**MINISTRY OF LABOR AND SOCIAL PROTECTION OF THE POPULATION OF THE REPUBLIC OF KAZAKHSTAN**

**"DEVELOPMENT OF LABOR SKILLS AND STIMULATION OF WORKPLACES" PROJECT**

# EDUCATIONAL PROGRAMME

**0917000-conventional energy**
(code and name of the specialty)

**Professional Qualification Level**: Applied Bachelor

**Duration of training**: 2 years 10 months.

**Astana, 2018**

The education program was reviewed and recommended by the Republican Educational and Methodological Council of the Ministry of Education and Science of the Republic of Kazakhstan

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**Authors-developers:**

1. Yelnur Mahmudzhanovich Bektashov – a teacher of special disciplines Private Education Institution "Kentau Polytechnic College";
2. Marina V. Kerimbaeva - Deputy Director for Education-Methodological work of Private Education Institution "Kentau Polytechnic College";
3. Nurzhamal Sezdzhanovna Dzhumartbaeva – Deputy Director for Education Practical Work of Private Education Institution "Kentau Polytechnic College";
4. Aktolkyn Bekarysovna Agabekova –a teacher of special disciplines of Private Education Institution "Kentau Polytechnic College"
5. Baurzhan Amangeldiyevich Kudaybergenov - Technical Director of JSC "KTZ" (Kentau Transformer Plant)

**Experts:**

Sh.Zh. Issakhanova – a teacher of special disciplines in Almaty College of energy and electronic technologies, Almaty

A.G. Asylhan – a teacher of special disciplines in Almaty College of energy and electronic technologies, Almaty

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# INTRODUCTION

This educational programme on specially 0917000 – "Conventional Energy" is developed in accordance with State compulsory education standard of technical and vocational education, approved by the Government Decree of the Republic of Kazakhstan dated 23 August 2012, No. 1080, National Qualifications framework approved by the Protocol of Republican Tripartite Commission on social partnership and the regulation of social and labor relations, professional standards "Electric Power industry (by branches)", "Thermal power plants of thermal electric power stations", "Electricity Supply (by branches)", "Technical operation, maintenance and repair of electrical and electromechanical equipment (by types)" that define the training content.

The programme is designed to implement the principles of democratic administration of education, expanding the boundaries of academic freedom and the authority of the educational institutions that will ensure the adaptation of the system of technical and vocational education to the changing needs of society, the economy and the labor market. The flexibility of the program will take into account the ability and needs of the individual, production and society.

The educational programme includes the use of modular competence-based approach, based on developing and evaluating competence of students of the educational institutions in the form of basic educational results, use of a module training.

In accordance with this educational programme, training process in organizations of technical and vocational education is based both on the modular system and on the credit system of teaching.

The programme provides differentiated, individual approach to trainees, development of trainees' abilities for self-education, teachers have great freedom in the choice of teaching methods, forms of organization and content of the educational process, getting of education at different levels in one institution by students – from the basics of the profession to the levels of the highly skilled worker, mid-level specialist, applied Bachelor's degree, including in the framework of integrated programs.

Based on the present EP, the education organization develops working programs and curricula, using appropriate methodological recommendations for the working educational and planning documentation.

Legislative and normative acts of the Republic of Kazakhstan, domestic and foreign scientific and methodical work in this area, materials on the state of the economy, labor market and vocational education in Kazakhstan are used at the designing of the provided experimental modular training program.

# 1 SYMBOLS AND ABBREVIATIONS

| | |
|---|---|
| BC | Basic competence |
| BM | Basic module |
| SCES | The State compulsory education standard |
| DP | Diploma project |
| FC | Final certification |
| C | Consultation |
| NQF | National Qualifications framework |
| GCEA | General classifier of types of economic activity |
| EP | Educational program |
| GED | General Education Discipline |
| SQF | Sectorial Qualifications framework |
| IC | Intermediate certification |
| PS | Professional standard |
| PC | Professional competence |
| PM | Professional module |
| RP&A | Relay protection and Automatics |
| RK | The Republic of Kazakhstan |
| LO | Learning Outcomes |
| CAD | Computer-aided design system |
| TVE | Technical and vocational education |
| T&PPSE | Technical and vocational, post-secondary education |

## 2 PASSPORT OF THE WORKING EDUCATIONAL PROGRAMME

**Name *(specialty code and name)*:** 0917000 – Conventional energy
**Name and code:** "Applied Bachelor"
**Purpose of the educational programme:** preparation of highly qualified specialists who perform maintenance, operation, repair and modernization of thermal and power equipment in accordance with the prepared technical and planning documentation.
**Level of education:** technical and vocational
**Professional qualification:** Applied Bachelor
**Skill levels on NQF/SQF:** 5
**Professional Area activity *:** Energy
**Type (s) of employment:**
11. Maintenance, operation, repair, and modernization of equipment of power stations, substations, thermal and electrical networks.
2. Identification of the production needs in the fuel and energy resources.
3. Testing, troubleshooting and commissioning of equipment of power stations, substations, thermal and electrical networks.
4. Organization of inspection and testing of relay protection and automation tools.
5. Management and control over the operation of the repair and maintenance unit of electric power stations and substations
6. Design and development using CAD electric stations and substations
**Object (s) of professional activity:** equipment of power stations, substations, thermal and electrical networks.
**Program Features ****:** The possibility to use dual forms for vocational training, credit system.
**Form of study:** full-time
**Training terms: 2** years 10 months.
**Language of instruction:** Russian
**The volume of credits/hours: 1**65 credits/ 4950 hours.
**Requirements for students*****:** persons with basic secondary education

*Specifies the parameters of the SQF (methodical recommendations on the development and design of sectorial qualification frameworks, Astana, 2016).
** Specifies according to PS (methodical recommendations on the design and execution of professional standards, Astana, 2017)
***Specifies the system objects (objects), phenomena, processes, and technology that aims activities.
****Specifies the dual education/distance training/credit technology
***** Specifies the previous education: basic secondary/secondary/technical and vocational education

## 3 COMPETENCY PROFILE

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| **The purpose of the training** : perform maintenance, operation, repair and modernization of equipment of power stations, substations, thermal and electrical networks | After the successful completion of the program, **the trainee** will be able to perform maintenance work, maintenance, repair and modernization of equipment of power stations, substations, thermal and electrical networks |
| Section names, section, group, class and subclass according to GCEA * (*by PS)* | **Section D:** Electricity supply, gas, steam supply and air conditioning<br>**Section [35]:** Electricity supply, gas, steam supply and air conditioning<br>**Group [351]:** Electric power generation, transmission and distribution:<br>**Class [3511]:** Production of electricity |
| Scope of competences (*on core labor functions of professional standard or analysis profession*)** | **A .** Maintenance, operation, repair and modernization of equipment at power stations, substations, thermal and electrical networks<br>**B .** Determination of the production needs in fuel-energy resources<br>**C.** Testing, revealing of troubles and commissioning of equipment of power stations, substations, thermal and electrical networks<br>**D.** Organization of inspection and testing of relay protection and automation<br>**E.** Management and control over the activities of repair and maintenance unit of electric power stations and substations<br>**F.** Design and development using CAD electric stations and substations |

| **General (Basic) competencies** | | |
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| **Competence Code** | **Competence (in line with labor functions and skill levels)** | **Modules** |
| **Basic Competence** | | |
| BC 1 | Use professional vocabulary, make business papers in the field of professional activity | BM 1. Application of professional vocabulary, preparation of business |

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| | | papers in the field of professional activity |
| BC 2 | Understand the history, role and place of Kazakhstan in the world community | BM 02. Understanding the history, role and place of Kazakhstan in the world community |
| BC 3. | Maintain and develop an adequate level of physical fitness to ensure the full social and professional activities | BM 3. Development and improvement of physical qualities |
| BC 4. | Use the basics of philosophical knowledge, be aware of oneself and one's place in society, tolerate the social, political, ethnic, confessional and cultural values | BM 4. Use of the basics of philosophical knowledge and social sciences for socialization and adaptation in society and work collective |
| BC 5. | Understand the basic laws and mechanisms of the functioning of the modern economic system | BM 05. Application of the basic knowledge of the economy and knowledge of labor law and regulations to protect their rights in their professional activities |
| BC 6. | Perform sketches, diagrams and drawings, read the technological documentation, use the application packages of development programs of design and technological documentation | BM 06. Performance, design, reading of design and technological documentation using application programs |
| **Professional Competence** | | |
| PC 1. | Maintain and repair of equipment of power stations, substations, thermal and electrical networks | PM 01. Maintenance and repair of equipment of power stations, substations, electric and heat networks |
| PC 2. | Carry out work on the equipment operation of power plants, | PM 02. Maintenance of equipment of power |

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| | substations, thermal and electrical networks | stations, substations, thermal and electrical networks |
| PC 3. | Upgrade equipment of power stations, substations, thermal and electrical networks. | PM 03. Modernization of equipment power stations, substations, thermal and electrical networks |
| PC 4. | Determine the needs of the production in the fuel-energy resources | LP 04. Determination of needs in the production of fuel-energy resources. |
| 5 PC. | Organize acceptance and testing equipment of power stations, substations, thermal and electrical networks | PM 5. Acceptance and testing of equipment of power stations, substations, thermal and electrical networks |
| PC 6. | Inspect and monitor the operation of the test equipment, relay protection and Automatics | PM 6. Inspection and control of test equipment, relay protection and Automatics |
| PC 7. | Exercise management and control over the activities of the unit for repair and maintenance of electric power stations and substations | PM 7. Management and control over the activities of the unit for repair and maintenance of electric power stations and substations |
| 8 PC. | Use CAD for design of electric stations and substations | PM 8. The use of CAD SOFTWARE for designing power plants and substations |

## 4 LIST OF MODULES AND TRAINING OUTCOMES

| Module name | Learning outcomes (in accordance with the professional tasks) | Criteria evaluation learning outcomes | Module forming disciplines |
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| **Basic modules** | | | |
| BM 1. Application of professional vocabulary in the sphere of activities to meet the challenges of interpersonal and intercultural interaction | LO 1. To know lexical (1200-1400 lexical units) and grammatical minimum required for reading, translation and communication in the sphere of their professional activities. | 1. Knowledge of lexico-grammatical material, necessary for professional communication. | -Professional Kazakh (Russian) language;<br>-Professional foreign language; |
| | | 2. Use of terminology. | |
| | | 3. Definition of the unfamiliar words and phrases using dictionaries and reference books. | |
| | LO 2. To know translation methodology (with dictionary) of professionally oriented texts | 1. Reading and translation (with dictionary) texts of professional orientation.<br>2. Preparation of a coherent, logical, reasoned statements in accordance with the proposed topic. | |
| | LO 3. To work with organizational, administrative, information and reference documents using computer technologies | 1. Drawing up in Kazakh (Russian) and foreign languages a resume, autobiography, description, statement, complaint, power of attorney, receipt | |

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| | | 2. Compliance with the basic requirements for the text of the document | |
| | | 3. Creation of documents on the computer that meet modern requirements and established regulations | |
| BM 2. Understanding the history, the role and place of Kazakhstan in the world community, respectful and caring attitude to historical heritage and cultural traditions | LO1. To understand the role and place of culture of the peoples of the Republic of Kazakhstan in world civilization | 1. Knowledge of the history of national culture, the values of traditional Kazakh culture. | Modern history of Kazakhstan, Culturology |
| | | 2. Understanding the role and place of culture of the peoples of the Republic of Kazakhstan in world civilization. | |
| | | 3. Characteristics of the cultural achievements of independent Kazakhstan.. | |
| | LO2. To understand the moral values and norms that form tolerance and an active personal position | 1. Characteristic of the form, type and history of various cultures and civilizations. | |
| | | 2. Knowledge of history and understanding of the current state of the world and traditional religions. | |
| | | 3. Tolerant perception of social, ethnic, religious and cultural differences. | |
| | LO3. To understand the main historical events | CO 1. Knowledge of chronology and understanding of the essence of historical events that took place | |

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| | | from antiquity to the present. | |
| | | KO 2. Disclosure of the role and place of the Kazakh people in the common Turkic community, in the system of a nomadic civilization, in the development of the historical and cultural community of the peoples of the Eurasian world. | |
| | | CC 3. Understanding the nature and purpose of the political and social changes taking place in the Republic of Kazakhstan after independence. | |
| | | KO 4. Characteristics of the achievement of an independent Kazakhstan. | |
| | LO4. To determine causal relationships of historical events. | 1. Determination of the main facts, processes and phenomena, reflecting and characterizing the integrity and consistency of the history of Kazakhstan. | |
| | | 2. Establishing links between historical events | |
| | | 3. Use of historical sources. | |
| BM 03. Development and improvement of | LO 1. To strengthen health and to follow the | 1. Understanding the importance of physical culture for health promotion, the role of | -Physical education |

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| physical qualities | principles of a healthy lifestyle | physical culture and sports in the development of the country | |
| | | 2. Performance of physical exercises training complexes. | |
| | | 3. Application of rules of a healthy lifestyle in daily life. | |
| | LO 2. To improve the physical qualities and psychophysiological abilities | 1. Mastery of the exercise technique | |
| | | 2. Compliance with the rules of team sports | |
| | | 3. Application of the studied methods of games and individual tactical tasks in an educational game. | |
| | | 4. Implementation of control standards and tests provided by the program | |
| | LO3. Provide first aid for injuries and accidents | 1. Understanding the causes of injury during exercise, methods of injury prevention | |
| | | 2. Provision of first aid for injuries. | |
| | | 3. Estimation of the difficulty and risk arising during the execution of various physical activities, own and others physical capabilities | |
| BM 04. Application of | LO 1. To be aware of the most | 1. Possession of basic philosophical concepts. | - Basic philosophy; |

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| the foundations of philosophical knowledge, social sciences for socialization and adaptation in society and the workforce. | general philosophical questions. | 2. Explanation of the essence of the process of knowledge and different points of view on the process of knowledge in the history of philosophy. | - Basics of political science and sociology;<br>- Cultural Studies |
| | | 3. Description of the essence of the concepts "dialectic", "laws of dialectics", "being", "matter", "movement", "space and time". | |
| | | 4. Identification of the essence and relationship of the main categories of philosophy | |
| | | 5. Explaining the features of scientific, philosophical and religious pictures of the world. | |
| | LO 2. To determine the correlation in the life of a person of such philosophical categories as freedom and responsibility, material and spiritual values. | 1. Awareness of the degree of personal responsibility for the preservation of life, culture and the natural environment. | |
| | | 2. Explanation of the essence of social and ethical problems associated with the development and use of the achievements of science, technology and technology. | |

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| | | 3. The formulation of their own opinions about the ratio of material and spiritual values in human life.<br>concepts. | |
| | | 4. Analysis of various points of view on the categories of truth and the meaning of life, the formulation of one's own point of view on data | |
| | RO 3. Possess basic concepts of sociology and political science | 1. Possession of the main political science concepts: power, political system, political regime, state, forms of government, forms of government, political parties, party systems, political elite, political leadership, geopolitics. | |
| | | 2. Possession of the main sociological concepts: social relations, social phenomena, social processes, social progress. | |
| | | 3. The ratio of general social and political processes and individual facts. | |

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| | LO 4. To describe international political processes, geopolitical situation | 1. Explanation of the place and role of Kazakhstan in the modern world. | |
| | | 2. Description of the structure of the political system of the Republic of Kazakhstan. | |
| | | 3. Explanation of the nature and laws of the functioning of political culture. | |
| | LO 5. To explain the role and place of culture of the peoples of the Republic of Kazakhstan in world civilization | 1. Rendering of the history of national culture, values of traditional Kazakh culture. | |
| | | 2. Explanation of the role and place of culture of the peoples of the Republic of Kazakhstan in world civilization. | |
| | | 3. Description of the cultural achievements of independent Kazakhstan. | |
| | LO 6. Explain the moral values and norms that form tolerance and an active personal position. | 1. Description of the form, types and history of various cultures and civilizations. | |
| | | 2. Explanation of the history and current state of the world and traditional religions. | |

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| | | 3. The distinction between the judgments of extremist radical and terrorist ideologies. | |
| | | 4. Tolerant attitude towards social, ethnic, confessional and cultural differences. | |
| BM 5. Application of basic knowledge of the economy and knowledge of labor laws and regulations to protect their rights in their professional activities | LO1. To determine the forms and types of ownership, types of plans, basic economic indicators of the enterprise | 1. Perform the necessary economic calculations using mathematical methods | - Basics of Economic; Law basics |
| | | 2. Discussion of the main economic indicators of the enterprise | |
| | | 3. Carrying out measurements of the cost of working time to perform a certain work | |
| | | 4. Determination of methods for reducing costs and increasing profitability. | |
| | LO 2. To understand the development trends of the world economy, the main objectives of the state's transition to a green economy | 1. Understanding the main objectives of the state's transition to a green economy | |
| | | 2. The use of basic methods for calculating gross domestic product and gross national product | |
| | | 3. Definition of global economic problems, ways to overcome them | |

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| | LO 3. To protect rights in accordance with labor laws | 1. Understanding the legal status in the formation of the identity of a citizen in accordance with the provisions of the Constitution of the Republic of Kazakhstan | |
| | | 2. Application of evidence-based argumentation of one's own position in specific legal situations using normative acts. | |
| | | 3. Understanding of responsibility for administrative and corruption offenses. | |
| BM 06. Performance, design, reading of design and technological documentation using application programs | LO1. To follow the rules of documentation design | 1. Understanding rules for documentation design. | Engineering graphics. Computer design. |
| | | 2. Making drawings according to the rules of a unified system of design of documentation. | |
| | | 3. Determination of the purpose and scale of the drawing technical details. | |
| | | 4. Compliance with the requirements of the unified system for design documentation (ESKD). | |
| | LO2. To have the skills of projecting on the plane | 1. Execution and design of the necessary cuts on the drawings. | |
| | | 2. Perform axonometric projection. | |

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| | | 3. Execution of drawings of schemes according to symbols according to a single system of design documentation. | |
| | | 4. Application of computer graphics techniques. | |
| | LO3.<br>To develop and design schemes for the specialty with the help of the application package. | 1. Execution of specialty schemes using technical drawing tools. | |
| | | 2. The use of modern software applications. | |
| | | 3. Computer graphics, 3D graphics. | |
| **Professional modules** | | | |
| PM 01. Maintenance and repair of equipment of power plants, substations, electrical and thermal networks | LO 1. To define according to the results of the preventive inspection and external general serviceability of equipment and the complexity of forthcoming repair | 1. Definition of classification, scope, purpose, parameters and operation equipment | -Basics of technical mechanics;<br>-Theoretical bases of electrical engineering and thermal engineering;<br>-Electric machines and transformers;<br>-Electric stations and substations;<br>Maintenance and repair of equipment;<br>-Record keeping;<br>-Training; |
| | | 2. Conduct of external revision of general condition of equipment | |
| | | 3. Provision of reasons of equipment failure | |
| | LO 2. To choose ways of maintenance and repair of power equipment | 1. Listing of the maintenance works of electrical installations and repairs | |
| | | 2. Scheduling of preventive maintenance of equipment and networks | |
| | | 3. Alignment of the selected methods of repair and services | |

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| | LO 3. Apply optimum variants of technology of repair of energy equipment, thermal and electrical networks | 1. Compliance with technology repair<br>2. Demonstration of technology repairs with due regard to safety and<br>3. Evaluation of the cost and effectiveness of refurbishment | |
| PM 02. Maintenance of equipment of power stations, substations, thermal and electrical networks | LO 1. To explain technical specifications, design features, modes of operation and rules of technical operation of power equipment | 1. Listing of the specifications, design features of operation | -Basics of technical mechanics;<br>-Theoretical bases of electrical engineering and thermal engineering;<br>-Operation of an electric equipment of electric stations and substations;<br>-Thermal power stations and pipelines;<br>-Occupational safety and health;<br>-Materials;<br>-Training; |
| | | 2. Characterization of the modes of operation and rules of technical operation | |
| | | 3. Correlation of technical specifications, design features of equipment under conditions of exploitation | |
| | LO 2. To determine the types of work for equipment operation | 1. Definition of tools for maintenance of equipment | |
| | | 2. Following the safety rules when operating equipment | |
| | | 3. Identification of works for the exploitation of equipment | |
| | LO 3. To apply optimum modes of operation of power equipment | 1. Selection of tools for maintenance of equipment<br>2. Characteristics of the main directions of operation of equipment<br>3. Performance of a sequence of actions in compliance with the safety instructions when operating the equipment | |

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| PM 03. Modernization equipment power stations, substations, thermal and electrical networks | LO 1. To justify the objectives and phases of modernization energy equipment | 1. conduct a SWOT analysis of the need to modernize<br>2. Choice of modernization<br>3. rationale for the objectives and phases of modernization of power equipment | -Basics of industrial electronics;<br>-Electrical measurements;<br>-Materials;<br>Installation, adjustment and repair of electrical equipment;<br>-Introduction of new technologies;<br>-Record keeping;<br>-Occupational safety and health;<br>-Training; |
| | LO 2. To upgrade power generating equipment, thermal and electrical networks | 1. Select tools for equipment upgrading<br>2. Safety in the process of modernization<br>3. Retrofitting energy equipment | |
| | LO 3. To test equipment of electric and heat networks after upgrading | 1. Preparation for the test<br>2. Application of the test methods<br>3. Reporting carried out modernization | |
| PM 04. Definition of needs in the production of fuel-energy resources. | LO 1. To play the main provisions of energy balances and energy efficiency indicators of production systems | 1. Expression of the nature and necessity of accounting in the enterprise<br>2. Difference in material, labor and financial resources of the enterprise<br>3. Reproduction of the main provisions of the compilation of energy balances and the calculation of energy efficiency indicators of production systems | -Economics and production management;<br>-Energy-and resource-saving technologies in power systems and complexes;<br>-Energy Economics;<br>-Energy and the environment;<br>-Record keeping;<br>-Internship |
| | LO 2. To carry out energy audits and prepare energy balance enterprises | 1. Difference in fixed assets by type.<br>2. Analysis of the activities of the enterprise for the main production and economic indicators. | |

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| | | 3. Conduct an energy audit and compile the energy balance of the enterprise. | |
| | LO3. To conduct economic analysis and calculation of plant needs | 1. Methods of rationing and distribution of energy resources energy consumption<br>2. Development of measures for the efficient allocation of energy resources<br>3. Economic analysis needs of power facilities | |
| PM 5. Acceptance and test equipment of power stations, substations, thermal and electrical networks | LO 1. To test power equipment | 1. Enumeration of the types of tests of power equipment<br>2. Explanation of the test phases<br>3. Demonstration test of power equipment | -Electrical measurements;<br>-Repair, adjustment and testing of electrical equipment;<br>-Materials;<br>-Record keeping;<br>-Occupational safety and health;<br>-Training; |
| | LO 2. To identify energy failure equipment | 1. Explanation of the causes of failures of equipment<br>2. Evaluation of complexity of fault equipment<br>3. Offer solutions to troubleshooting | |
| | LO 3. To lead regulatory and technical documentation on acceptance | 1. Compliance with the rules of drafting of normative-technical documentation<br>2. Work with specialized computer programs<br>3. Preparation of test defective statements | |
| PM 6. Inspection and monitoring of the operation of instrumentation, means of relay | LO 1. To organize a test of the operation of relay protection, automation and measurement devices | 1. Description of the structures, the principles of action, the technical characteristics of the elements of relay protection, automation | -Relay protection and Automatics;<br>-Basics of electric drive; |

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| protection and automation | | 2. Enumeration of validation methods, ways of regulating relays, automation, calibration of measuring instruments<br>3. Programming testing of relay protection and automation devices<br>4. Follow the instructions and required methodic instructions when checking the Relay device | -Basics of industrial electronics;<br>-Electrical measurements;<br>-Record keeping;<br>-Occupational safety and health;<br>-Training; |
| | LO 2. To carry out the adjustment and the adjustment of relay protection | 1. Explanation of the principles of relay protection settings<br>2. Preparation of normative-technical documentation<br>3. Conduction of adjustment and adjustment of relay protection | |
| | LO 3. To test relay protection and automation tools | 1. Enumeration of types of testing of relay protection<br>2. Test mapping, implementation of assembly means of relay protection<br>3. Demonstration test of relay protection | |
| PM 7. Management and control over the activities of the unit for repair and maintenance of electric power | LO 1. To plan the work of a production unit | 1. Application of the tools and techniques of production planning<br>2. Compilation of job descriptions of personnel, operational-technical documentation<br>3. Planning of industrial division | -Metrology, standardization and measurement tools;<br>-Organization of electric energy |

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| stations and substations | LO 2. To manage the activities of a production unit | 1. Application of the principles and strategies for lean manufacturing<br>2. Evaluation of working conditions in the workplace<br>3. Management of the production unit | accounting system;<br>-Network management of electricity and heat;<br>-Principles of management;<br>-The basics of lean manufacturing;<br>-Record keeping;<br>-Occupational safety and health;<br>-Training; |
| | LO 3. To control over quality of production units | 1. Maintenance of normative-technical and Executive documentation<br>2. Ensuring compliance with the rules and norms of labor protection in the operation of power plants and networks<br>3. Implementation of the quality control work of the production unit | |
| PM 8. Application of CAD software for designing power plants and substations | LO 1. To collect and analyze the initial data for designing | 1. Establishment of baseline data for design<br>2. Analysis of financial and economic part of design objects<br>3. Development of technical documentation | Engineering and computer graphics;<br>-Descriptive geometry;<br>-Electric networks of power supply systems;<br>-Economy industry<br>-Math problems and computer modeling in |
| | LO 2. To calculate the parameters of objects in accordance with the terms of reference | 1. Calculation of estimated cost<br>2. Use of methods of mathematical and physical modeling modes, processes and States of objects<br>3. Calculation of parameters of objects in accordance with the terms of reference | |

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| | LO 3. To design objects with use of CAD | 1. Knowledge of a basic skills of work with CAD<br>2. Compliance with the rules of design and technological documentation<br>3. Designing of objects using CAD | electric power industry;<br>-Record keeping;<br>-Training; |

## 4.1 Specification of base unit 1
## "Application of professional vocabulary, the preparation of business papers in the field of professional activity'"

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| **Scope of competence** | Basic |
| **Module name** | Application of professional vocabulary, the preparation of business papers in the field of professional activity |
| **Purpose of the module** | After studying this module, the student will be able to solve actual problems of communication in various fields of professional activity; |
| **Level of professional qualification** | 5 |
| **Learning Outcomes by Module** | LO 1. To know lexical (1200-1400 lexical units) and grammatical minimum required for reading, translation and communication in the sphere of their professional activities.<br>LO 2. To know the technology of translation (with dictionary) professionally-oriented texts.<br>TO 3. To conduct professional dialogues and business talks in Kazakh (Russian) and foreign languages. |
| **Summary of Content (sections, themes)** | 1.Knowledge of lexico-grammatical material, necessary for professional communication.<br>2. Application of terminology.<br>3. Definition of the unfamiliar words and phrases using dictionaries and reference books.<br>4. Reading and translation (with dictionary) texts of professional orientation.<br>5. Preparation of a coherent, logical, reasoned statements in accordance with the proposed topic.<br>6. Logically and consistently to provide opinions in accordance with the situation.<br>7. Drawing up in Kazakh (Russian) and foreign languages a summary, autobiography, description, statement, complaint, power of attorney, receipt<br>8. Compliance with the basic requirements for the text of the document.<br>9. Creation of documents on the computer that meet modern requirements and established regulations |
| **Prerequisites** | Kazakh, Russian, foreign languages |

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| **Module forming disciplines** | - Professional Kazakh (Russian) language<br>- Professional foreign language |
| **Module type (mandatory, optional)** | Mandatory |
| **Labor intense (credits RK/academic hours)** | 6 credits / 180 hours |
| **The duration of the module** | 3-5 semester |
| **Form of teaching** | Full-time |
| **Teaching methods** | Lecture, practical. |
| **Control Forms** | Pass fail exam, exam |
| **Required Resources** | Personal computer software.<br>Educational and methodical literature:<br>T.I. Akhmetov “Professional Kazakh language»;<br>T.M. Voiteleva “Russian language and speech. Didactic materials”;<br>A.L. Lugovaya “English for students of energy majors: a training manual” |
| **Language of instruction** | Russian, Kazakh |
| **Post-requisites** | -Record keeping;<br>-Introduction to the field. |

## 4.2 Specification of basic module 2
## "Understanding the history, role and place of Kazakhstan in the world community"

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| **Scope of competence** | Basic |
| **Module name** | Understanding the history, role and place of Kazakhstan in the world community |
| **Purpose of the module** | After completion of the module, the student will explain the history, role and place of Kazakhstan in the world community. |
| **Level of professional qualification** | 5 |
| **Learning Outcomes by Module** | LO 1. To identify major historical events<br>LO 2. To determine causal relationships of historical events. |
| **Summary of Content (sections, themes)** | 1. Description of the chronology and essence of historical events that occurred from antiquity to the present.<br>2. Disclosure of the role and place of the Kazakh people in the common Turkic community, in the system of nomadic civilization, in the development of the history of the cultural community of the peoples of the Eurasian world.<br>3. Explanation of the nature and purpose of political and social changes taking place in the Republic of Kazakhstan after independence.<br>4. Review of the achievements of independent Kazakhstan.<br>5. Determination of the main facts, processes and phenomena that reflect and characterize the integrity and consistency of the history of Kazakhstan.<br>6. Establishing the connection between historical events. |
| **Prerequisites** | -World history;<br>-History of Kazakhstan; |
| **Module forming disciplines** | World history;<br>-History of Kazakhstan; |
| **Module type (mandatory, optional)** | Mandatory |

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| **Labor intense (credits RK/academic hours)** | 4 credits / 120 hours |
| **Duration of the module** | 3-4 semester |
| **Form of teaching** | Full-time |
| **Teaching methods** | Lecture, practical. |
| **Control Forms** | Pass fail exam, exam |
| **Required Resources** | Personal computer, software.<br>Toleubaeva K., Naumova Y., Kopekbai A. "History of Kazakhstan"; Smagulova S., Kydyrkozhaeva N. "Man. Society. Right." |
| **Language of instruction** | Russian, Kazakh |
| **Post-requisites** | - Culturology;<br>- Philosophy;<br>- Political science;<br>- Sociology. |

## 4.3 Specification of basic module 3
## "Development and improvement of physical qualities"

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| **Scope of competence** | Basic |
| **Module name** | Development and improvement of physical qualities |
| **Purpose of the module** | After studying this module, the trainee will follow healthy lifestyles for his/her mental and physical abilities in the course of daily activities. |
| **Level of professional qualification** | 5 |
| **Learning Outcomes by Module** | LO 1. Strengthen health and abide by the principles of a healthy lifestyle.<br>LO 2. Improve physical qualities and psycho-physiological abilities<br>LO 3. Provide first aid for injuries and accidents. |
| **Summary of Content (sections, themes)** | 1. Explanation of the principles and rules of a healthy lifestyle.<br>2. Description of the physiological basis of the activity of the respiratory, circulatory and energy supply systems under muscle loads.<br>3. Performing sets of exercises for general physical training.<br>4. Application of the rules of a healthy lifestyle in everyday life.<br>5. Compliance with the rules of team sports.<br>6. Description of the basics of physical activity and methods of its regulation.<br>7. Possession of technical accomplishments of the exercise.<br>8. Application of the studied methods of games and individual tactical tasks in the educational game.<br>9. Implementation of control standards and tests provided by the program.<br>10. Explanation of the causes of injuries during exercise, methods of injury prevention.<br>11. Providing medical care for injuries. |
| **Prerequisites** | Biology (Anatomy) |
| **Module forming disciplines** | - Physical culture |
| **Module type (mandatory, optional)** | Mandatory |

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| **Labor intense (credits RK/academic hours)** | 6 credits/180 hours |
| **Duration of the module** | 1-8 semester |
| **Form of teaching** | Full-time |
| **Teaching methods** | Methods of education of motor qualities: uniform method, variable method, repeated method, interval method, competitive method, game method, circular method. |
| **Control Forms** | Pass fail exam, exam |
| **Required Resources** | Showing movements in kind or in the form of images, sports equipment.<br>M. Gandil, F. Delave “Anatomy of strength training for women”; Yu. Kokkonen, A. Nelson, “Anatomy of stretching exercises. Illustrated manual for development of flexibility and muscle strength;; |
| **Language of instruction** | Russian, Kazakh |
| **Post-requisites** | Occupational safety and health |

## 4.4 Specification of the basic module 4 “Application of the foundations of philosophical knowledge, social sciences for socialization and adaptation in society and the workforce”

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| **Scope of competence** | Basic |
| **Module name** | Application of the basics of philosophical knowledge, social sciences for socialization and adaptation in society and the workforce |
| **Purpose of the module** | After studying this module, the student will be able to apply the basics of philosophical knowledge, social sciences for socialization and adaptation in society and the workforce. |
| **Level of professional qualification** | 5 |
| **Learning Outcomes by Module** | LO 1. To be aware of the most general philosophical questions.<br>LO 2. To determine the correlation in the life of a person of such philosophical categories as freedom and responsibility, material and spiritual values.<br>LO 3. To know basic concepts of sociology and political science.<br>LO 4. To describe international political processes, geopolitical situation.<br>LO 5. To explain the role and place of culture of the peoples of the Republic of Kazakhstan in world civilization.<br>LO 6. To explain the moral values and norms that form tolerance and an active personal position. |
| **Summary of Content (sections, themes)** | 1. Knowledge of basic philosophical concepts.<br>2. Explanation of the essence of the process of knowledge and different points of view on the process of knowledge in the history of philosophy.<br>3. Description of the essence of the concepts "dialectic", "laws of dialectics", "being", "matter", "movement", "space and time".<br>4. Identification of the essence and relationship of the main categories of philosophy.<br>5. Explanation of the features of scientific, philosophical and religious pictures of the world.<br>6. Awareness of the degree of personal responsibility for the preservation of life, culture and the natural environment. |

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| | 7. Explanation of the essence of social and ethical problems associated with the development and use of the achievements of science, technology and technology.<br>8. Formulation of his/her own opinion about the ratio of material and spiritual values in human life.<br>9. Analysis of various points of view on the categories of truth and the meaning of life, the formulation of his own point of view on these concepts.<br>10. Possession of the main political science concepts: power, political system, political regime, state, forms of government, forms of government, political parties, party systems, political elite, political leadership, geopolitics.<br>11. Possession of the main sociological concepts: social relations, social phenomena, social processes, social progress.<br>12. The ratio of general social and political processes and individual facts.<br>13. Explaining the place and role of Kazakhstan in the modern world.<br>14. Description of the structure of the political system of the Republic of Kazakhstan.<br>15. Explanation of the nature and laws of the functioning of political culture.<br>16. Reproduction of the history of national culture, values of traditional Kazakh culture.<br>17. Explanation of the role and place of culture of the peoples of the Republic of Kazakhstan in the world civilization.<br>18. Description of the cultural achievements of independent Kazakhstan.<br>19. Description of the form, types and history of various cultures and civilizations.<br>20. Explanation of the history and current state of the world and traditional religions.<br>21. Distinction between the judgments of extremist radical and terrorist ideologies.<br>22. Tolerant attitude to social, ethnic, religious and cultural differences. |
| **Prerequisites** | - The World History;<br>- History of Kazakhstan;<br>- Basics of economic theory. |

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| **Module forming disciplines** | Basic Philosophy<br>- Basics of political science and sociology<br>- Cultural Studies |
| **Module type (mandatory, optional)** | Mandatory |
| **Labor intense (credits /academic hours)** | 6 credits / 180 hours |
| **Duration of the module** | 3-4 semester |
| **Form of teaching** | Full-time |
| **Teaching methods** | Lecture, practical. |
| **Control Forms** | Pass fail exam |
| **Required Resources** | Personal computer, software.<br>A.A. Gorelov "Fundamentals of Philosophy"; Kravchenko A.I. "Fundamentals of Sociology"; Demidov N. M. “Fundamentals of Sociology and Political Science. Textbook"; Mamontov S.P. "Basics of Cultural Studies" |
| **Language of instruction** | Russian, Kazakh |
| **Post-requisites** | Basics of entrepreneurship;<br>- Business Law of RK. |

## 4.5 Specification of the basic module 5
## "Application of basic knowledge of the economy and knowledge of labor laws and regulations to protect rights in their professional activities"

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| **Scope of competence** | - |
| **Module name** | Application of basic knowledge of economics and knowledge of labor laws and regulations to protect their rights in their professional activities |
| **Purpose of the module** | After studying the module, the student will be able to understand the basic laws and mechanisms of the functioning of the modern economic system. |
| **Level of professional qualification** | 5 |
| **Learning Outcomes by Module** | 1. To determine the forms and types of ownership, types of plans, the main economic indicators of the enterprise<br>2. To understand the development trends of the world economy, the main objectives of the state's transition to a green economy<br>3. To protect rights in accordance with labor laws<br>4. To know basic concepts of law and state-legal phenomena |
| **Summary of Content (sections, themes)** | 1. Perform the necessary economic calculations using mathematical methods<br>2. Discussion of the main economic indicators of the enterprise 3. Measurement of the cost of working time to perform a certain work<br>4. Definition of methods to reduce costs and increase profitability<br>5. Understanding the main objectives of the state's transition to a green economy<br>6. Application of basic methods for calculating gross domestic product and gross national product<br>7. Definition of global economic problems, ways to overcome them<br>8. Understanding the legal status in the formation of the identity of a citizen in accordance with the provisions of the Constitution of the Republic of Kazakhstan<br>9. Application of evidence-based argumentation of one's own position in specific legal situations using regulatory acts.<br>10. Understanding of responsibility for administrative and corruption offenses. |

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| **Prerequisites** | - School program: Man and Society, Basics of Law, Geography |
| **Module forming disciplines** | Basics of Economics<br>Basics of Law |
| **Module type (mandatory, optional)** | Mandatory |
| **Labor intense (credits /academic hours)** | 4 credits / 120 hours |
| **The duration of the module** | 1-2 semester |
| **Form of teaching** | Pass fail exam |
| **Teaching methods** | Traditional teaching methods - lectures, practical classes, problem solving methods,<br>interactive teaching methods |
| **Control Forms** | Literal rating system on a 100-point scale, mid-term control, current control, exam, final grade |
| **Required Resources** | Library fund, Internet classes, typical educational, electronic educational resources |
| **Language of instruction** | Russian, Kazakh |
| **Post-requisites** | - Principles of Philosophy, Labor Law of the Republic of Kazakhstan, Family Law of the Republic of Kazakhstan. |

## 4.6 Specification of the basic module 6 "Performance, design, reading of design and technological documentation using application programmes"

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| **Scope of competence** | - |
| **Module name** | Performance, design, reading of design and technological documentation using application programs |
| **Purpose of the module** | After studying this module, the student will be able to perform, design, read design and technological documentation using application programs. |
| **Level of professional qualification** | 5 |
| **Learning Outcomes by Module** | 1. To follow the rules of design documentation.<br>2. To have the skills of projecting on the plane.<br>3. To develop and design schemes for the specialty with the help of the application package. |
| **Summary of Content (sections, themes)** | 1. Understanding the rules for design documentation.<br>2. Design drawings according to the rules of a single system of design documentation.<br>3. Definition of the purpose and scale of the drawing technical details.<br>4. Compliance with the requirements of the unified system of design documentation (ESKD).<br>5. Execution and registration of the necessary cuts on the drawings.<br>6. Perform axonometric projection.<br>7. Execution of drawings of schemes according to symbols according to a single system of design documentation.<br>8. Application of computer graphics techniques.<br>9. Implementation of schemes in the specialty, using the means of technical drawing.<br>10. The use of modern software applications.<br>11. Knowledge of computer graphics, the use of 3D-graphics. |
| **Prerequisites** | - Mathematics, geometry and stereometry of the school program; Computer science; Object Oriented Programming. |
| **Module forming disciplines** | -Engineering graphics;<br>- Computer design. |
| **Module type (mandatory, optional)** | Mandatory/Optional |

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| **Labor intense (credits /academic hours)** | 4 credits /120 hours |
| **Duration of the module** | 1 semester |
| **Form of teaching** | Full-time |
| **Learning technology** | Modular (local); different levelled |
| **Teaching methods** | Verbal (conversation, lecture); visual practical; problem search; reproductive; inductive; case method |
| **Control Forms** | Pass fail exam, exam |
| **Required Resources** | Personal Computer; software; presentations; electronic resources; support cards; handouts. |
| **Language of instruction** | Russian, Kazakh |
| **Post-requisites** | Basics of computer simulation. |

**4.7 Specification of professional module 1 "Maintenance and repair of equipment of power stations, substations, electric and heat networks"**

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| **Scope of competence** | Maintenance, operation, repair, and modernization of equipment of power stations, substations, thermal and electrical networks |
| **Name and code of the module** | PM 01. Maintenance and repair of equipment of power stations, substations, electric and heat networks |
| **Purpose of the module** | After studying this module the trainee will be able to maintenance and repair of equipment of power stations, substations, electric and heat networks. |
| **Level of professional qualification** | 5 |
| **Leaning outcomes for the module** | LO 1. To define according to the results of the preventive inspection and external general serviceability of equipment and the complexity of forthcoming repair<br>LO 2. To choose ways of maintenance and repair of power equipment<br>LO 3. To apply optimum variants of technology of repair of energy equipment, thermal and electrical networks |
| **Summary of Content (sections, themes)** | 1. Definition of types, classifications, scope, purpose, parameters and principle of operation of equipment;<br>2. Conduction of an external examination of the general condition of the equipment;<br>3. Justification of the causes of equipment malfunction;<br>4. Enlisting the routine maintenance of electrical equipment and types of repair;<br>5. Scheduling of preventive maintenance of equipment and networks;<br>6. Corresponding of the selected methods of repair and types of maintenance;<br>7. Compliance with the repair technology;<br>8. Demonstration of the technology of repair work in compliance with safety regulations;<br>9. Evaluation of the cost and effectiveness of the repair. |
| **Prerequisites** | Geometry, physics, drawing |
| **Module forming disciplines** | -Basics of technical mechanics; |

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| | -Theoretical bases of electrical engineering and thermal engineering;<br>-Electric machines and transformers;<br>-Electric stations and substations;<br>Maintenance and repair of equipment;<br>-Record keeping;<br>-Training. |
| **Module type (mandatory, optional)** | Mandatory |
| **Labor intense (credits RK/academic hours)** | 18 credits / 540 hours |
| **The duration of the module** | 3-8 semester |
| **Form of teaching** | Full-time |
| **Education technology** | Modular |
| **The form of organization of educational process. Teaching methods.** | Lecture, independent work, practical. |
| **Control Forms** | Pass fail exam, exam |
| **Required Resources** | Personal computer, software, stands.<br>M. Moldakulova “Mechanical Engineering Technology”<br>B. Kangozhin “Basics of electric power generation”;<br>B. Yashkov “Commissioning of electrical equipment”;<br>M.M. Katzman “Electrical machines”;<br>Yu.D. Sibikin “Maintenance, repair of electrical equipment and networks of industrial enterprises;<br>Yu.D. Sibikin “Reference for an electrician to repair electrical equipment of industrial enterprises”; |
| **Language of instruction** | Russian, Kazakh |
| **Post-requisites** | -Basics of technical mechanics;<br>-Theoretical bases of electrical engineering and thermal engineering;<br>-Operation of an electric equipment of electric stations and substations;<br>-Thermal power stations and pipelines;<br>-Occupational safety and health;<br>-Materials;<br>-Training; |

## 4.8 Specification of the professional module 2 "Operation of equipment of power plants, substations, thermal and electrical networks"

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| **Scope of competence** | Maintenance, operation, repair, and modernization of equipment of power stations, substations, thermal and electrical networks |
| **Name and code of the module** | PM 02. Operation of equipment of power stations, substations, thermal and electrical networks |
| **The purpose of the module** | After studying this module the trainee will be able to carry out work on the equipment operation power stations, substations, thermal and electrical networks. |
| **Level of professional qualification** | 5 |
| **Learning outcomes for the module** | LO 1. To explain technical specifications, design features, modes of operation and rules of technical operation of power equipment<br>LO 2. To determine the types of work for equipment operation<br>LO 3. To apply optimum modes operation of power equipment |
| **Summary of Content (sections, themes)** | 1. Listing of the specifications, design features;<br>2. Characterization of the modes of operation and rules of technical operation;<br>3. Correlation of technical specifications, design features of equipment under conditions of exploitation;<br>4. Definition of tools for maintenance of equipment;<br>5. Following the safety rules when operating the equipment;<br>6. Identification of works for the exploitation equipment;<br>7. Selection of instruments for the operation of the equipment;<br>8. Characteristics of the main directions of the exploitation equipment;<br>9. Perform a sequence of actions in compliance with the safety instructions when operating the equipment; |
| **Prerequisites** | -Basics of technical mechanics;<br>-Theoretical bases of electrical engineering and thermal engineering; |

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|---|---|
| | -Electric machines and transformers;<br>-Electric stations and substations;<br>Maintenance and repair of equipment; |
| **Module forming disciplines** | -Basics of technical mechanics;<br>-Theoretical bases of electrical engineering and thermal engineering;<br>-Operation of an electric equipment of electric stations and substations;<br>-Thermal power stations and pipelines;<br>-Occupational safety and health;<br>-Materials;<br>-Training; |
| **Module type (mandatory, optional)** | Mandatory |
| **Labor intense (credits /academic hours)** | 18 credits / 540 hours |
| **Duration of the module** | 3-8 semester |
| **Form of teaching** | Full-time |
| **Education technology** | Modular |
| **Form of organization of educational process. Teaching methods.** | Lecture, independent work, practical. |
| **Control Forms** | Pass fail exam, exam |
| **Required Resources** | Personal computer, software, stands.<br>A. Ajtimov, “Electrical Engineering”;<br>V.L. Likhachev “Handbook for a wrapper of induction motors”;<br>A.A.Fedorchenko, Yu.G. Sindeyev “Electrical equipment with the basics of Electronics: Textbook for Students of vocational colleges, lyceums and schools”;<br>Zh. Amanzholov “OSH in energy systems”; |
| **Language of instruction** | Russian, Kazakh |
| **Post-requisites** | -Basics of industrial electronics;<br>-Electrical measurements;<br>-Materials;<br>Installation, adjustment and repair of electrical equipment;<br>-Introduction of new technologies;<br>-Record keeping;<br>-Occupational safety and health;<br>-Training. |

## 4.9 Specification of the professional module 3 "Modernization of equipment of power stations, substations, thermal and electrical networks"

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| **Scope of competence** | Maintenance, operation, repair, and modernization of equipment of power stations, substations, thermal and electrical networks |
| **Name and code of the module** | PM 03. Modernization of equipment of power stations, substations, thermal and electrical networks |
| **The purpose of the module** | After studying this module the trainee will be able to carry out modernization of equipment of power stations, substations, thermal and electrical networks |
| **Level of professional qualification** | 5 |
| **Learning outcomes for the module** | LO 1. To justify the objectives and phases of modernization energy equipment<br>LO 2. To upgrade power generating equipment, thermal and electrical networks<br>LO 3. To test equipment of electric and heat networks after upgrading |
| **Summary of Content (sections, themes)** | 1. SWOT-analysis of the need for modernization<br>2. Selection of types of modernization<br>3. Rationale for the objectives and phases of modernization of power equipment<br>4. Selection of tools for equipment upgrading<br>5. Following the safety rules in the process of modernization<br>6. Retrofitting of energy equipment<br>7. Preparation for the test<br>8. Application of the test methods<br>9. Reporting on carried out modernization |
| **Prerequisites** | -Basics of technical mechanics;<br>-Theoretical bases of electrical engineering and thermal engineering;<br>-Operation of an electric equipment of electric stations and substations;<br>-Thermal power stations and pipelines;<br>-Occupational safety and health;<br>-Materials;<br>-Training; |
| **Module forming disciplines** | -Basics of industrial electronics;<br>-Electrical measurements;<br>-Materials; |

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|---|---|
| | Installation, adjustment and repair of electrical equipment;<br>-Introduction of new technologies;<br>-Record keeping;<br>-Occupational safety and health;<br>-Training; |
| **Module type (mandatory, optional)** | Mandatory |
| **Labor intense (credits RK/academic hours)** | 6 credits/ 180 hours |
| **Duration of the module** | 3-8 semester |
| **Form of teaching** | Full-time |
| **Education technology** | Modular |
| **Form of organization of educational process. Teaching methods.** | Lecture, independent work, practical. |
| **Control Forms** | Pass fail exam, exam |
| **Required Resources** | Personal computer, software, laboratory equipment.<br>Zh. Amanzholov "OSH in energy systems"; V.V. Krasnik "Questions and answers on rational exploitation and safe service of electroinstallations of consumers\|; V.I. Skala, N.V.Skala, B.V. Skala "Office work in the Republic of Kazakhstan (with samples of forms + CD) in Kazakh and Russian languages"; B. Minto "Minto's pyramid principle". The golden rules of thinking, business letters and oral presentations";<br>Yu.D. Sibikin "Labor safety during assembly, maintenance and repair of electrical equipment of enterprises: directory"; V.A. Panfilov "Electrical measurements. Textbook for students of institutions of secondary professional education; V.V. Pankratov, S.A. Pokotilo "Electrical and electronics engineering. Tutorial" |
| **Language of instruction** | Russian, Kazakh |
| **Post-requisites** | -Economics and production management;<br>-Energy-and resource-saving technologies in power systems and complexes;<br>-Energy Economics;<br>-Energy and the environment Wednesday;<br>-Electrical measurements; |

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| | -Repair, adjustment and testing of electrical equipment;<br>-Materials;<br>-Occupational safety and health;<br>-Record keeping;<br>Production practice. |

## 4.10 Specification of the professional module 4 "Identification of the production needs in fuel-energy resources"

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| **Scope of competence** | Definition of needs in the production of fuel-energy resources |
| **Name and code of the module** | LP 04. Identification of the production needs in fuel-energy resources. |
| **Purpose of the module** | After studying this module, the trainee will be able to determine the needs of the production in the fuel and energy resources. |
| **Level of professional qualification** | 5 |
| **Learning outcomes for the module** | LO 1. To know the main provisions of energy balances and energy efficiency indicators of production systems<br>LO 2. To carry out energy audits and prepare energy balance of enterprises<br>LO3. To conduct economic analysis and calculation of plant needs |
| **Summary of Content (sections, themes)** | 1. Expression of the nature and necessity of accounting in the enterprise;<br>2. Distinction of material, technical, labor and financial resources of an enterprise;<br>3. Reproduction of the main provisions of the compilation of energy balances and the calculation of energy efficiency indicators of production systems;<br>4. Difference in fixed assets by type;<br>5. Analysis of the activities of the enterprise for the main production and economic indicators;<br>6. Conducting energy audits and compiling the energy balance of the enterprise;<br>7. Methods of rationing and distribution of energy resources of energy consumption;<br>8. Development of measures for the economical distribution of fuel and energy resources;<br>9. Conducting an economic analysis of the needs of power facilities. |
| **Prerequisites** | -Basics of industrial electronics;<br>-Electrical measurements;<br>-Materials;<br>Installation, adjustment and repair of electrical equipment;<br>-Introduction of new technologies; |

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| | -Record keeping;<br>-Occupational safety and health;<br>-Training; |
| **Module forming disciplines** | -Economics and production management;<br>-Energy-and resource-saving technologies in power systems and complexes;<br>-Energy Economics;<br>-Energy and the environment Wednesday;<br>-Record keeping;<br>Production practice. |
| **Module type (mandatory, optional)** | Mandatory |
| **Labor intense (credits RK/academic hours)** | 7 credits / 210 hours |
| **Duration of the module** | 3-8 semester |
| **Form of teaching** | Full-time |
| **Education technology** | Modular |
| **Form of organization of educational process. Teaching methods.** | Lecture, independent work, practical. |
| **Control Forms** | Pass fail exam, exam |
| **Required Resources** | Personal computer software stands.<br>L. Polulyakh "Economic social geography of the world";<br>V.V. Krasnik "Market electricity: connect to power grids, the purchase and sale of electricity;<br>Zh. Amanzholov "OSH in energy systems";<br>D.P. Vumek, D. Jones "Economical production. How to get rid of losses and achieve prosperity of your company; V.I. Skala, N.V.Skala, B.V. Skala "Office work in the Republic of Kazakhstan (with samples of forms + CD) in Kazakh and Russian languages"; B. Minto "Minto's pyramid principle". The golden rules of thinking, business letters and oral presentations"; |
| **Language of instruction** | Russian, Kazakh |
| **Post-requisites** | -Electrical measurements;<br>-Repair, adjustment and testing of electrical equipment;<br>-Materials;<br>-Record keeping;<br>-Occupational safety and health;<br>-Training. |

## 4.11 Specification of professional module 5 "Acceptance and testing of equipment of power stations, substations, thermal and electrical networks"

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| **Scope of competence** | Testing, troubleshooting and commissioning of equipment of power stations, substations, thermal and electrical networks |
| **Name and code of the module** | PM 5. Acceptance and testing of equipment of power stations, substations, thermal and electrical networks |
| **Purpose of the module** | After studying this module the trainee will be able to carry out acceptance and test equipment of power stations, substations, thermal and electrical networks |
| **Level of professional qualification** | 5 |
| **Learning outcomes for the module** | LO 1. To test power equipment<br>TO 2. To identify troubles in energy equipment<br>TO 3. To conduct regulatory and technical documentation on acceptance |
| **Summary of Content (sections, themes)** | 1. Enumeration of types of testing power equipment;<br>2. explanation of the test phases;<br>3. demonstration test of power equipment;<br>4. Explanation of the causes of failures of equipment;<br>5. Evaluation of complexity of fault equipment;<br>6. Offer solutions to troubleshooting;<br>7. Compliance with rules of drafting of normative and technical documentation;<br>8. Work with specialized computer programs;<br>9. Preparation of test faulty statements. |
| **Prerequisites** | -Economics and production management;<br>-Energy-and resource-saving technologies in power systems and complexes;<br>-Energy Economics;<br>-Energy and the environment Wednesday;<br>-Record keeping;<br>-Internship |
| **Module forming disciplines** | -Electrical measurements;<br>-Repair, adjustment and testing of electrical equipment;<br>-Materials;<br>-Record keeping;<br>-Occupational safety and health; |

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| | -Training. |
| **Module type** | Mandatory |
| **Labor intense (credits /academic hours)** | 8 credits / 240 hours |
| **Duration of the module** | 3-8 semester |
| **Form of teaching** | Full-time |
| **Education technology** | Modular |
| **Form of organization of educational process. Teaching methods.** | Lecture, independent work, practical. |
| **Control Forms** | Pass fail exam, exam |
| **Required Resources** | Personal computer, software, stands.<br>Yu. Kljuzhev "Science of Materials with the basics of electric science of materials"; V.A. Panfilov "Electrical measurements. Textbook for students of secondary professional institutions; V.I. Skala, N.V.Skala, B.V. Skala "Office work in the Republic of Kazakhstan (with samples of forms + CD) in Kazakh and Russian languages"; B. Minto "Minto's pyramid principle". The golden rules of thinking, business letters and oral presentations"; Yu.D. Sibikin "Labor safety during assembly, maintenance and repair of electrical equipment companies: directory"; |
| **Language of instruction** | Russian, Kazakh |
| **Post-requisites** | -Relay protection and Automatics;<br>-Basics of electric drive;<br>-Basics of industrial electronics;<br>-Electrical measurements;<br>-Record keeping;<br>-Occupational safety and health;<br>-Training. |

## 4.12 Specification of professional module 6 "Inspection and control of the operation of instrumentation, means of relay protection and automation"

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| **Scope of competence** | Organization of inspection and testing of relay protection and automation |
| **Name and code of the module** | PM 6. Inspection and control of instrumentation, relay protection means and automation tools |
| **The purpose of the module** | After studying this module the trainee will be able to check and monitor the work of the test equipment, relay protection and Automatics |
| **Level of professional qualification** | 5 |
| **Learning outcomes for the module** | LO 1. To organize the operation of the relay protection devices of automatics and measurements;<br>LO 2. To carry out the adjustment and the adjustment of the relay protection;<br>LO 3. To test relay protection and automation tools. |
| **Summary of Content (sections, themes)** | 1. Description of the structures, the principles of action, the technical characteristics of the elements of relay protection, automation;<br>2. Enumeration of validation methods, ways of regulating relays, automation, calibration of measuring instruments;<br>3. Programming testing devices for relay protection and automation;<br>4. Follow the instructions and required methodic instructions when checking the Relay devices;<br>5. Explanation of the principles of relay protection settings;<br>6. Preparation of normative-technical documentation;<br>7. Conduct adjustment and the adjustment of the relay protection;<br>8. Enumeration of types of testing of relay protection;<br>9. Test mapping, implementation of assembly means of relay;<br>10. Demonstration tests of the relay. |
| **Prerequisites** | -Theoretical bases of electrical engineering;<br>-Basics of technical mechanics;<br>-Electric machines; |

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| | -Electrical materials;<br>-Occupational safety and health;<br>-Electrical measurements;<br>-Engineering graphics;<br>-Industrial electronics. |
| **Module forming disciplines** | -Relay protection and Automatics;<br>-Basics of electric drive;<br>-Basics of industrial electronics;<br>-Electrical measurements;<br>-Record keeping;<br>-Occupational safety and health;<br>-Training; |
| **Module type (mandatory, optional)** | Mandatory |
| **Labor intense (credits /academic hours)** | 10 credits / 300 hours |
| **Duration of the module** | 3-8 semester |
| **Form of teaching** | Full-time |
| **Education technology** | Modular |
| **Form of organization of educational process. Teaching methods.** | Lecture, independent work, practical. |
| **Control Forms** | Pass fail exam, exam |
| **Required Resources** | Personal computer, software, stands.<br>A.V. Bulychev, A.A. Navolochnyj “Relay protection and electric automation”;<br>Zh. Amanzholov “OSH in energy systems”;<br>Yu.D. Sibikin “Labor safety during assembly, maintenance and repair of electrical equipment companies: directory”; V.I. Skala, N.V.Skala, B.V. Skala “Office work in the Republic of Kazakhstan (with samples of forms + CD) in Kazakh and Russian languages”; B. Minto “Minto’s pyramid principle”. The golden rules of thinking, business letters and oral presentations”; |
| **Language of instruction** | Russian, Kazakh |
| **Post-requisites** | Knowledge acquired by the student when training modules are used to conduct research (essays, term papers, projects, theses, research reports, etc.) |

## 4.13 Specification of the professional module 7, " Management and control over the activities of the repair and maintenance unit of electric power stations and substations"

| | |
|---|---|
| **Scope of competence** | Management and control over the activities of the repair and maintenance unit of electric power stations and substations |
| **Name and code of the module** | PM 7. Management and control over the activities of the repair and maintenance unit of electric power stations and substations |
| **Purpose of the module** | After studying this module, the trainee will be able to manage and monitor the activities of the unit for repair and maintenance of electric power stations and substations |
| **Level of professional qualification** | 5 |
| **Learning outcomes for the module** | LO 1. To plan the work of production unit<br>LO 2. To manage the work of production unit<br>LO 3. To control the quality of production units |
| **Summary of Content (sections, themes)** | 1. Application of tools and methods of production planning;<br>2. Preparation of job descriptions of staff, operational and technical documentation;<br>3. Planning the activities of the production unit;<br>4. Application of lean production principles and strategies;<br>5. Assessment of working conditions in the workplace;<br>6. Management of the production unit;<br>7. Maintenance of regulatory, technical and executive documentation;<br>8. Ensuring compliance with the rules and standards of labor protection in the operation of power plants and networks;<br>9. Control over the quality of work of the production unit. |
| **Prerequisites** | -Basics of philosophy;<br>-Basics of sociology and political science;<br>-Cultural studies;<br>-Electric stations and substations;<br>-Operation of an electric equipment of electric stations and substations;<br>-Thermal power stations and pipelines; |

| | |
|---|---|
| | Installation, adjustment and repair of electrical equipment;<br>-Introduction of new technologies;<br>-Economics and production management;<br>-Energy Economics;<br>-Energy and the environment Wednesday;<br>-Relay protection and Automatics;<br>-Record keeping;<br>-Occupational safety and health;<br>-Training; |
| **Module forming disciplines** | -Metrology, standardization and measurement tools;<br>-Organization of electric energy accounting system;<br>-Network management of electricity and heat;<br>-Principles of management;<br>-The basics of lean manufacturing;<br>-Record keeping;<br>-Occupational safety and health;<br>-Training; |
| **Module type (mandatory, optional)** | Mandatory |
| **Labor intense (credits /academic hours)** | 10 credits /300 hours |
| **Duration of the module** | 3-8 semester |
| **Form of teaching** | Full-time |
| **Education technology** | Modulart |
| **Form of organization of educational process. Teaching methods.** | Independent work, practical. |
| **Control Forms** | Pass fail exam, exam |
| **Required Resources** | Personal computer, software.<br>M. Imai “Kaidzen. The key to the success of Japanese companies”;<br>M. Imai “Gemba Kaidzen”;<br>J. Amanzholov “OSH in energy systems; V V.I. Skala, N.V.Skala, B.V. Skala “Office work in the Republic of Kazakhstan (with samples of forms + CD) in Kazakh and Russian languages”; B. Minto “Minto’s pyramid principle”. The golden rules of thinking, business letters and oral presentations”; Yu.D. Sibikin “Labor safety during assembly, maintenance and repair of electrical equipment companies: directory”; D.P. Vumek, D. Jones |

| | |
|---|---|
| | "Economical manufacturing. How to get rid of losses and achieve prosperity of your company; M.Kh.Meskon, M.Albert, F. Hedouri, "Fundamentals of management" |
| **Language of instruction** | Russian, Kazakh |
| **Post-requisites** | -Electric networks of power supply systems;<br>-Economy industry<br>-Record keeping;<br>-Training; |

## 4.14 Specification of the professional module 8 "Application of CAD software for designing of power stations and substations"

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|---|---|
| **Scope of competence** | Design and design development of power stations and substations using CAD |
| **Name and code of the module** | PM 8. The use of CAD SOFTWARE for designing power plants and substations |
| **Purpose of the module** | After studying this module the trainee will be able to design and manufacture the designs of electric stations and substations using CAD |
| **Level of professional qualification** | 5 |
| **Learning outcomes for the module** | LO 1. To collect and analyze the initial data for designing<br>LO 2. To calculate the parameters of objects in accordance with the terms of reference<br>LO 3. To design objects using CAD |
| **Summary of Content (sections, themes)** | 1. Establishment of baseline data for design<br>2. Analysis of financial and economic part of design objects<br>3. Development of technical documentation technical specifications<br>4. Calculation of the estimated cost<br>5. Application of methods of mathematical and physical modeling modes, processes and States of objects<br>6. Calculation of parameters of objects in accordance with the<br>7. Knowledge of basic skills of work with CAD<br>8. Following the norms of design and technological documentation<br>9. Designing of objects using CAD |
| **Prerequisites** | -Geometry;<br>-Drawing;<br>-Fundamentals of computer technology;<br>-Engineering graphics. |
| **Module forming disciplines** | Engineering and computer graphics;<br>-Descriptive geometry;<br>-Electric networks of power supply systems;<br>-Economy industry;<br>-Math problems and computer modeling in electric power industry;<br>-Record keeping;<br>-Training; |

| | |
|---|---|
| **Module type (mandatory, optional)** | Mandatory |
| **Labor intense (credits /academic hours)** | 7 credits / 210 hours |
| **Duration of the module** | 3-8 semester |
| **Form of teaching** | Full-time |
| **Education technology** | Modular |
| **Form of organization of educational process. Teaching methods.** | Lecture, independent work, practical. |
| **Control Forms** | Pass fail exam, exam |
| **Required Resources** | Personal computer software.<br>D.Yu. Murovtsev "Designing of units and devices of electronic means";<br>N.P. Bondareva "Electric networks of electric power systems";<br>Yu.A.Rogoza "Computer graphics and graphics in education";<br>G.M. Mikhailova "Engineering graphics: Practicum"; V.I. Skala, N.V.Skala, B.V. Skala "Office work in the Republic of Kazakhstan (with samples of forms + CD) in Kazakh and Russian languages"; B. Minto "Minto's pyramid principle". The golden rules of thinking, business letters and oral presentations"; |
| **Language of instruction** | Russian, Kazakh |
| **Post-requisites** | -Metrology, standardization and measurement tools;<br>-Organization of electric energy accounting system;<br>-Network management of electricity and heat;<br>-Principles of management;<br>-The basics of lean manufacturing. |

## PLAN OF EDUCATIONAL PROCESS

**Code and the education profile:** 0900000 - Energy. Electricity
**Specialty:** 0917000 - Conventional energy
**Qualification:** 0917024-Applied Bachelor of conventional energy

Form of study: Full-time
Standard term of training: 2 years 10 months
on the basis of general secondary education

| Index | Modules and types of training activities | Number of credits | Form control | | The amount of training time (hours) | | | | | | | Distribution courses |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Exam | Differential testing | Total hours | From them: | | | | | | |
| | | | | | | On the types of training | | | On the forms of organization training | | | |
| | | | | | | Theoretical training | Laboratory and practical works, course projects and | Practical training * | Audit, contact | SRO | | |
| | | | | | | | | | | SROP | SROS | |

| **BM** | **Basic modules** | **30** | **3** | **8** | **900** | **630** | **270** | | **720** | **180** | **60** | **1-6** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BM 1 | Application of professional vocabulary, the preparation of business papers in the field of professional activity | 6 | + | + | 180 | 120 | 60 | - | 120 | 60 | 15 | 1-6 |
| BM 2 | Understanding the history, role and place of Kazakhstan in the world community | 4 | + | + | 120 | 120 | - | - | 120 | - | | 1-6 |
| BM 3 | Development and improvement of physical qualities | 6 | + | + | 180 | - | 180 | - | 180 | - | | 1-6 |
| BM 4 | Application of the basics of philosophical knowledge, social sciences for socialization and adaptation in society and the workforce | 6 | | + | 180 | 180 | - | - | 120 | 60 | 15 | 1-6 |
| BM 5 | Application of basic knowledge of economics and knowledge of labor laws and regulations to protect their rights in their professional activities | 4 | | + | 120 | 120 | - | - | 90 | 30 | 15 | 1-6 |
| BM 6 | Execution, execution, reading of design and technological documentation using application programs | 4 | | + | 120 | 90 | 30 | - | 90 | 30 | 15 | 1-6 |
| **PM** | **Professional modules on working qualifications** | **36** | | | **1080** | **600** | **240** | **240** | **600** | **480** | **120** | **1-6** |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PM 1 | Carrying out maintenance and repair of equipment of power plants, substations, electrical and thermal networks | 18 | + | + | 540 | 300 | 120 | 120 | 300 | 240 | 60 | 1-6 |
| PM 2 | Operation of the equipment of power plants, substations, thermal and electrical networks | 18 | + | + | 540 | 300 | 120 | 120 | 300 | 240 | 60 | 1-6 |
| **PM** | **Professional Modules of Qualifications of Mid-level Specialist** | **21** | | | **630** | **300** | **240** | **90** | **300** | **330** | **180** | **1-6** |
| PM 3 | Modernization of equipment of power plants, substations, thermal and electrical networks | 6 | + | + | 180 | 90 | 60 | 30 | 90 | 90 | 60 | 1-6 |
| PM 4 | Determination of production needs in fuel and energy resources | 7 | + | + | 210 | 90 | 90 | 30 | 90 | 120 | 60 | 1-6 |
| PM 5 | Acceptance and testing of equipment of power plants, substations, thermal and electrical networks | 8 | + | + | 240 | 120 | 90 | 30 | 120 | 120 | 60 | 1-6 |
| **PM** | **Professional modules of applied bachelor qualifications** | **27** | | | **810** | **240** | **390** | **180** | **240** | **570** | **390** | |
| PM 6 | Inspection and monitoring of the operation of instrumentation, means of relay protection and automation | 10 | + | + | 300 | 90 | 150 | 60 | 90 | 210 | 150 | 1-6 |
| PM 7 | Management and control over the activities of the division for repair | 10 | + | + | 300 | 90 | 150 | 60 | 90 | 210 | 150 | 1-6 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | and maintenance of equipment of power plants and substations | | | | | | | | | | | |
| PM 8 | Using CAD for the design of power plants and substations | 7 | + | + | 210 | 60 | 9 0 | 60 | 60 | 150 | 90 | 1-6 |
| | **Subtotal:** | **114** | | | **3420** | **1770** | **1140** | **510** | **1860** | **1560** | **750** | |
| PP | Professional practice (academic, industrial, undergraduate) | 42 | | | 1260 | | | 1260 | 180 | 1080 | 300 | 1-6 |
| DP | Diploma project * | 9 | | | 270 | | 270 | | 60 | 210 | 30 | 6 |
| IC | Intermediate certification | 10 | | | 300 | 300 | | | 300 | | | 1-6 |
| FC | Final certification | 2 | | | 60 | 60 | | | 60 | | | 6 |
| | **Total compulsory education:** | **180 (144 +36)** | | | **5400 (4320 +1080)** | **2130** | **1410** | **1770** | **2460** | **2850** | **1080** | |
| C | Consultation | 10 | | | 300 | 300 | | | | 300 | | 1-6 |
| O | Optional classes | 11 | | | 330 | 330 | | | | 330 | | 1-6 |
| | **Total:** | **201 (165 +36)** | | | **6030 (4950 +1080** | **2760** | **1410** | **1770** | **2460** | **3480** | **1080** | |

**Note:**

* The forms of control (the number of course papers, examinations), the order of studying the disciplines (distribution by semester) are exemplary and can vary depending on the forms of study, the specifics of specialties, local and other conditions (circumstances), including, in accordance with the needs of employers.

** In accordance with the State compulsory education standard the Technical and Vocational Education, educational institutions can change up to 50% of the amount of study time allocated for the development of educational material for modules, up to 50% for each module and up to 60% (up to 80% for dual training) of vocational training and professional practice with keeping the total number of hours for compulsory education.