elements are analyzed. Skills are formed in determining the coefficients of a four-terminal network, calculating circuits with distributed parameters, determining parameters, currents and voltages in long lines. The skills of setting up an experiment, drawing up a diagram, working in a team, discussing and summing up the results of the work are instilled. | 6 |  |  | **ѵ** |  |  | **ѵ** |  |  |  |  |  |
|  | BD | EC | Theory of Electrical Circuits II | Transient processes in linear AC and DC electric circuits, quadripoles and their equivalent circuits, methods of constructing electric filters, circuits with distributed parameters, circuits with alternating and direct current with nonlinear elements are studied.The skills of solving problems in the transient process mode, determining the coefficients of a four-port network are taught. The skills of calculation, determination of currents, voltages in long lines are formed. The skills of setting up an experiment, drawing up a diagram, working in a team, discussing and summing up the results of the work are instilled. |  |  | **ѵ** |  |  | **ѵ** |  |  |  |  |  |
| 22 | BD | EC | Theoretical Fundamentals of Electrical Engineerig III | The theory of the electrostatic field, the foundations of the theory of the electric field of direct current in a conducting medium, the magnetic field from direct current and the foundations of the theory of alternating magnetic fields, the basic equations of the alternating electromagnetic field are studied.The skills of calculating the electrostatic field, direct current electric field, direct current magnetic field, alternating electromagnetic field are taught | 4 |  |  | **ѵ** |  |  | **ѵ** |  |  |  |  |  |
|  | BD | EC | Theory of Electromagnetic Fields | The basic concepts and laws of the electrostatic field, the basic concepts and laws of the magnetic field of a direct current, the basic equations of an alternating electromagnetic field, an alternating electromagnetic field in a homogeneous and isotropic conducting medium are studied.The skills are taught to reveal the physical essence of phenomena and processes in devices of various physical nature, to perform technical calculations. |  |  | **ѵ** |  |  | **ѵ** |  |  |  |  |  |
| 23 | BD | EC | Introduction to Specialty  | The profile of the educational program, general issues of the electric power industry and energy resources are considered. Traditional and modern methods of obtaining electrical energy, possible ways of converting various types of energy into electrical energy, consumption of electrical energy, transmission of energy over a distance, the main trends of the power supply system are studied. Skills of working with modern information resources are taught, the horizons of future specialists are broadened and they allow one to have an idea about the specialty and about the electric power systems. | 4 | **ѵ** |  | **ѵ** |  |  |  |  |  |  |  | **ѵ** |
|  | BD | EC | Fundamentals of Academic Writing | The features of scientific discourse, the types of genres of academic writing, the concept and types of substyles in the academic text are studied. The principles of the analysis of a linguistic article, morphological, stylistic and lexical signs of the educational style are considered. The skills of analysis, editing, editing the text of the article, annotation design, justification of relevance, and setting the problem are taught. | **ѵ** |  |  |  |  |  |  |  |  |  | **ѵ** |
| 24 | BD | HSC | Educational Practice | Students gain a general understanding of the objects of professional activity in the form of excursions to enterprises, familiarity with the functions and tasks of future professional activities, consolidation, development and improvement of primary knowledge in the disciplines of the professional cycle studied by students in the first year. Practical skills are acquired in the field of training, skills are formed make independent decisions on specific areas of work in real conditions. Students will be prepared and motivated to deliberately and in depth study of general professional and special disciplines. | 2 | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  | **ѵ** |
| 25 | Specific Professional Deepening of the Main Objectives Module | CHD | EC | Electrical Machines | The role and importance of electric machines in modern technology and power engineering are considered. The basics of the general theory of electrical machines, the structure and principle of operation of various types of machines - transformers, asynchronous machines, synchronous machines and DC machines are studied. The basic equations and characteristics of electrical machines and transformers are given.Skills are taught to independently carry out calculations to determine the parameters and characteristics of electrical machines, which are necessary for work in production and in scientific research in the field of energy generation | 6 |  |  | **ѵ** |  |  | **ѵ** |  |  |  |  |  |
|  | CHD | EC | Energy Converters  | The properties and methods of constructing energy conversion systems, the principle of operation and design features of energy converters are studied. The use of converters in technological processes is considered. The skills of analysis and calculation of energy converters are taught. |  | **ѵ** | **ѵ** |  |  | **ѵ** |  |  |  |  |  |
| 26 | CHD | EC | Digital and Microprocessor Technology | We study digital and analog signals, a logic signal, combinational logic circuits, sequential logic circuits, memory elements (triggers), circuits designed using triggers. We study the classification of analog electronic devices, principles of building electronic amplifiers, elements of digital circuitry, logic integrated circuits, systems based on microprocessors and microcontrollers. Skills of building digital circuits and digital devices are developed. | 5 |  | **ѵ**  | **ѵ** | **ѵ** |  |  |  |  |  |  |  |
|  | CHD | EC | Industrial Electronics | Semiconductor devices, electrical properties of materials, current-voltage characteristic, basic parameters of semiconductor diodes, bipolar transistor of a field-effect transistor, thyristor are studied. Devices and properties of microcircuits, digital and analog microcircuits, amplifying electronic devices, generators of harmonic oscillations, memory devices, the purpose of analog-to-digital and digital-to-analog converters are considered. The skills of designing electronic assemblies, the use of various electronic devices in electrical circuits are taught. |  |  |  | **ѵ** | **ѵ** |  |  |  |  |  |  |
| 27 | BD | EC | High Voltage Techniques | The main issues of gas insulation, electronic avalanches, conditions for the self-sufficiency of the discharge, and the shape of electric fields are being studied. The maximum and average intensity of electric fields, the influence of the polarity of the tip electrode (volume charge), the dependence of the discharge voltage in the gas on pressure, temperature and humidity, Townsend and spark discharges, breakdown of long interelectrode gaps are considered. The skills of determining the discharge time and its components are taught. | 4 |  | **ѵ** |  |  |  | **ѵ** |  |  |  |  |  |
|  | BD | EC | Isolation of High Voltage Installations | Electrical insulation of high-voltage equipment and installations, insulators of power lines of all types of voltages are being studied. Materials for indoor and outdoor insulators are considered. Skills are taught in the selection of electrical insulating materials, the preparation of initial data in the calculation and design of the insulation of high-voltage equipment of electrical systems, the application of knowledge in practice. |  | **ѵ** |  |  |  | **ѵ** |  |  |  |  |  |
| 28 | CHD | HSC | Industrial Practice 1  | The activities of structural divisions and support services of the enterprise, technologies of transmission processes, distribution and consumption of electrical energy, devices and modes of operation of electrical installations, methods of information technology and labor protection are studied. The necessary data is formed to optimize the power supply system. The consolidation of theoretical knowledge in scientific disciplines. The skills of compliance with the rules of safety and labor protection are taught | 4 | **ѵ** |  | **ѵ** |  |  |  |  |  |  | **ѵ** | **ѵ** |
| 29 | Physical Processes of Power and Electrotechnical Devices | BD | EC | Electric Drive of Industrial Equipment | The basic requirements for electric drives, characteristics of operating modes of industrial equipment are studied. The current trends in the development of industrial equipment electric drives are considered. calculation of power and selection of electric motors, typical schemes of electric drives with DC and AC motors, contact and contactless control, TP-D system. Skills of determining static loads of electric drives of industrial equipment, construction of load diagrams are taught. | 4 |  | **ѵ** | **ѵ** |  |  |  |  |  | **ѵ** |  |  |
|  | BD | EC | Electric Drive and Power Supply of Industrial Enterprises | The main issues of the theory and practice of the electric drive of modern industrial enterprises and power supply of industrial enterprises are studied. The calculation of power is considered and recommendations are given on the choice of motors for various operating modes in the technological process of industrial enterprises, typical schemes of supply and distribution networks. The skills of calculating electrical networks are taught. |  | **ѵ** | **ѵ** |  |  |  |  |  | **ѵ** |  |  |
| 30 | BD | EC | Electrotechnical Materials Science | The modern classification of electrical materials, electrical characteristics and processes in dielectric, conductive, semiconducting, magnetic materials are studied. The choice of electrical materials is being considered. The skills of calculating the characteristics of electrical materials, setting up an experiment, drawing up a diagram, working in a team, discussing and summing up the results of the work are taught. | 5 |  | **ѵ** |  |  |  | **ѵ** |  |  |  |  |  |
|  | BD | EC | Materials Science and Technology of Construction Material | Modern methods of obtaining materials and products from them with a given level of operational properties, the structure and properties of materials, the essence of the phenomena occurring in materials under the operating conditions of products are studied. Methods of shaping and processing of blanks for the manufacture of parts of a given shape and quality, their technological features are considered. Skills are taught to choose a rational method of obtaining blanks based on the specified operational properties, knowledge of the methodology for choosing structural materials for the manufacture of elements of machines and mechanisms |  | **ѵ** |  |  |  | **ѵ** |  |  |  |  |  |
| 31 | CHD | EC | Electrical and Electronic Apparatus | General information, classification, requirements for electrical and electronic devices, thermal processes in electrical devices are studied. The location of electrical and electronic devices in an installation for the production, distribution and consumption of electrical energy, intermittent and repeated operating modes of an electrical device, control of operating modes, protection and regulation of the parameters of the power supply system and control of the automated electric drive, The skills of determining the magnetic flux in an unbranched magnetic circuit according to a given magnetizing force are taught. | 4 |  |  | **ѵ** |  |  |  | **ѵ** |  |  |  |  |
|  | CHD | EC | Electrical Energy Consumers and their Power Supply Systems  | The types of consumers of electrical energy and their power supply systems are considered. Methods for calculating consumers of electrical energy and their power supply systems, transferring consumers of electrical energy of one voltage to another voltage level, reading electrical circuits, connecting general industrial consumers of electricity are studied. The skills of calculating electrical loads at different voltage levels are taught, taking into account reactive power compensation, choosing the type and number of transformers, drawing up power supply schemes and choosing equipment. |  | **ѵ** | **ѵ** |  |  |  |  |  | **ѵ** |  |  |
| 32 | CHD | EC | Digital Measurement Technology | Classification and measurement methods, properties and measurement errors of measuring, electromechanical and electronic devices are studied. The skills of applying the methods of presenting the results of measurements, standardizing the errors of measuring instruments and the skills of using, operating and choosing measuring instruments are taught. The skills of calculating errors, setting up an experiment, drawing up a diagram, working in a team, discussing and summing up the results of the work are taught. | 5 |  |  |  |  |  | **ѵ** | **ѵ** |  |  |  |  |
|  | CHD | EC | Modern Digital Devices | Studied analog and discrete values, their main differences. Quantization of analog values ​​by level (by value) and sampling by time. The ability to restore an analog signal by its discrete values. Stepwise and piecewise-linear approximation. Numeral systems and codes used in CIU. Code converters, registers and pulse counters. Converters of a serial unit code into a parallel binary code - binary counters. The skills of solving problems of designing modern digital measuring instruments and devices are taught. |  |  | **ѵ** | **ѵ** |  |  |  |  |  |  |  |
| 33 | Electrical Equipment Operation Module | BD | EC | Electric Power Systems and Networks | All types of voltage and elements of electric power systems and networks, parameters of equivalent circuits of elements of electric networks, circuits of electric networks, operating modes of electric power systems, voltage regulation in electric networks are studied. The issue of power and energy losses in the elements of electrical networks is considered. The skills of calculating the steady-state modes of electrical networks and the choice of means of regulating the voltage in the network are taught, | 4 |  |  |  |  |  | **ѵ** |  |  | **ѵ** |  |  |
|  | BD | EC | Autonomous Energetic Systems | The classification, the principle of operation of autonomous power systems, thermodynamic cycles of autonomous power systems, technical and economic indicators of autonomous power plants, working processes of autonomous power systems, calculation of the required energy are studied.The types of autonomous power supply sources, the operational characteristics of autonomous energy systems, the choice of a complex of installations for obtaining alternative energy are considered. The skills of choosing a generation technology corresponding to local conditions and adapting it for a specific consumer are taught. |  |  | **ѵ** |  |  |  |  |  | **ѵ** |  |  |
| 34 | BD | EC | Operation and Diagnostics of High Voltage Electrical Equipment | The basics of the organization of installation and the implementation of commissioning and operation of electrical equipment, technical diagnostics of high voltage electrical equipment, requirements for monitoring and diagnostic systems, the main types of defects in asynchronous motors, power cable lines, instrument transformers, capacitors, surge arresters and surge arresters. Methods for assessing the technical condition of electrical equipment, Skills for diagnosing high voltage electrical equipment are taught | 4 |  |  |  |  | **ѵ** |  | **ѵ** |  |  |  |  |
|  | BD | EC | Electrical Equipment Repair Technology | The issues of planning and organizing the repair of electrical equipment, technical conditions for the acceptance of electrical equipment for repair, repair and testing of electrical equipment, the technology of repairing electrical machines, transformers, electrical devices with a voltage higher than 1000 V. impregnation of windings of electrical machines. Skills of calculating electrical equipment during repair are taught. |  |  |  |  | **ѵ** |  | **ѵ** |  |  |  |  |
| 35 | BD | EC | Alternative and Renewable Energy Sources | Alternative and renewable energy sources are studied using the foundations of philosophical knowledge to form a world outlook, methods of converting natural energy and secondary energy sources into heat and electricity. Consideredmain renewable energy resources, principles of use, designs and modes of operation of the corresponding power plants, experience of their operation, prospects for the development of energy using nano-traditional and renewable energy sources. Skills of drawing up a schematic diagram of installations for the use of renewable energy sources are taught. | 4 |  | **ѵ** |  |  |  | **ѵ** |  |  |  |  |  |
|  | BD | EC | Electric and Heat Energy Storage Devices | The features of the choice of storage devices for systems with renewable energy sources, electric energy storage devices based on compressed air (ESDCA) are studied. The structure and functions of lithium-ion batteries (LIB), hydrogen fuel cells, kinetic storage devices (flywheels), flowing redox storage devices, accumulation of electric and thermal energy are considered. The skills of applied research to improve the properties of energy storage systems (high-capacity batteries, heat storage, flywheels, etc.) are taught. |  | **ѵ** |  | **ѵ** |  |  |  |  |  |  |  |
| 36 | BD | EC | Electrical Station and Substation Engineering | Traditional and non-traditional power plants and substations are considered. The purpose, main parameters, characteristics, design features of the equipment used at power plants and substations, electrical wiring diagrams of power plants and substations, switchgears, auxiliary systems of electrical installations are studied. The skills of developing wiring diagrams and auxiliaries of stations, calculating the modes of electrical networks and choosing electrical equipment for switchgears are taught. all voltage classes. | 4 |  |  | **ѵ** | **ѵ** |  |  |  |  |  |  |  |
|  | BD | EC | Electrical Station and Substation Engineering | The main electrical equipment of power plants and substations is considered: synchronous generators and compensators, power transformers and autotransformers, switching devices, measuring transformers. Studied are designs, basic parameters and characteristics, cooling systems, power limits, excitation systems, methods of connecting synchronous generators to the network. Cooling systems, heating, wear and tear of insulation, load capacity, voltage regulation, methods of neutral grounding, overvoltage protection of power transformers and autotransformers. The skills of calculating and selecting electrical equipment for power plants and substations are taught. |  |  | **ѵ**  | **ѵ** |  |  |  |  |  |  |  |
| 37 | Theory and Mаnagement by the Electric Systems of Electroenergy Module | BD | EC | Automatic Control Theory | The principles of automatic control, types of control systems are considered. Methods of analysis and synthesis of automatic control systems are studied. The skills of modeling and research of dynamic systems using analog and digital computers are taught. The skills of analyzing the stability of the operation of an automatic control system are taught. | 3 |  | **ѵ** |  | **ѵ** |  |  |  |  |  |  |  |
|  | BD | EC | Automatic Control of Electric Power Facilities | The study is devoted to the automatic control of objects of open, closed and combined systems. Requirements for the stability of the characteristics and accuracy of the measuring element of the controlled quantity, the automatic voltage regulation system for synchronous generators with compounding, and the characteristics varying over a relatively wide range are considered. The skills of describing the mathematical model of the generator and the subsequent analysis of the system are taught. |  | **ѵ** |  | **ѵ** |  |  |  |  |  |  |  |
| 38 | CHD | EC | Electric Power Supply | The features of the power supply of industrial enterprises, the electric power system are considered. The structure and parameters of power supply systems, electrical circuits for connecting electrical equipment of general industrial consumers of electricity are studied. The skills of calculating electrical loads, short-circuit currents, choosing electrical equipment, reading basic and functional power supply diagrams are taught. | 6 |  | **ѵ** | **ѵ** | **ѵ** |  |  |  |  | **ѵ** |  |  |
|  | CHD | EC | Power Supply Reliability | The main provisions of the theory of reliability in power supply, operating and working conditions, causes of failures of electrical equipment, possible violations of the normal mode of power supply are studied.Methods for analyzing the reliability of technical power supply systems, operational assurance of the reliability of electrical equipment and power supply systems are considered. The skills of calculating power supply systems for reliability are taught. |  | **ѵ** | **ѵ**  | **ѵ** |  |  |  |  |  |  |  |
| 39 | CHD | EC | Relay Protection and Automation of Electric Power Systems | The purpose of relay protection and automation of power supply systems is being studied. All types of relay protection and automation based on microelectronic and microprocessor technology of power supply systems are considered. The skills of calculating the main parameters of relay protection and automation in power supply systems, setting up an experiment, drawing up a diagram, working in a team, discussing and summing up the results of work are taught. | 5 |  |  |  |  |  | **ѵ** |  | **ѵ** |  |  |  |
|  | CHD | EC | Modern Systems for Protection of Electrical Networks of High Voltage | The purpose of a modern protection system for high voltage electrical networks is being studied. Protection systems based on microelectronic and microprocessor technology of high voltage electrical networks are considered. The skills of calculating the main parameters of the protection of high voltage electrical networks, setting up an experiment, drawing up a diagram, working in a team, discussing and summing up the results of the work are taught. |  |  |  |  |  | **ѵ** |  | **ѵ** |  |  |  |
| 40 | CHD | EC | Operational Dispatch Control | The system of operational dispatch control of electric power systems, the structure of the system operator, stages of operational dispatch control, on-line and offline control in the power system, automatic and operational dispatch control are studied. The principles of operational dispatch control in the electric power industry, control of technological modes of operation of EPS, dispatch control in a competitive environment, promising areas of activity of the operational dispatch control system are considered. Skills of determining the potential and reserve of energy savings, monitoring of energy efficiency are taught. | 5 |  | **ѵ** |  |  |  |  |  |  | **ѵ** |  |  |
|  | CHD | EC | Basics of SCADA System Construction at Electric Power Plants  | The problems of constructing effective and reliable dispatch control systems, general trends in the development of SCADA are studied. SCADA systems, requirements, capabilities and characteristics, real-time operating systems for SCADA systems, organization of distributed SCADA systems are considered.The skills of designing a SCADA system are taught using modern built-in development tools and programming languages. |  | **ѵ** | **ѵ** | **ѵ** |  |  |  | **ѵ** |  |  |  |
| 41 | CHD | HSC | Industrial Practice ІI | The issues of operation and diagnostics of the main and auxiliary electrical equipment at the enterprise are being studied. Acquire practical skills in determining the technical condition of electrical equipment; performing switching; inspection, identification and elimination of defects and damages, as well as independently make decisions on the development of new and improvement (modernization) of existing hardware and technological schemes and experimental design work of modernizing the production of the enterprise, on the feasibility study of the proposed new innovative technologies and solutions. | 6 | **ѵ** |  | **ѵ** |  |  |  |  |  |  | **ѵ** | **ѵ** |
| 42 | Designing of Power Systems and Energy Saving  | BD | EC | Energy Audit and Energy Efficiency of Electric Power Systems | The basics of energy audit of electric power facilities, features of energy audit of industrial enterprises, energy conservation policy in the Republic of Kazakhstan are studied. Consideration is given to the accounting and control of electrical energy, indicators of energy efficiency, rationing of the specific consumption of electrical energy. The skills of applying methods for calculating electrical energy losses are taught | 4 |  | **ѵ** |  |  |  |  |  |  | **ѵ** |  |  |
|  | CHD | EC | Management and Marketing in Electric Power Industry | The basic concepts of economic theory, methods of technical and economic choice of the best option for a power supply network under construction or reconstructed are studied. The article considers the current state of the country's electric power industry and the problems of its restructuring, modern marketing concepts of enterprise management, management decisions on pricing. The skills of calculating and evaluating the technical and economic indicators of electric power facilities, drawing up technical and economic documentation, a business plan for the design of power supply systems are taught. |  | **ѵ** |  |  |  |  |  |  | **ѵ** |  |  |
| 43 | CHD | EC | Modern Technologies for the Design of Electric Power Facilities | The organization of project activities, stages of work on a project, the main tasks of project planning, classification of methods for assessing the effectiveness of investment projects, theoretical aspects of modeling when creating projects, management of investment projects, static and dynamic methods for assessing the effectiveness of projects are studied. The hierarchical structure of the work, the organizational environment of the project, the project passport, the project charter, methods of risk assessment and management are considered. The skills of self-construction and design of energy facilities, autonomous power systems for an individual consumer, "smart" grids "Smart Grid" are taught. | 6 |  |  |  |  | **ѵ** |  |  | **ѵ** |  |  |  |
|  | CHD | EC | Automated Design of Local Networks | The concept of engineering design of local area networks, the principles of the system approach, design stages, classification of models and parameters used in automated design, technical support of automated design systems are studied. The content of technical specifications for design, methods of access in local area networks, methodological and software support for automated systems, modeling of physical behavior of objects in the virtual world are considered. The skills of modeling energy objects, modeling the behavior of an object in various environments, in statics, dynamics, etc. are taught. |  | **ѵ** |  |  |  |  |  | **ѵ** |  |  |  |
| 44 | Module Acquisition of New Professional Competencies | BD | EC | Subjects on the Additional Educational Program | A set of disciplines and (or) modules and other types of educational work, assigned to a student for study in order to form additional competencies | 12 |  | **ѵ** | **ѵ** |  |  |  |  |  |  |  |  |
| 45 | Module of Final Affestation | CHD | HSC | Pre-degree or Industrial Practice  | Practical skills of setting goals, objectives, defining problems and ways of solving them are imparted. Collection and analysis of practical material on the topic of the final qualifying work. In-depth study of production activities, the main equipment of the enterprise. | 8 |  |  | **ѵ** |  |  |  |  |  |  | **ѵ** | **ѵ** |
| 46 |  |  | Writing and Defence of Degree Work (Project) or Passing a Graded Exam/  | Description and solution of technical problems in the field of electric power industry, development of control schemes for systems of electric power facilities, analyze options for technical solutions in the design of electric power facilities, evaluate the technical and economic advantages of the adopted technical solutions, assess the impact of equipment on the cost of products, use applied computer programs. | 12 | **ѵ** | **ѵ** | **ѵ** | **ѵ** |  | **ѵ** |  | **ѵ** | **ѵ** | **ѵ** | **ѵ** |
|  |  |  |  |  | TOTAL | 240 |  |  |  |  |  |  |  |  |  |  |  |

**5 SUMMARY TABLE REFLECTING THE VOLUME OF MASTERED CREDITS BROKEN DOWN EDUCATION PROGRAM MODULES**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Course of Study | Semester | The number of mastered modules | The number of studied disciplines | Number of KZ credits | Total I hours | TotalKZ credits | The number of |
| OC | HSC | EC |  | exam |  | Industrial practice, pregraduate practice | Final examination | exam | differentialoffset |
| 1 | 1 | 4 | 5 | 2 | - | 28 | 2 |  |  |  | 900 | 30 | 6 | 1 |
| 2 | 5 | 3 | 5 |  | 27 | 2 | 1 |  |  | 900 | 30 | 5 | 3 |
| 2 | 3 | 5 | 1 | 4 | 3 | 28 | 2 |  |  |  | 900 | 30 | 6 | 2 |
| 4 | 7 | 3 | 2 | 2 | 24 | 2 |  | 4 |  | 900 | 30 | 5 | 2 |
| 3 | 5 | 5 | - | 1 | 5 | 30 |  |  |  |  | 900 | 30 | 6 | - |
| 6 | 3 | - | 2 | 3 | 24 |  |  | 6 |  | 900 | 30 | 3 | 1 |
| 4 | 7 | 4 | - | - | 5 | 20 |  |  |  |  | 600 | 20 | 5 | - |
| 8 | 2 | - | - | 4 | 20 |  |  |  |  | 600 | 20 | 4 | - |
| 9 | 1 |  | 1 | - | - |  |  | 8 | 12 | 600 | 20 | - | 1 |
| Total |  | 12 | 17 | 22 | 201 | 8 | 1 | 18 | 12 | 7200 | 240 | 40 | 10 |

**6 LEARNING STRATEGIES AND METHODS, MONITORING AND EVALUATION**

|  |  |
| --- | --- |
| **Learning strategies**  | **Student-centered learning:** the learner is the center of teaching/learning and an active participant in the learning and decision-making process.**Practice-oriented learning:** focus on the development of practical skills. |
| **Learning methods** | Conducting lectures, seminars, various types of practices with:• application of innovative technologies:- problem learning;- case study;- work in groups;- discussions and dialogues, intellectual games, business games;- virtual laboratory work;- methods of reflection, projects, benchmarking;- presentations;• rational and creative use of information sources:- multimedia training programs;- electronic textbooks;- video lectures, video films;- digital resources.Organization of independent student work, individual consultations. |
| **Monitoring and assessing the achievability of learning outcomes**  | **Current control** on each topic of a discipline, control of knowledge in in-class and out-of-class activities (according to a syllabus). Assessment forms:• questioning in the classroom;• testing on the topics;• test;• defending student independent works;• virtual laboratory work;• discussions;• trainings;• colloquia;• essays, etc.**Midterm control:** at least two times during one academic period within each academic discipline.**Intermediate attestation** is carried out in accordance with the working curriculum, academic calendar.Conduct forms:• exam in the form of testing;• oral exam;• written exam;• combined exam;• defense of term works/projects;• defense of practice reports.**Final state attestation:** defense of a thesis or passing a comprehensive exam.  |

**7 EDUCATIONAL AND RESOURCE SUPPORT OF THE EDUCATION PROGRAM**

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| **Information Resource Center** | There are 6 library departments, 16 reading rooms, 2 electronic resource centers (ERC) in the structure of the Information Resource Center. The network infrastructure of the IRC is based on 180 computers with Internet access, 110 workstations, 6 interactive whiteboards, 2 video doubles, 1 video conferencing system, 3 A-4 format scanners. The IRC software includes AIBS “IRBIS-64” for MS Windows (the basic set consisting of 6 modules), stand-alone server for uninterrupted operation in the IRBIS system.The library fund is in the electronic catalog available to users on the site <http://lib.ukgu.kz> on-line 24 hours 7 days a week.Own thematic databases have been created: “Almamater”, “Proceedings of SKU scientists”, “Electronic archive”. Online access from any device in 24/7 mode via an external link <http://articles.ukgu.kz/ru/pps>.Work with catalogs in electronic form. The Electronic Catalog consists of 9 databases: “Books”, “Articles”, “Periodicals”, “Proceedings of the SKU teaching staff”, “Rare Books”, “Electronic Fund”, “SKU in Print”, “Readers”, and “South Kazakhstan Oblast”.The IRC provides its users with 3 options for accessing their own electronic information resources: using the “Electronic Catalog” terminals in the catalog hall and in the IRC subdivisions; through the information network of the university for faculties and departments; remotely on the library website <http://lib.ukgu.kz/>.Open access:* to international and republican resources: “SpringerLink”, “Polpred”, “Web of Science”, “EBSCO”, “Epigraph”;
* to electronic versions of scientific journals in the public domain, “Zan”, “RMEL”, “Adebiet”, Digital library “Aknurpress”, “Smart-kіtаp”, “Kitаp.kz”, etc.

For persons with special needs and disabilities, the IRC has adapted the library website for the work of visually impaired users. |
| **Material and technical base** | For the implementation of the Educational Program 6B07152-Engineering of electric power systems, the following material and technical base is provided:1. Virtual laboratory "Electrical engineering and electronics";2.Laboratory of electrical machines and electric drive:- Electric cars;- Electric drive and automation (standard set Converting equipment, standard set Automated electric drive, simulator stand Automation using SMART system;3. Laboratory "Renewable Energy";4. Stand - simulator "Power supply of industrial enterprises"- Laboratory "Electric circuits and basics of electronics":-Typical set of educational equipment "Electrical materials";5Laboratory complex "Information and measuring equipment"6. Laboratory complex "Electrical systems with relay protection" - Stand-simulator "House wiring"- Typical set "Electrical installation in residential and office premises"-Typical set of educational equipment for the training of electricians and electricians with a measuring unit "- Training and experimental ground "Traditional and non-traditional energy"- the interactive board is equipped in laboratory No. 504G.7 The educational-scientific-practical complex was organized at the Electroapparat Plant LLP8 A branch of the department was organized at ASIA Trafo LLP. |

**APPROVAL SHEET**

for the Educational program " 6В07152-Engineering of electric power system "

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