ANNEX 1

Module Reference Book

Electrical Power Engineering (Ba)

Table of Contents

Module Name:	**Module 1: Physics**
Code	M1EPE(Ba)
Module Elements:	*Compulsory Subject* Physics
Semester Number:	2
Person responsible for the module	P.I. Leontyev
Lecturer:	Physics - P.I. Leontyev
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	2 semester: hours per week – 12 (lectures -1; workshops -1; labs-2; independent work -8); hours per semester – 180.
Workload:	Teaching Load: 60 hours Extracurricular Classes: 120 hours Total: 180 hours
Credit Points:	6 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for the subject
Recommended Conditions:	This module is based on the knowledge gained by students in high school during the course of Physics
Expected Learning Outcomes:	**Know** the basic physical phenomena and laws of classical and modern Physics. **Be able** to apply physical phenomena, laws and modern methods for solving applied problems. **Possess the skills** to solve engineering problems using the laws of Physics. **Demonstrate the ability** to conduct a physical experiment, work with measuring instruments, as well as those used for data calculation and processing.
Intendend use/applicability	Modules: Electrical Engineering, Industrial Electronics, Electric Power Plants and Substations, Basics of Equipment Operation, Electrical Machinery, Power Systems and Networks
Content:	*Physics* Mechanics. Molecular Physics. Thermodynamics. Electricity and Magnetism. Optics. Elements of Atom and Nucleus Physics.
Examination Form, module mark:	*Physics* – computer-based testing Module mark: the result of the exam *Physics*
Technical/Multimedia Facilities:	Multimedia system, laboratories of Mechanics, Optics and Electric Power, IT room with Internet access, internal educational network of the University.
Study Materials:	1. T.I. Trofimova. Course of Physics. Moscow, 2003 2. A. A. Detlaf, B. M. Yavorskiy. Course of Physics, M., 2000 3. L. A. Dyachenko, I. I. Golovaschenko. Collection of Problems on Physics. Petropavlovsk, 2009 4. I. V. Savelyev. Course of General Physics. Ed. 5, SR. Saint Petersburg: Lan, 2006. 5. T. I. Trofimova. Collection of Tests on the General Course of Physics, Moscow, 2004 6. T. M. Trofimova. Physics Basics..: Moscow, 2007 7. L. A. Dyachenko. Laboratory Practical Course for Technical Professions, Petropavlovsk: NKSU, 2009
Date of last amendment	26.01.2023

Module Name:	**Module 2: Basics of Mathematics**
Code	M2EPE(Ba)
Module Elements:	*Compulsory Subjects* Mathematics 1 Mathematics 2
Semester Number:	1, 2
Person responsible for the module	K.I. Darbayeva
Lecturer:	Mathematics 1 - K.I. Darbayeva Mathematics 2 - K.I. Darbayeva
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	1 semester: hours per week – 6 (lectures -1; workshops -2; independent work -3); hours per semester – 90. 2 semester: hours per week – 8 (lectures -1; workshops -1; labs-1; independent work -5); hours per semester – 120.
Workload:	Teaching Load: 90 hours Extracurricular Classes: 120 hours Total: 210 hours
Credit Points:	7 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	This module is based on the knowledge gained by students in high school in the courses of Algebra and Pre-calculus, and Geometry
Expected Learning Outcomes:	**Know** the course of Higher Mathematics. **Be able** to apply modern mathematical methods to solve applied problems. **Possess the skills** to solve engineering problems using mathematical methods. **Demonstrate the ability** to perform calculations and justification of technical solutions adopted during the development.
Intendend use/applicability	Modules: Electrical Engineering, Industrial Electronics, Electrical Machinery, Electric Power Plants and Substations, Basics of Equipment Operation, Technical Equipment of Power Facilities, Power Systems and Networks
Content:	*Mathematics 1* Elements of linear algebra and analytic geometry. Basic concepts of mathematical analysis. Differential calculus of a function of one variable and its application to the study of functions. Elements of linear algebra and analytic geometry. *Mathematics 2* Introduction to mathematical analysis. Differential calculus of a function of one variable and its applications. Integral calculus of a function of one variable and its applications. Differential calculus of a function of many variables. Multiple integrals and their applications. Theory of series. Differential equations. Elements of probability theory and mathematical statistics.
Examination Form, module mark:	Comprehensive examination including: *Mathematics 1* – written examination *Mathematics 2* – computer-based testing Module mark: the result of the exam *Mathematics 2*

Technical/Multimedia Facilities:	Multimedia system, IT room with Internet access, internal educational network of the University.
Study Materials:	1. D. T. Pismenniy. Abstract of Lectures on Higher Mathematics. Part 1. M.: Ayris Press, 2004 2. K. I. Lungu, D. T. Pismenniy. Collection of Tests in Higher Mathematics. Part 1. Moscow. Ayris Press, 2001. 3. P. Y. Danko, A. G. Popov. Higher Mathematics in Exercises and Problems. Part 1. Moscow: Vysshaya Shkola, 2002. 4. Y. S. Bugrov, S. M. Nikolskiy. Elements of Linear Algebra and Analytic Geometry. Moscow. Nauka. 2000. 5. P. Y. Danko, A. G. Popov, T.Y. Kozhevnikova. Higher Mathematics in Exercises and Problems. Part 2. Moscow: Vysshaya Shkola, 2006. 6. Demidovich. Collection of Problems in Mathematical Analysis for Technical Colleges. M.: Vysshaya Shkola, 2001. 7. L. A. Kuznetsov. Collection of Problems in Higher Mathematics. – Moscow: Vysshaya Shkola, 2006. 8. Y. S. Mironenko. Higher Mathematics (Methodical Instructions and Control Tasks). M.: Vysshaya Shkola, 2002.
Date of last amendment	26.01.2023

Module Name:	**Module 3: History of the State**
Code	M3EPE(Ba)
Module Elements:	*Compulsory Subject* Modern History of Kazakhstan
Semester Number:	1
Person responsible for the module	A.A. Pleshakov
Lecturer:	Modern History of Kazakhstan – A.A. Pleshakov
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	1 semester: hours per week – 8 (lectures -2; workshops -2; independent work -4); hours per semester – 120.
Workload:	Teaching Load: 60 hours Extracurricular Classes: 60 hours Total: 120 hours
Credit Points:	4 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for the subject
Recommended Conditions:	The discipline is based on the knowledge and skills of students obtained in the school in the following disciplines: History of Kazakhstan, World History, People and Society, World Art, Literature.
Expected Learning Outcomes:	**Know:** the main stages of the history of Kazakhstan in the context of world history. **Be able to:** distinguish scientific and not scientific views on historical processes. **Possess the skills:** to work with historical sources of information; to analyze the situation of conflict of interest and moral choice. **Demonstrate the ability to:** professionally understand the social, cultural and political conditions of the modern world.
Intendend use/applicability	Module: Philosophy
Content:	*Modern History of Kazakhstan* The study of the history of Kazakhstan as the original and at the same time as an integral part of world history; to reveal the role and place of the Kazakh people in the world community at various stages of formation and development; to show the main regularities of ethno-genetic processes on the territory of Kazakhstan; to consider features of development of socio-economic relations and the key problems of the political history; to trace the evolution of material and spiritual culture.
Examination Form, module mark:	*Modern History of Kazakhstan* - computer-based testing Module mark: the result of the exam *Modern History of Kazakhstan*
Technical/Multimedia Facilities:	Portable and stationary multimedia systems.
Study Materials:	1. History of Kazakhstan. Essay. - A. 2003. 2. S. G. Sheretov. Recent History of Kazakhstan (1985-2002). – A. 2009. 3. History of Kazakhstan: Peoples and Cultures: Text Book / N. E. Masanov et al. - A., 2001. 4. History of Kazakhstan and Central Asia: Text Book / M. K. Abuseitova et al. - A., 2001. 5. History of Kazakhstan. In 5 books. - A., 1996-2011.
Date of last amendment	26.01.2023

Module Name:	**Module 4: Foreign Language**
Code	M4EPE(Ba)
Module Elements:	*Compulsory Subject* English (German) Language
Semester Number:	1, 2
Person responsible for the module	I.A. Olkova
Lecturer:	English (German) Language - I.A. Olkova
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	1 semester: hours per week – 12 (workshops -4; independent work -8); hours per semester – 180. 2 semester: hours per week – 6 (workshops -2; independent work -4); hours per semester – 90.
Workload:	Teaching Load: 90 hours Extracurricular Classes: 180 hours Total: 270 hours
Credit Points:	9 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	Minimal sufficient level of foreign language proficiency, which students receive in secondary school.
Expected Learning Outcomes:	**Know:** basic grammar and vocabulary required for reading and translating (with a dictionary) of texts in a foreign language; basic spelling rules; main parts of speech; structure of a simple and a complex sentence. **Be able to**: communicate (orally and in writing) in a foreign language on everyday topics; build simple and complex sentences; comprehend messages of a domestic or informational nature. **Possess the skills:** to improve own speaking and written speech, vocabulary; reading, monologue speech within the study topics; translation of the text in accordance with language norms. **Demonstrate the ability to:** build a monologue and a dialogue; reasoned presentation of own point of view in interpersonal communication in a foreign language; extract the necessary information from the authentic text in a foreign language; fill in most personal and business forms (questionnaires, CV).
Intendend use/applicability	Modules: Profound Language Learning, Information and Communication Technologies
Content:	*English (German) Language* Vocabulary: - Social and Domestic Communication: Family in modern society, Housing and accommodation; - Social and Cultural Communication: Kazakhstan, Country studies (English speaking countries: culture, geography, economy), Leisure, Traveling; - Educational and Professional Communication: Education, My University, Jobs and Professions, My future profession, Professional competence, Advantages and disadvantages of different professions; - Social and Cultural Communication: Health and Healthy Life Style, Law, Human Rights, Environment and

	environmental problems, Mass Media Grammar: - Tenses (Present, Past, Future – Simple, Continuous, Perfect); - Conditional sentences; - Reflexive, Possessive and Relative Pronouns; - Passive Voice; - Modal verbs (might, could, might, can); - Reported Speech; - Connectors (although, however, thus…); - Quantifiers (a few, a little etc.); - Adverbs of frequency; - Degrees of comparison (adjectives and adverbs)
Examination Form, module mark:	Comprehensive examination including: *English (German) Language (1 semester)* – written examination *English (German) Language (2 semester)* - computer-based testing Module mark: the result of the exam *English (German) Language (2 semester)*
Technical/Multimedia Facilities:	Multimedia language laboratory, interactive whiteboard, multimedia system
Study Materials:	1. Sue Kay & Vaughan Jones. Inside Out - Elementary: Macmillan, 2003. 2. Luke Prodromou. Rising Star – An Intermediate Course: Macmillan, 2001. 3. Raymond Murphy. English Grammar in Use: Cambridge University Press, 2004. 4. Simon Clarke. Macmillan English Grammar in Context: Macmillan, 2008. 5. I. Agabekyan, P. Kovalenko. English for Engineers. - 4th ed., Rostov-on-Don: Phoenix, 2006. 6. G. E. Vyborova, K. S. Makhmuryan, O. P. Melchina. Easy English: Basic course: M.: AST-Press Kniga, 2005.
Date of last amendment	26.01.2023

Module Name:	**Module 5: National Language**
Code	M5EPE(Ba)
Module Elements:	*Compulsory Subject* Kazakh Language
Semester Number:	1, 2
Person responsible for the module	D.K. Kuandykova
Lecturer:	Kazakh Language - D.K. Kuandykova
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	1 semester: hours per week – 12 (workshops -4; independent work -8); hours per semester – 180. 2 semester: hours per week – 6 (workshops -2; independent work -4); hours per semester – 90.
Workload:	Teaching Load: 90 hours Extracurricular Classes: 180 hours Total: 270 hours
Credit Points:	9 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	Minimal sufficient level of proficiency in the state language, which students receive in secondary school
Expected Learning Outcomes:	**Know:** basic concepts of speech culture (literary language, language norm, language variants); principles of speech communication; orthoepic, lexical, grammatical and stylistic norms of the Kazakh literary language. **Be able to:** build oral and written statements in accordance with the norms of the Kazakh literary language, logically substantiate the stated provisions; competently conduct business correspondence; use dictionaries and reference literature on the Kazakh language; use the language to establish interpersonal relations in a professional environment. **Possess the skills:** to improve their own oral and written speech, vocabulary; reading, monologue speech within the study topics; translation of the text in accordance with language norms. **Demonstrate ability:** proficiency in linguistic apparatus and basic communication skills necessary for successful professional performance
Intendend use/applicability	Module: Profound Language Learning
Content:	*Kazakh Language* Man and society. North Kazakhstan State University named after M. Kozybayev. Food is the basis of a man. Cleanliness is the basis of health, Health is the basis of wealth. Modern clothing samples. Native land. Our city is Petropavlovsk. Man and Nature. Journey. Historical sights. Art and culture. Famous people. Historical figures. My country is Kazakhstan. Education system of Kazakhstan. Society and youth. Man and law.
Examination Form, module mark:	Comprehensive examination including: *Kazakh Language (1 semester)* – written examination *Kazakh Language (2 semester)* - computer-based testing Module mark: the result of the exam *Kazakh Language (2 semester)*

Technical/Multimedia Facilities:	Multimedia language laboratory, interactive whiteboard, multimedia system
Study Materials:	1. A. Aldasheva, Z. Akhmetzhanova, K. Kadasheva, E. Suleymenova. Official papers. "Sosdik-Slovar" A., 2002 2. Z. Akhmetzhanova, Z. Yernazarova. Business Kazakh Language. Basic level. Almaty: Arkhisema Publishing House, 2007 3. A. Bekturova, S. Bekturov. Kazakh Language for Everyone. Almaty: Atamura, 2004 4. Paper Work in the Republic of Kazakhstan. Almaty, 2005 5. M. Pirimbetova. Record Keeping in the Kazakh Language. Textbook. Astana, 2007 6. A. Kokanbayev, K. Musabekov, K. Ashimuly. Russian-Kazakh and Kazakh-Russian Dictionary of Petrochemical Terms and Phrases. Almaty, 2007 7. R. Kudaybergenov. Dictionary of Technical Terms. Almaty, 2009
Date of last amendment	26.01.2023

Module Name:	**Module 6: Recreation Classes (Beginner Level)**
Code	M6EPE(Ba)
Module Elements:	*Compulsory Subject* Physical Education
Semester Number:	1, 2
Person responsible for the module	A.A. Shitov
Lecturer:	Physical Education - A.A. Shitov
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	1 semester: hours per week –4 (workshops -1; independent work -3); hours per semester – 60. 2 semester: hours per week – 4 (workshops -1; independent work -3); hours per semester – 60.
Workload:	Teaching Load: 30 hours Extracurricular Classes: 90 hours Total: 120 hours
Credit Points:	4 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for the subject of the module
Recommended Conditions:	Physical Education in school
Expected Learning Outcomes:	**Know:** social functions of physical education; systems of physical education; hygienic bases of health management; prevention of occupational diseases. **Be able to:** use the means and methods of physical education to maintain a special professional performance, health and prevention of occupational diseases; plan, monitor and manage physical and functional fitness. **Possess the skills:** show and do exercises, assess the adequacy of the loads to the functional capabilities of the body; management of physical fitness. **Demonstrate the ability:** to fulfill the Presidential Tests of Physical Fitness; execution of tactics and rules of competition in applied sports.
Intendend use/applicability	Module: Recreation Classes (Intermediate Level)
Content:	*Physical Education* 1 semester: track and field athletics and basketball (beginner). 2 semester: swimming and volleyball (beginner).
Examination Form, module mark:	*Physical Education* – graded test. Module mark: the result of the test *Physical Education (2 semester)*
Technical/Multimedia Facilities:	Gym, swimming pool, sports ground, play court
Study Materials:	1. Track and Field Athletics. Textbook for Physical Education Institutes. Ed. N.G. Azolin, D. P. Markov, 2nd edition, – M., 2002 2. Basketball. Textbook for Universities. M., 2007. 3. Swimming for Beginners. K. Wilke. M.: Znaniye, 2001 4. Basics of Swimming. Learning and the Way to Perfection. M. Pedroletti. M.: Phoenix, 2006. 5. Volleyball. Textbook. A. V. Belyaev, N. V.Savin. M.: Fizkultura, 2000 6. Physical Education. Textbook for Universities. M. V. Sokolova. Almaty: RIK, 2005.
Date of last amendment	26.01.2023

Module Name:	**Module 7: Recreation Classes (Intermediate Level)**
Code	M7EPE(Ba)
Module Elements:	*Compulsory Subject* Physical Education
Semester Number:	3, 4
Person responsible for the module	A.A. Shitov
Lecturer:	Physical Education - A.A. Shitov
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	3 semester: hours per week –4 (workshops -1; independent work -3); hours per semester – 60. 4 semester: hours per week – 4 (workshops -1; independent work -3); hours per semester – 60.
Workload:	Teaching Load: 30 hours Extracurricular Classes: 90 hours Total: 120 hours
Credit Points:	4 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	Module: Physical Education (Beginner Level)
Expected Learning Outcomes:	**Know:** social functions of physical education; systems of physical education; hygienic bases of health management; prevention of occupational diseases. **Be able to:** use the means and methods of physical education to maintain a special professional performance, health and prevention of occupational diseases; plan, monitor and manage physical and functional fitness. **Possess the skills:** show and do exercises, assess the adequacy of the loads to the functional capabilities of the body; management of physical fitness. **Demonstrate the ability:** to fulfill the Presidential Tests of Physical Fitness; execution of tactics and rules of competition in applied sports.
Intendend use/applicability	-
Content:	*Physical Education* 3 semester: track and field athletics and basketball (intermediate). 4 semester: swimming and volleyball (intermediate).
Examination Form, module mark:	*Physical Education* – graded test. Module mark: the result of the test *Physical Education (4 semester)*
Technical/Multimedia Facilities:	Gym, swimming pool, sports ground, play court
Study Materials:	1. Track and Field Athletics. Textbook for Physical Education Institutes. Ed. N.G. Azolin, D. P. Markov, 2nd edition, – M., 2002 2. Basketball. Textbook for Universities. M., 2007. 3. Swimming for Beginners. K. Wilke. M.: Znaniye, 2001 4. Basics of Swimming. Learning and the Way to Perfection. M. Pedroletti. M.: Phoenix, 2006. 5. Volleyball. Textbook. A. V. Belyaev, N. V.Savin. M.: Fizkultura, 2000 6. Physical Education. Textbook for Universities. M. V. Sokolova. Almaty: RIK, 2005.
Date of last amendment	26.01.2023

Module Name:	**Module 8: Electrical Engineering**
Code	M8EPE(Ba)
Module Elements:	*Compulsory subjects* Theoretical Basics of Electrical Engineering 1 Theoretical Basics of Electrical Engineering 2
Semester Number:	3, 4
Person responsible for the module	N.V. Zykova
Lecturer:	Theoretical Basics of Electrical Engineering 1, 2 - N.V. Zykova
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	3 semester: hours per week – 10 (lectures -1; workshops -1; labs-1; independent work -7); hours per semester – 150. 4 semester: hours per week – 8 (lectures -1; workshops -1; labs-1; independent work -5); hours per semester – 120.
Workload:	Teaching Load: 90 hours Extracurricular Classes: 180 hours Total: 270 hours
Credit Points:	9 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	Modules: Basics of Mathematics. Physics
Expected Learning Outcomes:	**Know:** methods of calculation of steady-state processes in linear electrical circuits of direct and alternating current, methods of calculation of modes in three-phase circuits. **Be able to** experimentally and analytically determine the parameters and properties of typical electrical circuits. **Possess the skills** of calculation and modeling of linear circuits of direct and alternating current**.** **Demonstrate the ability to** analyze and calculate linear electrical circuits using the basic laws of physics and electrical engineering.
Intendend use/applicability	Modules: Electrical Machinery, Power Systems and Networks, Electrical Drive, Design of Electrical Systems, Technical Equipment of Power Facilities
Content:	*Theoretical Basics of Electrical Engineering 1* Linear electric circuits of direct current. Electrical circuits of single-phase sinusoidal current. Three-phase circuits. Non-sinusoidal currents. *Theoretical Basics of Electrical Engineering 2* Transients in linear electrical circuits. Quadripoles and frequency electric filters Chain with distributed parameters. Nonlinear electrical circuits. Electromagnetic field theory. Electric and magnetic field of direct and alternating current.
Examination Form, module mark:	Comprehensive examination including: *Theoretical Basics of Electrical Engineering 1* – Written examination *Theoretical Basics of Electrical Engineering 2* – computer-based testing Module mark: the result of the exam *Theoretical Basics of Electrical Engineering 2*
Technical/Multimedia Facilities:	Multimedia system. Laboratory of Electrical Engineering and Materials Science.

Study Materials:	1. V. S. Kassatkin, M. V. Nemtsov. Theoretical Basics of Electrical Engineering. - M: Energoatomizdat, 2005. 2. S. A. Basharin, V. V. Fedorov. Theoretical Basics of Electrical Engineering. Theory of Electric Circuits and Electromagnetic Field. - M: Akademiya, 2004. 3. A. B. Novgorodtsev. Theoretical Basics of Electrical Engineering. 30 Lectures on the Theory of Electric Circuits. - St. Petersburg: Piter, 2006. 4. V. V. Aliferenko. Electrical Engineering: Textbook – Astana: Foliant, 2010. 5. L. A. Bessonov. Theoretical Basics of Electrical Engineering. Electric Circuits: Textbook. – M.: Gardariki, 2006 6. V. I. Denisenko. Theoretical Basics of Electrical Engineering: Textbook – Almaty: AIES, 2000.
Date of last amendment	26.01.2023

Module Name:	**Module 9: Electrical Machinery**
Code	M9EPE(Ba)
Module Elements:	*Compulsory Subject* Electrical Machinery
Semester Number:	5
Person responsible for the module	O.S. Gagolina
Lecturer:	Electrical Machinery - O.S. Gagolina
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	5 semester: hours per week – 10 (lectures -1; workshops -1; labs-1; independent work -7); hours per semester – 150.
Workload:	Teaching Load: 45 hours Extracurricular Classes: 105 hours Total: 150 hours
Credit Points:	5 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for the subject of the module
Recommended Conditions:	Modules: Basics of Mathematics, Physics, Industrial Electronics, Electrical Engineering
Expected Learning Outcomes:	**Know:** principles of operation and arrangement of different types of electrical machines and transformers; physical phenomena occurring in electrical machines and transformers under different operating conditions and their mathematical description; the main characteristics of machines and transformers. **Be able** to select electrical machines and transformers for specific practice conditions; analyze and describe processes in systems including electrical machines and transformers; conduct testing of electrical machines and transformers. **Possess the skills:** operation and repair of electric machines. **Demonstrate the ability to:** select the type of electrical machines for specific processes..
Intendend use/applicability	Modules: Electrical Drive, Technical Equipment of Power Facilities
Content:	*Electrical Machinery* The layout and principle of operation of the transformer. Transformer operation under load. Principle of operation and structural structure of generators and DC motors. Main types of AC machines and their layout. Armature windings of AC machines. Basics of the theory of asynchronous machines. Synchronous machines.
Examination Form, module mark:	*Electrical Machinery* - written examination Module mark: the result of the exam *Electrical Machinery*
Technical/Multimedia Facilities:	Multimedia system. Laboratory of Electric Machines and Electric Drive.
Study Materials:	1. A. I. Voldek, V. V. Popov. Electric Machines. Introduction to Electrical Engineering. DC Machines and Transformers: Textbook for universities. – SPb,: – Piter, 2007. 2. A. I. Voldek, V. V. Popov. Electric Machines. AC Machines: Textbook for universities. – SPb,: – Piter, 2007. 3. Design of Electrical Machines: Textbook for universities /I. P. Kopylov, B. K. Klokov, V. P. Morozkin, B. F. Tokarev; Under the editorship of I. P. Kopylov. – 4th ed., updated and

	revised - M.: Vysshaya shkola, 2005. 4. M. M. Katsman. Reference Book of Electric Machines: Textbook – M.: Akademiya, 2005 5. M. M. Katsman. Electric Machines: Textbook - M.: Vysshaya shkola, 2003. 6. I. P. Kopylov. Mathematical Simulation of Electric Machines: Textbook – M.: Vysshaya shkola, 2001
Date of last amendment	26.01.2023

Module Name:	**Module 10: Profound Language Learning**
Code	M10EPE(Ba)
Module Elements:	*Compulsory subjects* Professional Kazakh (Russian) Language Professionally-Oriented Foreign Language
Semester Number:	7
Person responsible for the module	I.A. Olkova
Lecturer:	Professional Kazakh (Russian) Language – D.K. Kuandykova Professionally-Oriented Foreign Language - I.A. Olkova
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	7 semester: hours per week – 12 (workshops -4; independent work -8); hours per semester – 180.
Workload:	Teaching Load: 60 hours Extracurricular Classes: 120 hours Total: 180 hours
Credit Points:	6 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	Modules: Foreign Language, National Language
Expected Learning Outcomes:	**Know:** terminological minimal vocabulary focused on the future profession. **Be able to:** annotate the scientific text, summarize the content of the text and draw conclusions. **Possess the skills:** working with special texts, reading and translating with a dictionary. **Demonstrate the ability to:** discuss professionally-oriented topics in Kazakh (Russian) and the foreign language.
Intendend use/applicability	Module: Final Academic Assessment
Content:	*Professional Kazakh (Russian) Language* Constitution of Kazakhstan. human rights and freedoms and a man; Labour law. President. Parliament. Law on Languages. Entrepreneurship in Kazakhstan. Public and private entrepreneurship. Employment. On education. Economic opportunities of Kazakhstan. Kazakhstan and international organizations. Record keeping. *Professionally-Oriented Foreign Language* Improving students' English language skills: improving the skills of speaking, writing, understanding of oral and written speech; the study of the rules of construction of scientific and professional speech, the features of the language of reports and presentations; the study of the basic scientific terms, the consolidation of all major grammatical structures and phenomena.
Examination Form, module mark:	Comprehensive examination including: *Professional Kazakh (Russian) Language - computer-based testing*. *Professionally-Oriented Foreign Language - computer-based testing*. Module mark: the result of the exam *Oriented Foreign Language*
Technical/Multimedia Facilities:	Language laboratory, interactive whiteboard, AUDIO and video equipment, Internet

Study Materials:	1. D.E. Zemach, L.A.Rumisek. Academic Writing. MacMillan Press, 2006. 2. Key Concepts in Information and Communication Technology (Palgrave) by Roger I. Cartwright. 3. Hawley Roddick, Business Writing Makeovers, AST, Astrel, 2004. 4. A. M. Aldanova, D. K. Akanova. Social and Business Kazakh Language. Almaty, 2002 5. K. Atygayeva, T. Akhmetova. Business Kazakh Language. Petropavlovsk, NKSU. 2010. 6. A. O. Musa, I.M. Tolegenov. Kazakh Language. Almaty, 2003 7. T.A. Sauytova, R.N. Zholdybayeva. Kazakh Language, 2006.
Date of last amendment	26.01.2023

Module Name:	**Module 11: Information and Communication Technologies**
Code	M11EPE(Ba)
Module Elements:	*Compulsory Subject* Information and Communication Technologies
Semester Number:	3
Person responsible for the module	Y.A. Klishina
Lecturer:	Information and Communication Technologies - Y.A. Klishina
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	3 semester: hours per week – 10 (lectures -1; workshops -1; labs-1; independent work -7); hours per semester – 150.
Workload:	Teaching Load: 45 hours Extracurricular Classes: 105 hours Total: 150 hours
Credit Points:	5 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	This module is based on the knowledge gained by students in the school course of Informatics and University modules of Foreign Language and Basics of Simulation
Expected Learning Outcomes:	**Know:** basics and prospects of development of new information technologies, local and global networks. **Be able to:** create information objects of complex structure. **Possess the skills:** use of modern software, modern computer technology, communication systems and information transfer. **Demonstrate the ability to:** develop algorithms and flowcharts for solving problems in the subject area.
Intendend use/applicability	Module: Final Academic Assessment
Content:	*Information and Communication Technologies* An ICT role in key sectors of development of society. Introduction to computer systems. Software. Operating systems. Human-computer interaction. Database systems. Data analysis. Data management. Networks and telecommunications. Cyber safety. Internet technologies. Cloud and mobile technologies. Multimedia technologies. Technology Smart. E-technologies. Electronic business. Information technologies in the professional sphere. Prospects of development of ICT.
Examination Form, module mark:	*Information and Communication Technologies* - computer-based testing Module mark: the result of the exam *Information and Communication Technologies*
Technical/Multimedia Facilities:	Multimedia system, IT room with Internet access, educational server of the Department, internal educational network of the University.
Study Materials:	1. Computer Science: Textbook / under the editorship of prof. N.V. Makarova. - M., Finance and Statistics, 2007. 2. Computer Science. Abstract of the Textbook. 2003. 3. Electronic Version. Computer Science: Textbook / under the editorship of prof. N.V. Makarova. - M., Finance and Statistics, 2007. 4. L. S. Voskov. Programming in Visual Basic. 10 printed sheets. Practical Course. 2003. Electronic version.

	5. Computer Science. 4th edition, A. N. Stepanov SPb.- Piter, 2005. 6. Word. Excel. Internet. E-mail: Official Training Course for European Certification. – M.: Triumph, 2008. 7. Information Security and Information Protection: a textbook for universities./ V. P. Melnikov, S.A. Kleymenov and A. P. Petrakov; under the editorship of S. A. Kleymenov. – 3rd ed. – Moscow: Akademiya, 2008.
Date of last amendment	26.01.2023

Module Name:	**Module 12: Industrial Electronics**
Code	M12EPE(Ba)
Module Elements:	*Compulsory Subject* Industrial Electronics
Semester Number:	4
Person responsible for the module	A.A. Savostin
Lecturer:	Industrial Electronics - A.A. Savostin
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	4 semester: hours per week – 6 (lectures -1; labs-1; independent work -4); hours per semester – 90.
Workload:	Teaching Load: 30 hours Extracurricular Classes: 60 hours Total: 90 hours
Credit Points:	3 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for the subject of the module
Recommended Conditions:	Modules: Basics of Mathematics, Physics
Expected Learning Outcomes:	**Know:** element base and technical means of power electronics; electromagnetic processes in power electronics devices. **Be able to** analyze the operation of electronic circuits. **Possess the skills** of calculation and simulation of electronic functional units and devices of power electronic equipment and carrying out experiment. **Demonstrate the ability** to read basic circuit diagrams.
Intendend use/applicability	Modules: Technical Equipment of Power Facilities, Automation and control in the electric power industry
Content:	*Industrial Electronics* Semiconductor diodes. Bipolar transistor. Field-effect transistors. Transistors connection diagram and operation modes of the transistors in the amplification stages. Thyristors. Power amplifier. Integral operating amplifiers and circuits with them. Feedback Theory. Optoelectronic devices. Power supply. Rectifier circuits (including 3-phase). Frequency converter. Digital devices. Logic elements and synthesis of combinational logic circuits. Microcontrollers. Microprocessors.
Examination Form, module mark:	*Industrial Electronics - computer-based testing* Module mark: the result of the exam *Industrial Electronics*
Technical/Multimedia Facilities:	Multimedia system, interactive whiteboard, laboratory stands
Study Materials:	1. Y. S. Zabrodin. Industrial Electronics. - M.: Alliance, 2008 2. Y. K. Rozanov, M. V. Ryabchitskiy, A. A. Kvasnyuk. Power Electronics. - M: Publishing house of MPEI, 2009. 3. Rama Reddy S. Basics of Power Electronics. - M: Tekhnosfera, 2006. 4. G. N. Gorbachev, Y. Y. Chaplygin. Industrial Electronics/ edited by V. A. Labuntsov. - M: Energoatomizdat, 2012 5. O. V. Milovzorov. Electronics: Textbook for universities. – M: Vysshaya shkola, 2011
Date of last amendment	26.01.2023

Module Name:	**Module 13: Electric Power Plants and Substations**
Code	M13EPE(Ba)
Module Elements:	*Compulsory Subject* Electric Power Plants and Substations; Electrical Power Engineering
Semester Number:	3, 4
Person responsible for the module	S.I. Latypov
Lecturer:	Electric Power Plants and Substations – S.I. Latypov Electrical Power Engineering – O.S. Gagolina
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	3 semester: hours per week – 10 (lectures -1; workshops -1; labs-1; independent work -7); hours per semester – 150. 4 semester: hours per week – 12 (lectures -1; workshops -1; labs-2; independent work -8); hours per semester – 180.
Workload:	Teaching Load: 105 hours Extracurricular Classes: 225 hours Total: 330 hours
Credit Points:	11 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module.
Recommended Conditions:	Modules: Basics of Mathematics. Physics.
Expected Learning Outcomes:	**Know:** main equipment used at modern power plants and substations; the concept of providing consumers with power, methods of transmission and distribution of power, elements of relay protection and automation. **Be able to:** analyze the operation of the power plant and substation on the schematic diagram; apply and select equipment, elements of electrical networks, relay protection and automation, power supply systems and alternative and renewable power sources for power plants. **Possess the skills:** reading of single-line schematic diagrams of power objects and their drawing up, as well as in questions of the choice of the equipment; analysis of operating modes in the production, transmission and distribution of power, relay protection and automation. **Demonstrate the ability to:** use electrical insulation equipment; repair of electrical equipment; develop, implement and set up electrical equipment, electrical systems and networks, relay protection and automation for power plants.
Intendend use/applicability	Modules: Power Systems and Networks, Design of Electrical Systems, Automation and control in the electric power industry
Content:	*Electric Power Plants and Substations* General information on the operation of the power system. A method of constructing the annual load diagram. Types of power plants and basic quantities characterizing them. *Electrical Power Engineering* Power plants. The concept of the energy system and fuel and energy complex. Electric power systems and networks. General concepts of electric power systems and electric networks. Power supply. Measures and devices for the

	normalization of power supply modes. Relay protection and automation. Purpose of relay protection and its place in the power industry. Alternative and renewable power sources. Use of non-extractive power resources - wind, solar radiation, energy of seas and thermal waters.
Examination Form, module mark:	Comprehensive examination including: *Electric Power Plants and Substations* - course paper *Electrical Power Generation* - computer-based testing Module mark: course paper *Electric Power Plants and Substations*
Technical/Multimedia Facilities:	Multimedia system. Laboratory of Electrical Power Engineering
Study Materials:	1. R. S. Abzhanov. Electrical Part of the Power Plant. Lecture Notes. Almaty, AIES, 2009 2. G. H. Khozhin Electrical Part of Power Plants. Textbook. Almaty, AIES, 2009 3. L. D. Rozhkova. Electrical Equipment of Electric Power Plants and Substations. M.: Akademiya, 2004 4. G. F. Bystritsky. General Power Engineering, M: Akademiya, 2005 5. L. D. Rozhkova, L. K. Karneyeva, T. V. Chirkova. Electrical Equipment of Electric Power Plants and Substation. - M: Akademiya Publishing Center, 2008 6. Basics of Modern Power Engineering. Edited by Y. V. Ametistov, M.: Publishing House of MPEI, 2003 7. B. A. Alekseyev. Main Equipment in Power Systems, M.: Publishing House of NC ENAS, 2002
Date of last amendment	26.01.2023

Module Name:	**Module 14: Power Systems and Networks**
Code	M14EPE(Ba)
Module Elements:	*Compulsory Subject* Power Supply of Facilities Relay Protection of Electric Power Systems Power Systems and Networks
Semester Number:	5
Person responsible for the module	A.A. Kashevkin
Lecturer:	Power Supply of Facilities – A.A. Kashevkin Relay Protection of Electric Power Systems – S.I. Latypov Power Systems and Networks - O.S. Gagolina
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	5 semester: hours per week – 26 (lectures -3; workshops -3; labs-4; independent work -16); hours per semester – 390.
Workload:	Teaching Load: 150 hours Extracurricular Classes: 240 hours Total: 390 hours
Credit Points:	13 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for the subject модуля
Recommended Conditions:	Modules: Electrical Engineering, Basics of Mathematics, Physics, Electric Power Plants and Substations
Expected Learning Outcomes:	**Know:** the criteria for selection of devices and conductors, transformers, compensating devices, automation elements and relay protection in networks up to and above 1kV; the principles of construction and operation of the main types of relay protection devices and automation of electric power systems. **Be able to:** calculate electrical loads, short-circuit currents, power loss and voltage; apply and produce a selection of electrical relay protection and automation. **Possess the skills:** calculation of power supply systems of enterprises of various industries; analysis of modes of operation of relay protection and automation, as well as calculation of parameters of relay protection and automation devices; main characteristics of the electrical equipment used, analysis of the modes of operation of electric power and electrical equipment. **Demonstrate the ability to:** design power supply systems of enterprises; to develop, implement and set up electrical relay protection and automation; use modern tools for development, implementation and commissioning of electrical power plants, electrical systems and networks..
Intendend use/applicability	Modules: Automation and control in the electric power industry, Alternative energy and transmission of electrical energy, Final Academic Assessment, Final Internship
Content:	*Power Supply of Facilities* Diagrams of electrical connections in the power supply system, electrical loads, short circuits in power supply systems, selection of devices and conductors of the power supply system of facilities with a voltage above 1 kV, selection of electrical equipment at a voltage of up to 1 kV.

	Relay Protection of Electric Power Systems Purpose of relay protection and basic requirements. Relay Protection and Automation Devices implemented on the microelectronic basis. Current and voltage transformers. DC voltage sources. Protection of lines, transformers, electric motors. Automation of power supply networks. Fault localization. Relay protection and automation cabinets. Installations for testing of relay protection devices. *Power Systems and Networks* General concepts of electric power systems and electric networks. Structural elements of overhead power lines. Basic information on the design of cables. Equivalent circuit parameters of air and cable lines. Equivalent circuits, parameters of transformers and autotransformers. Determination of power losses in the lines. Power losses in transformers. Problem of calculating the network mode, the basic assumptions. Simulation of open-loop electric networks. Ring network mode calculations. Calculations of the mode of lines with two-way power supply at different voltages of power sources. Calculations of the mode of lines with two-way power supply at different voltages of power sources. Influence of power quality on the work of electrical receivers and electrical devices. Problems of voltage regulation in electrical networks. Voltage regulation by changing the transformation factors of transformers and autotransformers.
Examination Form, module mark:	*Power Supply of Facilities* – course paper *Relay Protection of Electric Power Systems* – course paper *Power Systems and Networks* - course paper Module mark: course paper *Power Systems and Networks*
Technical/Multimedia Facilities:	Multimedia system. Laboratory of Power Supply and Installation of Electrical Equipment; Laboratory of Electrical Power Engineering
Study Materials:	1. V. P. Shekhovtsov. Calculation and Design of Power Supply Circuits. - M: Forum: Infra-M, 2004. 2. Y. A. Konyukhova Power Supply of Facilities. - M: Akademiya, 2010. 3. Y. D. Sibikin. Power Supply of Industrial and Civil Buildings. - M: Akademiya, 2006. 4. V. P. Shekhovtsov. Calculation and Design of Power Supply Circuits, M: Forum-Infra-M, 2014. 5. E. A Kireyeva, S. A. Tsyruk. Power Supply of Residential and Public Buildings. – M.: Energetik, 2005. 6. V. N. Kopyev. Relay Protection. Tomsk, 2001 7. A. M. Fedoseyev. Relay Protection of Electric Power Systems, M, 2004 8. B. A. Alekseyev, Maintenance of Relay Protection and Automation of Power Plants and Power Networks. Part 1. Electromagnetic Relay. / Ed M. Publishing House of the NC ENAS, 2000 9. V. N. Sazhin. Power Systems and Networks, Lecture Notes of AIES, 2004. 10. K. K. Tokhtibakiyev. Power Systems and Networks. Methods of Calculation of Power Losses and Their Rationing. Textbook, Almaty, 2005.
Date of last amendment	26.01.2023

Module Name:	**Module 15: Electrical Drive**
Code	M15EPE(Ba)
Module Elements:	*Compulsory Subject* Electrical Drive
Semester Number:	7
Person responsible for the module	A.A. Kashevkin
Lecturer:	Electrical Drive – A.A. Kashevkin
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	7 semester: hours per week – 10 (lectures -1; workshops -1; labs-1; independent work -7); hours per semester – 150.
Workload:	Teaching Load: 45 hours Extracurricular Classes: 105 hours Total: 150 hours
Credit Points:	5 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	Modules: Electrical Engineering, Electrical Machinery
Expected Learning Outcomes:	**Know:** general physical laws of the electric drive, nature of static and dynamic processes, methods of calculation and selection of elements of the electric drive. **Be able to:** apply and select elements of the electric drive; calculate the modes of start, stop and reverse; build static and dynamic properties of the modes of operation of the electric drive. **Possess the skills:** analysis of the modes of operation of the electric drive, calculation and selection of its parameters. **Demonstrate the ability to:** development, implementation and commissioning of electric drive systems, start-up control, reversal and stop of the electric drive.
Intendend use/applicability	Modules: Final Academic Assessment, Final Internship
Content:	*Electrical Drive* Mechanics of electric drive. DC drives. Coordinate regulation in open-loop structures. Coordinate regulation in closed structures. AC drives. Converters in AC drives. Transient processes. Energy of the electric drive.
Examination Form, module mark:	Comprehensive examination including: *Electrical Drive* – course paper Module mark: course paper *Electrical Drive*
Technical/Multimedia Facilities:	Multimedia system. Laboratory of Electrical Power Engineering
Study Materials:	1. N. F. Ilyinskiy. Basics of Electric Drives, Publishing House of MPEI,2003 2. V. I. Klyuchev. Electric Drive Theory: Textbook for universities.— M: Energoatomizdat, 2001. 3. Under the editorship of Y.N.Petrenko. Computer-Aided Control of Electric Drives, M: ACADEMA, 2005. 4. M. P. Belov et al. Automated Electric Drive of Typical Production Mechanisms and Technological Complexes", M.: ACADEMIA, 2005.
Date of last amendment	26.01.2023

Module Name:	**Module 16: Philosophy**
Code	M16EPE(Ba)
Module Elements:	*Compulsory Subject* Philosophy
Semester Number:	3
Person responsible for the module	A.V. Nikiforov
Lecturer:	Philosophy - A.V. Nikiforov
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	3 semester: hours per week – 10 (lectures -1; workshops -2; independent work -7); hours per semester – 150.
Workload:	Teaching Load: 45 hours Extracurricular Classes: 105 hours Total: 150 hours
Credit Points:	5 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	The study of the subject is based on the knowledge and skills of students obtained in the following school subjects: Man and Society, World history, World Art, Literature, and History, and University modules of Social and Humanitarian Knowledge and History of the State
Expected Learning Outcomes:	**Know:** forms and methods of scientific knowledge**.** **Be able to:** seek and apply new approaches to solving various philosophical problems. **Possess the skills:** defend personal point of view; analysis and logical thinking. **Demonstrate ability to:** use scientific views in life and profession**.**
Intendend use/applicability	Module: Final Academic Assessment
Content:	*Philosophy* Formation of understanding of a new type of rationality – as a consequence of the development of private and experimental sciences. Philosophical understanding of different forms of scienticism – mechanistic, cybernetic and synergetic. Identification of close interaction of scienticism with philosophical and anthropological problems, as well as elucidation of the true essence of science, religion, philosophy and art.
Examination Form, module mark:	*Philosophy* - computer-based testing Module mark: the result of the exam *Philosophy*
Technical/Multimedia Facilities:	PowerPoint presentations, electronic texts, multimedia system
Study Materials:	1. P. V. Alekseev, A.V. Panin. Philosophy: Textbook. M.: Prospect, 2003 2. V. D. Gubin. Philosophy: Textbook. M.: Omega, 2006 3. A. G. Spirkin. Philosophy: Textbook. M.: Gardariki, 2004 4. Philosophy: Textbook/Comp. T. H. Gabitov Almaty, 2003 5. S. F. Denisov. History and Philosophy of Science: Textbook. – Part 2: Science – Religion – Philosophy – Art. – Omsk: Amphora Publishing House, 2010. 6. S. A. Lebedev, V. A. Rubochkin. History of Science. Philosophical and Methodological Analysis. Textbook for Universities. – Moscow: Publishing house: MPSI, 2011
Date of last amendment	26.01.2023

Module Name:	**Module 17: Social and Humanitarian Knowledge**
Code	M17EPE(Ba)
Module Elements:	*Compulsory Subjects* Manashtanu Political and Social Studies Cultural Studies and Psychology
Semester Number:	1, 2
Person responsible for the module	A.V. Nikiforov
Lecturer:	Manashtanu – N.A. Abuov Political and Social Studies – A.V. Chukhno Cultural Studies and Psychology - A.V. Nikiforov
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	1 semester: hours per week – 10 (lectures -4; independent work -6); hours per semester – 150. 2 semester: hours per week – 6 (lectures -2; independent work -4); hours per semester – 90.
Workload:	Teaching Load: 90 hours Extracurricular Classes: 150 hours Total: 240 hours
Credit Points:	8 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	The study of the discipline is based on the knowledge and skills of students obtained in the following subjects of school: Man and Society, World History, World Art, Literature, History.
Expected Learning Outcomes:	**Know:** history of the University, historical milestones in the life and work of academician M. Kozybayev; theoretical and practical problems of modern business communication; the essence of socio-political processes and the role of political parties and social movements; cultural heritage of different religions. **Be able to:** apply the principles and methods of historical knowledge; apply the methods of collecting sociological information; freely navigate in issues of world religions. **Possess the skills:** work with historical sources of information; analyze the situation of conflict of interest and moral choice; ethics and psychology of business conversation. **Demonstrate the ability to:** professionally understand the social, cultural and political conditions of the modern world.
Intendend use/applicability	Module: Philosophy
Content:	*Manashtanu* The history of the University, the prospects for the development of the University in the future, historical milestones in the life and work of academician M. Kozybayev in different periods of his life, a scientific problem, which developed M. Kozybayev in the course of his life. *Political and Social Studies* Society as a socio-cultural and socio-dynamic system; system and structural-functional approaches to the analysis of society; the basic laws and patterns of development of society. Personality and society, factors of personality formation.

	Social institutions and processes. Methods and techniques of sociological research. Analysis of the collected information. Report and recommendations on the results of sociological research. Object, subject and method of political science; functions of political science; political life and power relations; role and place of politics in the life of modern societies; civil society, its origin and features; institutional aspects of politics; political system; political parties, political conflicts and ways of their resolution; political elites; foreign policy of the Republic of Kazakhstan. *Cultural Studies and Psychology* The concept and essence of culture. Typology of culture. Culture and people. The genesis of the culture. Values of ancient cultures. Values of national Kazakh culture. Methods and branches of psychology. The problem of personality in psychology. Psychology of groups and communities.
Examination Form, module mark:	Comprehensive examination including *Manashtanu* – reference paper *Political and Social Studies* - computer-based testing *Cultural Studies and Psychology* computer-based testing Module mark: the result of the exam *Cultural Studies and Psychology*
Technical/Multimedia Facilities:	PowerPoint presentations, electronic texts and maps, multimedia system
Study Materials:	1. M. K. Gorshkov. Applied sociology: methodology and methods: Textbook /M. K. Gorshkov, F. E. Sheregi. – M.: Alha_M:INFRA-M, 2009. 2. S. A. Kravchenko. Sociology: Paradigms from the Perspective of Sociological Imagination: Textbook for universities /S. A. Kravchenko. – 2nd ed. updated and revised.– M.: Egzamen Publishing House, 2004. 3. K. S.Gadzhiyev. Political Science: Basic Course: Textbook./ K. S. Gadzhiyev. - 2nd ed., updated and revised. – M.: YURAIT, 2012. 4. Political Science: Textbook for Bachelors / under the editorship of V. A. Achkasov, V. A. Gutorov. - 2nd ed., updated and revised. – M.: YURAIT, 2012. 5. V. N. Lavrinenko. Political Science. -3rd ed., updated and revised - M.: UNITY, 2010. 6. S. K. Zhantikeyev. Psychology, Yelorda, Astana, 2011. 7. R. S. Nemov. Psychology. Vol. 1,2, M., Vlados.2012. 8. Cultural Studies. / Textbook under the editorship of M. G. Bagdasaryan, 5th ed. M.: Vysshaya shkola, 2006. 9. V. G. Torosyan. Cultural Studies. History of World and National Culture. M., 2005. 10. Y. A. Malyuga, Cultural Studies. M., 2005
Date of last amendment	26.01.2023

Module Name:	**Module 18: Final Internship**
Code	M18EPE(Ba)
Module Elements:	*Compulsory subjects* Work Experience Internship 3 Pre-Graduation Internship
Semester Number:	8
Person responsible for the module	S.I. Latypov
Lecturer:	Work Experience Internship 3 – S.I. Latypov Pre-Graduation Internship – S.I. Latypov
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	8 semester: Work Experience Internship 3 – 300 hours. Pre-Graduation Internship – 150 hours.
Workload:	Extracurricular Classes: 450 hours Total: 450 hours
Credit Points:	15 ECTS
Conditions for Examinations:	For admission to the final control, the student must complete the internship program in full
Recommended Conditions:	Completion of theoretical training on the degree programme
Expected Learning Outcomes:	**Know:** theoretical basics of main and major subjects; modern achievements in the field of production, transmission and distribution of power, power enterprises according to their field of work. **Be able to:** apply the knowledge gained in practice; to present in writing or orally their ideas and solutions to problems; to calculate and design the main components of devices, systems and complexes, to maintain and use electrical equipment, systems and complexes in the professional activities. **Possess the skills:** safe operation of equipment and systems; aplication of software for calculations, simulation and implementation of production processes; assessment of technical condition and residual life of production equipment; work in groups to create projects. **Demonstrate the ability to:** apply knowledge and skills in professional activities; in the design and operation of power equipment and systems..
Intendend use/applicability	Module: Final Academic Assessment
Content:	*Work Experience Internship 3* Measures for safety, health and environment at the enterprise, structure of the technical department. Application of modern equipment of power plants, substations, power lines. New structural materials used in power engineering. Organization of innovation and inventive work. *Pre-Graduation Internship* Patent-information search on the theme of the thesis. Selection and analysis of the electrical circuit. Calculation, selection and justification of electrical circuit elements.
Examination Form, module mark:	*Work Experience Internship 3* – report defense *Pre-Graduation Internship* - report defense.
Technical/Multimedia Facilities:	Working equipment of the places of internship, laboratory equipment of the Department.
Study Materials:	1. Rules of Electrical Installations Astana: Decree of the Government of the Republic of Kazakhstan dated October 24, 2012.

	2. Safety Rules for the Operation of Electrical Installations Astana: Decree of the Government of the Republic of Kazakhstan dated October 24, 2012. 3. Y. A. Konyukhova. Power Supply of Facilities M.: Masterstvo Publishing house, 2008 4. V. P. Shekhovtsov. Calculation and Design of Power Supply Circuits. - M: Publishing house - Forum: INFRA-M, 2005 5. M. M. Katsman. Reference Book of Electric Machines M.: Akademiya Publishing Center, 2005 6. I. P. Kryuchkov, B. N. Neklepayev, V. A. Starshinov et al. Calculation of Short-Circuit and Selection of Electrical Equipment. - M.: Akademiya Publishing Center, 2005 7. L. D. Rozhkova, L. K. Karneyeva, T. V. Chirkova. Electrical Equipment of Power Plants and Substations. - M.: Akademiya Publishing Center, 2008 8. A. A. Gerasimenko, V. T. Fedin. Transmission and Distribution of Electrical Power. – Rostov-on-Don: Phoenix Publishing House, 2006
Date of last amendment	26.01.2023

Module Name:	**Module 19: Final Academic Assessment**
Code	M19EPE(Ba)
Module Elements:	*Compulsory subjects* State examination in the specialty Developing and defending a thesis
Semester Number:	8
Person responsible for the module	A.A. Kashevkin
Lecturer:	State examination in the specialty – A.A. Kashevkin Developing and defending a thesis – A.A. Kashevkin
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	8 semester: hours hours per semester – 450.
Workload:	Extracurricular Classes: 450 hours Total: 450 hours
Credit Points:	15 ECTS
Conditions for Examinations:	Completion of the Degree Programme and writing a bachelor's thesis
Recommended Conditions:	Completion of the full course of study on the Degree Programme
Expected Learning Outcomes:	**Know:** theoretical basics of main and major subjects; modern achievements in the field of production, transmission and distribution of power, power supply enterprises according to their field of work; methods of analysis and synthesis of devices, systems and complexes in the chosen field and the principles of their construction and operation. **Be able to:** apply the knowledge gained in practice; to present in writing or orally their ideas and solutions to problems; to calculate and design the main components of devices, systems and complexes, to maintain and use electrical equipment, systems and complexes in the professional activities; to formulate the basic technical and economic requirements for the designed devices and systems. **Possess the skills:** safe operation of equipment and systems; use of software for calculations, simulation and implementation of production processes; assessment of technical condition and residual life of production equipment; work in groups to create projects. **Demonstrate the ability to:** apply knowledge and skills in professional activities; in the design and operation of equipment and systems, using analog and digital, electric and electronic technologies; in the field of operation and prospective development of complex electrical equipment; in the field of analysis and synthesis of automatic control systems and regulation; in the field of design, maintenance, and operation of devices and systems of automation and telemechanics.
Intendend use/applicability	Professional activity
Content:	*State examination in the specialty* Demonstration of the knowledge and skills gained in the study of the following subjects: Data Measuring Equipment/ Engineering Measurements; Electrical Engineering Equipment /Electrical Machinery; Industrial Electronics; Electrical Power Engineering / General Issues in Electrical Power Engineering. *Developing and defending a thesis*

	Patent information search on the topic under study. Selection and analysis of the electrical circuit of the object. Calculation, selection and justification of electrical network elements. Calculation of short-circuit currents. Calculation of the grounding. Analysis of reliability of power supply, calculation of economic efficiency, as well as issues of labor protection and safety in the construction or reconstruction of electric power facilities.
Examination Form, module mark:	Comprehensive module examination including *State examination in the specialty* – oral examination *Developing and defending a thesis* – defending a bachelor's thesis
Technical/Multimedia Facilities:	Production equipment of enterprises, laboratory equipment of the department, software: Matcad, MATLAB, Proteus, S-Plan, office software packages.
Study Materials:	1. Rules of Electrical Installations Astana: Decree of the Government of the Republic of Kazakhstan dated October 24, 2012. 2. Safety Rules for the Operation of Electrical Installations Astana: Decree of the Government of the Republic of Kazakhstan dated October 24, 2012. 3. Y. A. Konyukhova. Power Supply of Facilities. M.: Masterstvo Publishing House, 2008. 4. V. P. Shekhovtsov. Calculation and Design of Power Supply Circuits. - Moscow: Publishing house - Forum: INFRA-M, 2005. 5. I. P. Kryuchkov, B. N. Neklepayev, V. A. Starshinov et al. Calculation of Short-Circuit and Selection of Electrical Equipment. - M.: Akademiya Publishing Center, 2005 6. L. D. Rozhkova, L. K. Karneyeva, T. V. Chirkova. Electrical Equipment of Power Plants and Substations. - M.: Akademiya Publishing Center, 2008 7. A. A. Gerasimenko, V. T. Fedin. Transmission and Distribution of Electrical Power. – Rostov-on-Don, 2006 8. V. N. Sazhin Power Systems and Networks. Lecture Notes. AIES, 2004, Almaty. 9. A. F. Monakhov. Protective Measures of Electrical Safety in Electrical Equipment. Textbook. M., ZAO Energoservis, 2008. 10. M. P. Belov et al. Automated Electric Drive of Typical Production Mechanisms and Technological Complexes, M.: ACADEMA, 2005.
Date of last amendment	26.01.2023

Module Name:	**Module 20: Basics of the Profession**
Code	M20EPE(Ba)
Module Elements:	*Elective Subjects* Introducation to the Profession; Introducation to the Specialty; Materials Science in Power Industry; Basics of Materials Science; Computer Graphics; Computer Simulation; Programming Technics; Software Programming Languages; Practical Training
Semester Number:	1, 2
Person responsible for the module	S.I. Latypov
Lecturer:	Introducation to the Profession – S.I. Latypov Introducation to the Specialty – O.S. Gagolina Materials Science in Power Industry – A.M. Aytulina Basics of Materials Science – N.V. Zykova Computer Graphics –S.I. Latypov Computer Simulation –S.I. Latypov Programming Technics – L.V. Dolmatova Software Programming Languages – N.V. Astapenko Practical Training – S.I. Latypov
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	1 semester: hours per week – 8 (lectures -1; workshops -1; labs-1; independent work -5); hours per semester – 120. 2 semester: hours per week – 16 (lectures -3; workshops -1; labs-1; independent work -11); hours per semester – 240. Practical Training: 30 hours.
Workload:	Teaching Load: 120 hours. Extracurricular Classes: 240 hours. Practical Training: 30 hours. Total: 390 hours
Credit Points:	13 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	-
Expected Learning Outcomes:	**Know** spheres, objects, subjects and types of professional activity of the bachelor in the specialty Electrical Power Engineering; prospective directions of development of the specialty; prospects of development of power industry; the basic applications for working with design documentation, calculations and models in the designing. **Be able to** successfully participate in the educational process in accordance with the approved working curriculum of the specialty; use various options of the applications studied to obtain during in the designing. **Possess the skills:** use knowledge on the power industry in the further study of special subjects; to develop drawings of finished products, as well as mathematical processing of project data using a personal computer. **Demonstrate the ability to:** understand the requirements for

	the level of qualification, competence and basic information on the professional activities of the bachelor specialty Electrical Power Engineering; use computer graphics and data acquisition software in the designing of process and design documentation.
Intendend use/applicability	Modules: Basics of Equipment Operation.
Content:	*Introducation to the Profession* Characteristics of professional activity of graduates of educational programs in the specialty. Requirements for the level of qualification and competence of the bachelor. Electrical Power Engineering is the leading component of power engineering. History of electronics development, its role in modern scientific and technical progress. A brief historical overview of the development of electrical equipment. Application of nanotechnology in the modern world. *Introducation to the Specialty* Sphere, objects, subjects and types of professional activity of the bachelor in the specialty Electrical Power Engineering. Prospective directions in the field of electrical power engineering. Equipment, technologies of production of the main shops of enterprises and their technical and economic indicators. *Materials Science in Power Industry* Classification of materials. Mechanical, electrical and thermal properties of materials. Magnetic materials. Dielectric materials. Conductor materials. Physical basics of semiconductor devices. Semiconductor devices. *Basics of Materials Science* Classification of materials. Structural materials. Metallic materials. Metal alloys used in production. Non-metallic materials. Composite materials. Nanostructured materials. Conductor materials. Semiconductor materials. Dielectric materials. Magnetic materials. *Computer Graphics* Hardware and functional capabilities of a modern personal computer. Pictorial symbols of elements in the drawing. Drawing up design documentation. Use of Splan application for preparation of drawings. Use of AutoCAD to create drawings. *Computer Simulation* Hardware and functional capabilities of a modern personal computer. MATLAB application for mathematical simultion of electrical processes. Electronics Workbench application for simulation of electrical processes. Microsoft Office Excel to solve common tasks. Microsoft Office Word for design documentation. AutoCAD to create drawings. *Programming Technics* Basics of algorithmization, methods of recording algorithms, basics of programming technology, programming style, structure of programs, methods of debugging and testing programs, data types, general information on object-oriented programming. *Software Programming Languages* Learning of the classification of programming languages, data types, operations, operators of C++ programming language, program development using subroutines,

	standard modules, programming style, programming quality indicators, methods of debugging and testing programs, basics of object-oriented programming, memory and addressing, program development using pointers, programming features in C++. *Practical Training* The structure of the enterprise, its internal regulations. Study of technological processes of production. Study of the Electrical Installation Code of the Republic of Kazakhstan. Analysis of the grounding system at the enterprise.
Examination Form, module mark:	Comprehensive examination including *Introducation to the Profession*– reference paper*;* *Introducation to the Specialty* – reference paper; *Materials Science in Power Industry* –computer-based testing; *Basics of Materials Science* – computer-based testing; *Computer Graphics* - free-form examination *Computer Simulation* - free-form examination *Programming Technics* - free-form examination *Software Programming Languages* - free-form examination *Practical Training* – training report defense Module mark: the result of the report defense *Practical Training*
Technical/Multimedia Facilities:	Multimedia system. IT room. Laboratory of Electrical Engineering and Materials Science
Study Materials:	1. K. D. Dukenbayev. Power Engineering of Kazakhstan. Moving to Market. - Almaty.; Gylym, 1999. 2. G. A. Yevdokunin. Power Systems and Networks. Textbook for electric power specialties. - SPb.; Publishing House of M. P. Sizov. 2001. 3. E.I. Bass, V.G. Doroguntsev. Relay Protection of Electric Power Systems. Ed. by A.F. Dyakov. - M., PH of MPEI, 2002. 4. Y. D. Sibikin, M. Y. Sibikin. Power Safety at Operation of Power Equipment of the Industrial Enterprises. – M: Akademiya, 2004. 5. G. I. Silman. Materials Science. - M:Akademiya, 2008 6. L. V. Zhuravleva. Electrical Materials Science - M.: Akademiya, 2004 7. O. S. Maryakov. Materials Science. – M: Akademiya, 2008 8. I. Chernukh. Simulation of Electrical Devices in MATLAB, SimPowerSystems and Simulink. – M: Piter PH, 2007. 9. A. S. Zhuravlev. AutoCAD for Designers. Standards of the Unified System for Design Documentation in AutoCAD 2009/2010/2011. Practical Tips from a Designer. – M: Nauka I tekhnika, 2010. 10. V. Dyakonov. VisSim+Mathcad+MATLAB. Visual Mathematical Simulation. M: SOLON-Press, 2004. 11. I. I. Aliyev. Virtual Electrical Engineering. Computer Technologies in Electrical Engineering and Electronics. – Kyiv: RadioSoft, 2003. 12. N.A. Litvinenko. C++Programming Technology. Beginners //St. Petersburg 2009, BHV 13. M.V. Kuznetsov. C++ Master Class in Problems and Examples //St. Petersburg 2010, BHV
Date of last amendment	26.01.2023

Module Name:	**Module 21: Basics of Equipment Operation**
Code	M21EPE(Ba)
Module Elements:	*Elective Subjects* Electromagnetic Capability; Basics of Heat Supply; Basics of Nanotechnology; Electroinsulating Devices; Equipment of Electric Power Plants and Substations Basics of Automation; Automatic Control; Computer Networks; WEB-Programming; Electrical Power Generation; Reliability and Quality of Power Energy; General Issues on Power Engineering; Work Experience Internship 1
Semester Number:	3, 4
Person responsible for the module	S.I. Latypov
Lecturer:	Electromagnetic Capability – A.A. Savostin Basics of Heat Supply – A.V. Demyanenko Basics of Nanotechnology – N.V. Zykova Electroinsulating Devices – O.S. Gagolina Equipment of Electric Power Plants and Substations - S.I. Latypov Basics of Automation - N.V. Zykova Automatic Control – Y.V. Gerasimova Computer Networks – I.R. Kasimov WEB-Programming – N.V. Astapenko Electrical Power Generation – Y.M. Dariy Reliability and Quality of Power Energy – S.I. Latypov General Issues on Power Engineering – O.S. Gagolina Work Experience Internship 1 - O.S. Gagolina
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	3 semester: hours per week – 16 (lectures -2; workshops -2; labs-2; independent work -10); hours per semester – 240. 4 semester: hours per week – 16 (lectures -2; workshops -2; labs-2; independent work -10); hours per semester – 240. Work Experience Internship 1 – 120; hours per semester – 360.
Workload:	Teaching Load: 180 hours Extracurricular Classes: 300 hours Work Experience Internship 1 – 120 hours Total: 600 hours
Credit Points:	20 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module.
Recommended Conditions:	Modules: Basics of Mathematics. Physics. Basics of the Profession.
Expected Learning Outcomes:	**Know:** physical and chemical processes at the micro level, main equipment used at modern power plants and substations, principles of electromagnetic compatibility of technical means and calculation of thermal processes; the basic concepts of automation, the basic principles of

	regulation and control, and the basic elements of automatic systems; the principles of construction of power plants and equipment of the electrical part of power plants and substations; the concept of providing consumers with power, methods of transmission and distribution of power, elements of relay protection and automation; methods of network configuration and testing. **Be able to:** apply methods of calculation and analysis of the properties of nanotechnology materials; analyze the operation of the power plant and substation on the schematic diagram; assess the electromagnetic environment in the operation of technical means; make design and technical decisions to limit the electromagnetic field, assess the thermal condition of objects; make functional schemes, to calculate indicators of management quality; apply and select equipment, elements of electrical networks, relay protection and automation, power supply systems and alternative and renewable power sources for power plants; configure network equipment settings. **Possess the skills:** hypothetical drawing up of nanostructures by means of nanoinstruments; reading of single-line schematic diagrams of power objects and their drawing up, as well as in questions of the choice of the equipment; development technical, schematic and organizational activities for ensuring electromagnetic compatibility; to solve problems on the basis of modern software packages; analysis of operating modes in the production, transmission and distribution of power, relay protection and automation; use the skills to organize local networks of different topologies. **Demonstrate the ability to:** use electrical insulation equipment; repair of electrical equipment; independently design and conduct research on automatic control systems; develop, implement and set up electrical equipment, electrical systems and networks, relay protection and automation for power plants; manipulating the parameters of program access to the network.
Intendend use/applicability	Module: Design of Electrical Systems
Content:	*Electromagnetic Capability* Basic notions of electromagnetic compatibility. Sources of electromagnetic interference, their classification. Methods of description and presentation of interference. The way of interference penetration (parasitic channels). *Basics of Heat Supply* Technical thermodynamics. Law of thermodynamics. Thermodynamic processes. Basics of heat transfer theory. Heat power plants (boilers, furnaces and compressor plants). *Basics of Nanotechnology* Nanoscience and nanotechnology. Measurement methods in nanotechnology. *Electroinsulating Devices* Polymeric materials and their application in power engineering. Electrochemical processes at the enterprises of the power industry. *Equipment of Electric Power Plants and Substations* Synchronous generators and their nominal parameters. Power transformers and autotransformers. Basic power devices. *Basics of Automation* General information on automation systems and their

	constituent elements. Sensors and transducers. Relay. Amplifiers. Non-contact magnetic relay and stabilizers. Execution units. Automatic control system. Automatic measuring systems. *Automatic Control* Classification of automated control systems (ACS). Description of ACS in the frequency domain. ACS Stability. Assessment of ACS quality and accuracy. Synthesis of ACS. *Computer Networks* Mastering the principles of organization and functioning of computer networks, features of the personal computer in networks. *WEB-Programming* Web-Programming is designed to promote students ' familiarity with computer telecommunications and possible approaches to the development of hypertext documents intended for publication in the global computer network of Internet. Training in the development of Web-pages on the basis of an integrated approach; training in Internet programming on the client and server side; training in the use of databases in the development of Web-projects; training in methods of marketing on the Internet, advertising and promotion of developed Internet-resources. *Electrical Power Generation* Types of power plants and the basic quantities characterizing the plants. Main equipment of power plants: synchronous generators, power transformers, autotransformers, electric motors, grounding devices, DC installations with batteries. Electrical diagrams of power plants. System of own needs of power plants. Management and control system. *Reliability and Quality of Power Energy* General information on the electrical systems. Main objects of the power systems and the values characterizing the reliability and quality of their work. Management and control systems. *General Issues on Power Engineering* Legal basis of power engineering, power resources of the Republic of Kazakhstan, development trends, principles of production, transmission, distribution of power, methods of automatic elimination of damage and abnormal conditions in the electrical part of power systems, main power consumers in the Republic of Kazakhstan. *Work Experience Internship 1* Measures for safety, health and environment at the enterprise, structure of the technical department. Application of modern equipment of power plants, substations, power lines.
Examination Form, module mark:	Comprehensive examination including: *Electromagnetic Capability* - reference paper *Basics of Heat Supply* - written examination *Basics of Nanotechnology* - reference paper *Electroinsulating Devices* - written examination *Equipment of Electric Power Plants and Substations* - written examination *Basics of Automation* - written examination *Automatic Control* - written examination *Computer Networks* – computer-based testing *WEB-Programming* – computer-based testing

	Reliability and Quality of Power Energy - reference paper *Electrical Power Generation* - computer-based testing *General Issues on Power Engineering* – written control examination *Work Experience Internship 1* – internship report defense Module mark: the result of the report defense *Work Experience Internship 1*
Technical/Multimedia Facilities:	Multimedia system. IT room. Laboratory of Electrical Power Engineering
Study Materials:	1. Y. Y. Sedelnikov. Electromagnetic Capability of Radio Electronic Equipment. Textbook. - Kazan. ZAO Novoye znaniye, 2016. 2. M. P. Bader. Electromagnetic Capability. - M.: Transport, 2008. 3. Heat Engineering. Under the editorship of V. N. Lukanina. – M: Vysshaya shkola, 2005 4. A. F. Apalkov. Heat Engineering. – Rostovon-Don: Feniks, 2008. 5. V. N. Lozovskiy, G. S. Konstantinova, S. V. Lozovsky, Nanotechnology in Electronics. Introduction to the Specialty. – SPb.: Lan, 2008. 6. Nanomaterials. Nanotechnologies. Nanosystem Technology. Edited by Maltsev P. P. – M.: Tekhnosfera, 2006. 7. G. H. Khozhin Electrical Part of Power Plants. Textbook. Almaty, AIES, 2009 8. L. D. Rozhkova. Electrical Equipment of Electric Power Plants and Substations. M.: Akademiya, 2004 9. V. Y. Shishmarev. Automation. – M: Akademiya, 2013 10. A. S. Vostrikova, G. A. Frantsuzova. Theory of Automatic Control – Novosibirsk: NSTU, 2012 11. G. C. Goodwin, S. F. Graebe, M. E. Salgado, Control System Design Engineering. - M.: Binom, 2008. 12. G. F. Bystritsky. General Power Engineering, M: Akademiya, 2005 13. L. D. Rozhkova, L. K. Karneyeva, T. V. Chirkova. Electrical Equipment of Electric Power Plants and Substation. - M: Akademiya Publishing Center, 2008 14. Basics of Modern Power Engineering. Edited by Y. V. Ametistov, M.: Publishing House of MPEI, 2003 15. Rules of Electrical Installations Astana: Decree of the Government of the Republic of Kazakhstan dated October 24, 2012. 16. Safety Rules for the Operation of Electrical Installations Astana: Decree of the Government of the Republic of Kazakhstan dated October 24, 2012. 17. V. G. Olifer, N. A. Olifer. Computer Networks. Moscow, 2010 18. M. Palmer, R. Sinclair. Design and Implementation of Computer Networks. St. Petersburg, 2011 19. D. Sklyar, A.Trachtenberg. PHP. Programming Recipes. 2nd ed.: Trans. from English, M.: Russkaya Redaktsiya Publishing House, 2007 – 736 p. 20. L. D. Sleptsova, Y. M. Bidasyuk. JavaScript. Tutorial. M.: Williams Publishing house, 2007 – 448 p.
Date of last amendment	26.01.2023

Module Name:	**Module 22: Technologies of Technogenic Risk Management**
Code	M22EPE(Ba)
Module Elements:	*Elective Subjects* Basics of Law and Anti-Corruption Culture; Basics of Financial Literacy; Economic and Business Studies; Power Saving Technologies in Modern Industries; Ecology and Sustainable Development; Information and Quality Management; Health and Safety Basics
Semester Number:	4
Person responsible for the module	V.V. Savinkin
Lecturer:	Basics of Law and Anti-Corruption Culture – D.T. Konyrbayeva Basics of Financial Literacy – O.A. Tsapova Economic and Business Studies – I.A. Shinkaryov Power Saving Technologies in Modern Industries – V.V. Savinkin Ecology and Sustainable Development – S.B.Baybusinova Information and Quality Management – T.P. Kovshova Health and Safety Basics – T.S. Zvyarechenko
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	4 semester: hours per week – 6 (lectures -2; independent work -4); hours per semester – 90.
Workload:	Teaching Load: 30 hours Extracurricular Classes: 60 hours Total: 90 hours
Credit Points:	3 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	This module is based on the knowledge gained in the school school of Geography; Basics of Life Safety; People. Society. Right.
Expected Learning Outcomes:	**Know:** theoretical basics and main concepts of humanitarian, economic and natural sciences, data and communication technologies that contribute to the formation of a highly educated person with a broad outlook and culture of thinking; **Be able to:** use humanitarian, economic, legal and natural science knowledge in the modern information space**;** **Possess the skills:** search, analysis, evaluation, work with sources and use of humanitarian, economic, legal and natural science knowledge for personal and professional development; **Demonstrate the ability to**: use the tool of historical analysis, knowledge of information and communication technologies for better solutions of professional problems, the basics of philosophical knowledge for the formation of scientific worldview and economic thinking to solve situational and practical problems**.**
Intendend use/applicability	Module: Final Academic Assessment
Content:	*Basics of Law and Anti-Corruption Culture* Basics of constitutional, criminal, administrative, labour and family law of the Republic of Kazakhstan. Theoretical and

	methodological basis of the concept of corruption. *Basics of Financial Literacy* Planning of capital investments and cash flows. Long-term and short-term sources of funding. *Economic and Business Studies* Introduction to Economics. Entrepreneurship and business. Money circulation and turnover. Functioning of markets. Business planning. *Power Saving Technologies in Modern Industries* Power industry, energy saving and energy resources. Types, methods of production, conversion and use of energy. Energy management. *Ecology and Sustainable Development* Ecology of individuals, populations and communities. The concept and principles of sustainable development. *Information and Quality Management* Elements of organizations and management process. Basics of quality management. Information management – basic concepts. *Health and Safety Basics* Legislative and legal acts in the field of safety and life. Protection of people and environment from harmful and dangerous factors of natural and man-made origin. Classification of hazardous and harmful factors.
Examination Form, module mark:	*Basics of Law and Anti-Corruption Culture / Basics of Financial Literacy / Economic and Business Studies / Power Saving Technologies in Modern Industries / Ecology and Sustainable Development / Information and Quality Management / Health and Safety Basics* – computer-based testing Module mark: the result of the exam *Basics of Law and Anti-Corruption Culture / Basics of Financial Literacy / Economic and Business Studies / Power Saving Technologies in Modern Industries / Ecology and Sustainable Development / Information and Quality Management / Health and Safety Basics*
Technical/Multimedia Facilities:	Multimedia system.
Study Materials:	1. K. S. Birzhanova, K. B Ibrayeva. Basics of Law of the Republic of Kazakhstan. - Almaty: Almaty kitap baspasy, 2013. 2. R. Y. Dzhanshanlo. Analysis of Cash Flows of the Organization: Textbook / R. Y. Dzhanshanlo. - Almaty: Lem, 2015. 3. Y. F Borisov, A. A. Petrov, T. Y. Berezkina. Economics: Textbook for Bachelors. - M.: Prospekt, 2013. 4. Fundamentals of Energy Conservation: Textbook / N.I. Danilov, Y. M. Schelokov. Yekaterinburg: GOU VPO UGTU - UPI, 2015. 5. T. A. Hwang, P. A. Hwang. Ecology: Short Course. - Rostov-on-Don: Phoenix, 2012. 6. A.V. Kostrov. Basics of Information Management: Textbook M.: Finance and Statistics, 2008. 7. Y. D. Vishnyakov. Life Safety. Protection of Population and Territories in Emergency Situations: Textbook. - M: Akademiya, 2012.
Date of last amendment	26.01.2023

Module Name:	**Module 23: Design of Electrical Systems**
Code	M23EPE(Ba)
Module Elements:	*Elective Subjects* Electrical Engineering Equipment Electromechanics Modes of Power Systems Data Measuring Equipment Engineering Measurements Process sensors Transducers of Measuring Signals Industrial Power Supply
Semester Number:	5
Person responsible for the module	O.S. Gagolina
Lecturer:	Electrical Engineering Equipment – A.A. Kashevkin Electromechanics – O.S. Gagolina Modes of Power Systems - O.S. Gagolina Data Measuring Equipment– Y.M. Dariy Engineering Measurements – Y.V. Gerasimova Process sensors- Y.M. Dariy Transducers of Measuring Signals – N.V. Zykova Industrial Power Supply - A.A. Kashevkin
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	5 semester: hours per week – 24 (lectures -3; workshops -2; labs-3; independent work -16); hours per semester – 360.
Workload:	Teaching Load: 120 hours Extracurricular Classes: 240 hours Total: 360 hours
Credit Points:	12 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	Modules: Electric Power Plants and Substations, Basics of equipment operation, Electrical Engineering
Expected Learning Outcomes:	**Know:** main characteristics of the electrical equipment used; principles of construction and operation of main types of relay protection devices and automation of electric power systems; the principles of operation of measuring instruments, the basics of the error theory, methods of measurement of electrical and non-electrical quantities; the theory of physical quantities conversion and principles of construction of measuring transducers; main properties required for analysis and calculation of power supply systems of industrial enterprises. **Be able to:** select a potential power source for operation in the power system or for the needs of the end user; formulate basic technical requirements for the selection of power equipment; apply and select the elements of relay protection and automation; choose a measuring device for a given metrological characteristics, to measure the basic electrical quantities; to process the results of measurements of analog and digital devices, to use virtual devices in the LabVIEW environment; to choose sensors for instrumentation, to use signal converters depending on the specifics of the measuring task. **Possess the skills** to main characteristics of the electrical

	equipment used, analysis of the modes of operation of electric power and electrical equipment; of use of modern measuring technologies and their information support; experimentation in the field of measurements of various values and parameters by electric methods; calculation of power supply systems of enterprises of various industries. **Demonstrate the ability to:** development, implementation and commissioning of electrical power plants, electrical systems and networks; use modern measurement technologies and different types of sensors in relation to the technological processes of power facilities; design power supply systems of enterprises/
Intendend use/applicability	Modules: Technical Equipment of Power Facilities, Automation and control in the electric power industry
Content:	*Electrical Engineering Equipment* Electrothermal resistance settings. Induction heating installations. Installation of dielectric heating. Arc furnace. Electrolysis industrial plants. Plasma industrial plants. Sources of optical radiation (thermal, gas-discharge, pulse, lasers). Light devices. Start-up control equipment. Lighting installations. Rationing of lighting systems. Operation of lighting systems. Lighting of industrial premises and public buildings. Outdoor lighting of cities. *Electromechanics* AC micromachines, DC micromachines, rotary transformers and selsyn motors. *Modes of Power Systems* Construction of electric power systems, modes of operation of power systems, determination of operating parameters, determination of power losses in systems. Influence of power quality on the operation of power systems. *Data Measuring Equipment* Development of materials relating to the measurement and evaluation, processing of measuring signals, study of modern principles of construction of power measuring equipment, measuring information systems and complexes, use of methods and measuring instruments in various practical areas. *Engineering Measurements* Classification of measuring instruments. Block diagrams of measuring instruments. Components and parts of measuring instruments. Magneto-electric devices, rectifiers and thermoelectric systems, electromagnetic and electrodynamic systems. Measuring converters of parameters of alternating currents and voltages. Electronic measuring instruments. Measurement of voltage in DC, AC voltage and current at low and high frequencies. Metrology of oscillographic measurements. Analog methods and recording tools *Process sensors* Basic notions of the converters of physical quantities and their classification, Physical Basics of The Sensors, Resistive Sensors, Semiconductor Photo Sensors, Galvanomagnetic Sensors, Thermoelectric Sensors, Piezoelectric Sensors, Capacitive Sensors *Transducers of Measuring Signals* Primary converters (generator and parametric sensors), secondary converters (amplifiers, voltage dividers and bridges, phase meters and frequency meters) and ADC.

	Principles of operation, transformation functions and application features. Power, information and other criteria for coordination of primary transducers with the object of measurement. *Industrial Power Supply* Basic notions of power supply systems, main electrical equipment of power substations, electrical connection diagrams in the power supply system, in-plant power supply, in-plant industrial power supply, electrical loads, power consumption and losses, parameters of electrical networks and their normal modes, compensation of reactive power in the power supply system, short circuits in power supply systems, selection of devices and conductors of the power supply system of facilities with a voltage above 1 kV, selection of electrical equipment at a voltage of up to 1 kV, power quality in power supply systems of facilities, automation and relay protection.
Examination Form, module mark:	Comprehensive examination including: *Electrical Engineering Equipment* – free-form examination *Industrial Power Supply* – free-form examination *Electromechanics* – written control examination *Modes of Power Systems* - written control examination *Data Measuring Equipment* - written control examination *Engineering Measurements* - written control examination *Process sensors* - computer-based testing *Transducers of Measuring Signals* - computer-based testing Module mark: written control examination *Elective Subject*
Technical/Multimedia Facilities:	Multimedia system. Laboratories of Data Measuring Equipment and Automation, Power Safety, Electrical Power Engineering and Power Supply and Installation of Electrical Equipment
Study Materials:	1. John.Twidell. Renewable Energy Source. M, 2000. 2. L. I. Kuperman. Secondary Energy Resources and Energy Technological Combination of Industry. Kyev, 2006. 3. V. A. Ostreykovskiy. Reliability Theory. M.: Vysshaya shkola. 2003. 4. V. P. Shekhovtsov. Electrical and Electromechanical Equipment. - M: Forum: Infra-M, 2008. 5. Reference Book for Electric Lighting Design / G. M. Knorring, I. M. Fadin, V. N. Sidorov. - SPb.: Energoatomizdat, 2002. 6. V. N. Sazhin. Power Systems and Networks, Lecture Notes of AIES, 2004. 7. K. K. Tokhtibakiyev. Power Systems and Networks. Methods of Calculation of Power Losses and Their Rationing. Textbook, Almaty, 2005. 8. E. G. Atamalyan. Devices and Methods of Measurement of Electrical Quantities. - M.: Drofa, 2005; 9. G. G. Rannev. Methods and Tools of Measuring. - M: Akademiya, 2004; 10. B. V. Dvoryashin. Metrology and Radio Measurements. - M: Akademiya, 2005; 11. A. F. Kotyuk. Sensors in Modern Measurements. – M.: Radio i svyaz, Goryachaya liniya - Telekom, 2006. 12. R. G. Jackson. Latest Sensors. – M: Tekhnosfera, 2008. 13. B. I. Kudrin. Industrial Power Supply. - M.: Intermet Engineering, 2005. 14. V. P. Shekhovtsov. Calculation and Design of Power Supply Circuits. - M: Forum: Infra-M, 2004.
Date of last amendment	26.01.2023

Module Name:	**Module 24: Technical Equipment of Power Facilities**
Code	M24EPE(Ba)
Module Elements:	*Elective Subjects* Elements of Automation and Relay Protection Devices Insulation and Overvoltage in Electrical Equipment Power Devices Electromechanical and Electronic Relays and Automation Devices Microcontrollers and Microprocessors Design of Systems Based on Programmable Integrated Circuits Work Experience Internship 2
Semester Number:	6
Person responsible for the module	A.A. Kashevkin
Lecturer:	Elements of Automation and Relay Protection Devices - A.A. Kashevkin Insulation and Overvoltage in Electrical Equipment - S.I. Latypov Power Devices - A.A. Kashevkin Electromechanical and Electronic Relays and Automation Devices – O.S. Gagolina Microcontrollers and Microprocessors – P.A. Petrov Design of Systems Based on Programmable Integrated Circuits – S.S. Moldakhmetov Work Experience Internship 2 – A.A. Kashevkin
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	6 semester: hours per week – 28 (lectures -3; workshops -3; labs-4; independent work -18); Work Experience Internship 2 - 120 hours per semester – 540.
Workload:	Teaching Load: 150 hours Extracurricular Classes: 270 hours Work Experience Internship 2 – 120 hours Total: 540 hours
Credit Points:	18 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	Modules: Basics of Mathematics, Information and Communication Technologies, Industrial Electronics, Electrical Machinery, Electrical Engineering
Expected Learning Outcomes:	**Know:** principles of operation and design of various types of power devices, their technical parameters and properties, physical phenomena in power devices; syntax of programming languages for microcontrollers, conditions for building algorithms required for writing programs; the principles of construction and operation of the main types of relay protection devices and automation of electric power systems; methods of calculation of inclusion in the network of transformers and motors. **Be able to:** formulate basic technical requirements when selecting a power device, to assess the condition of a power device; assemble various devices on microcontrollers of simple and medium complexity used in power systems, make an algorithm necessary for writing the program of the microcontroller, write a program for the microcontroller in

	any of the languages studied; flash the microcontroller with the help of the programmer; apply and produce a selection of electrical relay protection and automation, calculate electrical loads, short-circuit currents, power loss and voltage. **Possess the skills** of selection of power devices; designing microcontroller based devices; analysis of modes of operation of relay protection and automation, as well as calculation of parameters of relay protection and automation devices. **Demonstrate the ability to:** select power devices for specific operating conditions, independently test power devices, identify possible faults and their prompt elimination; design microcontroller devices; to develop, implement and set up electrical relay protection and automation.
Intendend use/applicability	Module: Automation and control in the electric power industry
Content:	*Power Devices* Electrodynamic and thermal processes in power device. Electrical contact. Electric arc. Insulation of power device. Magnetic circuits of electromagnets. Electromagnetic current and voltage relays. Thermal relays. Time relays. Switches. Fuses. Circuit breaker. RCD – residual current device. Command devices and switches. Contactors and magnetic starters. Contactless control devices. *Electromechanical and Electronic Relays and Automation Devices* Electromechanical devices of electrical power distribution systems. Thermal processes in power devices. Power contacts. Electric arc and switching process. Switches and disconnectors. *Elements of Automation and Relay Protection Devices* Automation devices. Basic definitions and classification of power divices. Basic physical phenomena and processes in power devices. Contactors and starters. Circuit breakers and fuses. Power semiconductor control devices. *Insulation and Overvoltage in Electrical Equipment* Operational electrical effects on electrical insulation of electrical equipment. General properties of external insulation of electrical eqyupment. Purpose and types of insulators. Formation of a discharge in air gaps at short-term and long-term acting voltage. Features of the discharge along the dielectric surface. Environmental voltage effects. *Microcontrollers and Microprocessors* Bus microprocessor systems and cycles of exchange. Features of the main devices. Command system of the processor. Processor core and memory of microcontrollers. Organization of communication of the microcontroller with the environment and time. Auxiliary hardware of the microcontroller. Features of development of digital devices based on microcontrollers. Programming languages for microcontrollers. *Design of Systems Based on Programmable Integrated Circuits* Microcontrollers. Microprocessors. Computer languages. Assembler. C and C++. Arduino. Debug boards and hardware platforms. *Work Experience Internship 2* Design of power supply systems for facilities, power plants,

	substations.
Examination Form, module mark:	Comprehensive examination including: *Power Devices* - written control examination *Electromechanical and Electronic Relays and Automation Devices* - computer-based testing *Elements of Automation and Relay Protection Devices* – written control examination *Insulation and Overvoltage in Electrical Equipment* - computer-based testing *Microcontrollers and Microprocessors*– computer-based testing *Design of Systems Based on Programmable Integrated Circuits* – computer-based testing Work Experience Internship 2 – internship report defense Module mark: the result of the report defense *Work Experience Internship 2*
Technical/Multimedia Facilities:	Multimedia system. Laboratories of Power Supply and Installation of Electrical Equipment, Digital Devices and Microprocessors, Electrical Power Engineering
Study Materials:	1. I. I. Aliyev, M. B. Abramov. Power Devices. Reference Book - M: radio soft, 2004. 2. A. A. Chunikhin. Power Devices. – M: Energoatomizdat, 2005 3. Abzhanov R. S. Electrical Part of the Power Plant. Lecture Notes. Almaty, AIES, 2009 4. G. H. Khozhin Electrical Part of Power Plants. Textbook. Almaty, AIES, 2006 5. L. D. Rozhkova Electro Equipment of Electric Power Plants and Substances.M.: Akademiya, 2004. 6. V. N. Kopyev. Relay Protection. Tomsk, 2001. 7. A. M. Fedoseyev. Relay Protection of Electric Power Systems, M, 2004. 8. B. A. Alekseyev, Maintenance of Relay Protection and Automation of Power Plants and Power Networks. Part 1. Electromagnetic Relay. / Ed M. Publishing House of the NC ENAS, 2000. 9. Guidelines for the Calculation of Short-Circuit Currents and Selection of Electrical Equipment. Rd 153-34.0-20.527-98 Russian Joint Stock Company of Energy and Electrification of UES of Russia, Moscow-Publishing House of NC ENAS, 2001. 10. V. I. Boyko Microprocessors and Microcontrollers. - SPb.: BHV-Petersburg, 2004. 11. Y. V. Novikov. Introduction to Digital Circuitry. – M: BINOM. Laboratoriya Znaniy, 2007. 12. A. K. Naryshkin. Digital Devices and Microprocessors. - M: ACADEMA, 2006. 13. Jeremy Blum. Exploring Arduino: Tools and Techniques for Engineering Wizardry. 1st Edition, 2015. 14. V. B. Brodin, A.V. Kalinin. Systems on Microcontrollers and LSI of programmable logic; M.: Publishing House ECOM, 2002. 15. Y. Ugryumov. Digital Circuitry; St. Petersburg.: BHV-Petersburg, 2000.
Date of last amendment	26.01.2023

Module Name:	**Module 25: Alternative energy and transmission of electrical energy**
Code	M25EPE(Ba)
Module Elements:	*Elective Subjects* Alternativel and Renewable Power Sources Basics of Power Saving Wind and Hydropower Energy Conversion Transients in Electric Power Systems Electrical Power Transmission and Distribution High-Voltage Equipment
Semester Number:	6
Person responsible for the module	O.S. Gagolina
Lecturer:	Alternativel and Renewable Power Sources - S.I. Latypov Basics of Power Saving – S.I. Latypov Wind and Hydropower Energy Conversion– O.S. Gagolina Transients in Electric Power Systems - A.A. Kashevkin Electrical Power Transmission and Distribution – S.I. Latypov High-Voltage Equipment – A.A. Kashevkin
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	6 semester: hours per week – 24 (lectures -3; workshops -2; labs-3; independent work -16); hours per semester – 360.
Workload:	Teaching Load: 120 hours Extracurricular Classes: 240 hours Total: 360 hours
Credit Points:	12 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	Modules: Electric Power Plants and Substations, Basics of equipment operation, Electrical Engineering
Expected Learning Outcomes:	**Know:** principles of production and use of electric power obtained by alternative methods; main characteristics of the electrical equipment used; technological process of obtaining, converting and using wind and hydraulic energy by various types of wind and hydropower plants; methods of calculation of currents in short circuits; principles of transmission systems and distribution of electric energy, simulation and accounting of electrical loads, calculation of operating parameters and power losses in open and closed electrical networks. **Be able to:** select a potential power source for operation in the power system or for the needs of the end user; formulate basic technical requirements for the selection of power equipment; evaluate the wind and hydropower potential of the territories, evaluate the economic efficiency of the practical use of wind and hydropower plants of various capacities; calculate electrical loads, short-circuit currents, power loss and voltage; to apply and make a choice of electrical equipment of power plants, elements of electrical networks;. **Possess the skills** to develop and calculate the equipment of power plants using alternative energy sources; main characteristics of the electrical equipment used; methods for calculating the main parameters of wind and hydropower installations; analysis of electromagnetic and electromechanical transients in electric power systems; analysis of operating modes of power plants and calculation of

	parameters of the equipment of the plant, analysis of modes of transmission and distribution networks;. **Demonstrate the ability to:** use modern tools for the development of alternative power facilities, development, implementation and commissioning of electrical power plants, electrical systems and networks; carrying out calculations and making a reasonable choice of wind and hydropower plants of various capacities; to assess the level of static and dynamic stability; development, implementation, repair and adjustment of electrical equipment of the power plant and electrical network.
Intendend use/applicability	Modules: Automation and control in the electric power industry
Content:	*Alternativel and Renewable Power Sources* Solar and wind power, power of tides, geothermal power, power from earth's magnetic field, power of biomass, use of independent sources of power supply in Kazakhstan. *Basics of Power Saving* Prospects for the use of alternative and renewable power sources, methods of detecting losses in the production, transportation and consumption of power, as well as ways to eliminate them. *Wind and Hydropower Energy Conversion* Fundamentals of the theory of wind power plants. Wind power calculation. Wind power stations (WPP). Offshore wind power. Water resources and their use. Design options for small HPPs. Hydraulic structures of small hydroelectric power stations. Types of hydraulic turbines. Tidal energy. Wave energy. *Transients in Electric Power Systems* Electromagnetic transients. Equations of electromagnetic transient of synchronous and asynchronous machines. Practical methods of calculation of short-circuit currents. Transients in violation of the symmetry of the three-phase circuit. Electromechanical transients *Electrical Power Transmission and Distribution* General properties of power networks and systems. Calculation and analysis of steady-state regimes. Bases of construction of schemes of systems of transmission and distribution of electric power. Selection of main design decisions. *High-Voltage Equipment* AC switches. Disconnectors. Short circuiter. Separators. Fuses. Surge arresters and surge protectors. Primary measuring transducers and their connection diagrams.
Examination Form, module mark:	Comprehensive examination including: *Alternativel and Renewable Power Sources* – written control examination *Basics of Power Saving* – free-form examination *Wind and Hydropower Energy Conversion*- written control examination *Transients in Electric Power Systems* - written control examination *Electrical Power Transmission and Distribution* - written control examination *High-Voltage Equipment* - written control examination Module mark: written control examination *Elective Subject*

Technical/Multimedia Facilities:	Multimedia system. Laboratories of Data Measuring Equipment and Automation, Power Safety, Electrical Power Engineering and Power Supply and Installation of Electrical Equipment
Study Materials:	1. John.Twidell. Renewable Energy Source. M, 2000. 2. L. I. Kuperman. Secondary Energy Resources and Energy Technological Combination of Industry. Kyev, 2006. 3. V. A. Ostreykovskiy. Reliability Theory. M.: Vysshaya shkola. 2003. 4. V. P. Shekhovtsov. Electrical and Electromechanical Equipment. - M: Forum: Infra-M, 2008. 5. N.V. Zubova, S.F. Mitrofanov. Renewable energy sources: water and wind energy. - Novosibirsk: NSTU, 2021. 6. Kuashning F. Systems of renewable energy sources. Technology - Calculations - Modeling. - Astana: Tome, 2013. 7. Germanovich V., Turilin A. Alternative energy sources. Practical designs for the use of wind, sun, water, earth, biomass energy. - St. Petersburg: Science and Technology, 2011. 8. Y. A. Kulikov. Transients in Electrical Systems. – Novosibirsk: NSTU, 2008. 9. I. P. Kryuchkov, V. A. Starshinov, Y. P. Gusev, M. V. Piratorov. Transients in Electric Power Systems: Textbook for universities. – M.: Publishing house of MPEI, 2008. 10. V. N. Sazhin. Power Systems and Networks, Lecture Notes, AIES, 2004, Almaty 11. K. K. Tokhtibakiyev. Power Systems and Networks. Methods of Calculation of Power Losses and Their Rationing. Textbook, Almaty, 2005. 12. A. A Gerasimenko, V. T. Fedin. Transmission and Distribution of Electric Power". Rostov-on-Don, 2006.
Date of last amendment	26.01.2023

Module Name:	**Module 25: Automation and control in the electric power industry**
Code	M25EPE(Ba)
Module Elements:	*Elective Subjects* Industrial Safety Power Safety Special Electrical Drive Electrical Drive Control Circuits Electrical Drive Integrated Automation Control in Electric Power Systems Power System Automation and Control Electric Power System Automation Technical Means of Power System Automation
Semester Number:	7
Person responsible for the module	N.V. Zykova
Lecturer:	Industrial Safety – T.I. Krashevskaya Power Safety - N.V. Zykova Special Electrical Drive - A.A. Kashevkin Electrical Drive Control Circuits - A.A. Kashevkin Electrical Drive Integrated Automation - O.S. Gagolina Control in Electric Power Systems - O.S. Gagolina Power System Automation and Control – A.A. Kashevkin Electric Power System Automation – Y.M. Dariy Technical Means of Power System Automation - A.V. Demyanenko
Language:	Russian, Kazakh
Curriculum relation:	Electrical Power Engineering (Ba)
Type of teaching / number of hours per week and per semester :	7 semester: hours per week – 38 (lectures -4; workshops -2; labs-8; independent work -24); hours per semester – 570.
Workload:	Teaching Load: 210 hours Extracurricular Classes: 360 hours Total: 570 hours
Credit Points:	19 ECTS
Conditions for Examinations:	For admission to the exam, the student must score at least 50 points out of 100 available for each subject of the module
Recommended Conditions:	Modules: Industrial Electronics, Electric Power Plants and Substations, Power Systems and Networks, Technical Equipment of Power Facilities, Design of Electric Systems
Expected Learning Outcomes:	**Know** the basic provisions of the Constitution of the Republic of Kazakhstan and regulations in the field of labor protection, occupational safety management system, socio-economic and environmental issues of safety and protection in emergency situations; general physical laws of the electric drive, nature of static and dynamic processes, methods of calculation and selection of elements of the electric drive; main characteristics of the operating control circuits of the automated electric drive; criteria for selecting elements of automation and relay protection of the electric drive; types and principles of work of various systems of automatic control and management in power systems; principles of automatic control of change of the hydro-and turbogenerator state, inclusion on parallel work, maintenance at the set level of indicators of electric power quality, ensuring static and dynamic stability of power systems in normal and emergency modes.

	Be able to solve specific engineering tasks for the prevention of emergencies and industrial injuries, to be able to use methods and means of protection against dangerous and harmful factors; to foresee and timely prevent possible dangers and hazards in the workplace; calculate the modes of start, stop and reverse; build static and dynamic properties of the modes of operation of the electric drive; select elements of automation and relay protection of the electric drive; justify the selection of a specific circuit solution to improve reliability and reduce the probability of false operation of the protection of the power system elements; select the elements of automation and relay protection of electrical drives; apply and produce automatic control in power systems. **Possess the skills** of effective use of knowledge and skills in the field of labor protection and life safety, culture of thinking and presentation of the results of professional activities; design of control schemes of the automated electric drive; calculation of necessary parameters of automated control systems in power systems; analysis of operating modes of electric power systems. **Demonstrate the ability** to use knowledge on occupational safety in professional activities; read electric drive control circuits; development, implementation and commissioning of electric drive systems, start-up control, reversal and stop of the electric drive; to develop and design automation and relay protection systems; identify possible faults and their prompt elimination, development, implementation and commissioning of automatic control systems.
Intendend use/applicability	Modules: Final Academic Assessment, Final Internship
Content:	*Industrial Safety* Classification of hazardous production facilities. State of industrial safety at hazardous production facilities. Main directions of reducing accidents and injuries. Sources of mechanical, chemical and electrical injury and ways to prevent them. State management of industrial safety. *Power Safety* Danger of electric shock to humans. First aid to victims of electric current. General safety requirements for maintenance of electrical equipment. Protection measures in case of emergency condition of electrical equipment. Power protection means. *Control in Electric Power Systems* Automatic control of changes in the state of hydro-and turbogenerators. Automatic control of synchronous generators switching on for parallel operation. Automatic speed control of hydro-and turbogenerators. Automatic power control of hydro-and turbogenerators. Automatic regulation of voltage and reactive power of synchronous generators. Automatic excitation regulators of synchronous generators. Automatic regulation of reactive power sources and transformers. *Power System Automation and Control* Automatic control of operating modes of power plants and electric power systems. Microprocessor-based automated control system for power plants. Features and tasks of emergency automatic control of electric power systems. Automatic termination of negative stability. Automatic termination of asynchronous mode. Automatic prevention of

	unacceptable changes of mode parameters. Microprocessor-based integrated emergency control system. *Electric Power System Automation* Automatic re-activation. Automatic reserve activation. Automatic activation of synchronous generators for parallel operation. Automatic frequency control. Automatic frequency unloading. *Technical Means of Power System Automation* Basic principles of construction of automatic control systems. Technical Means of Automation of the central part of the device information processing. Digital automatic control systems and telemechanics systems. Automated process and production control systems. *Special Electrical Drive* Open automatic control systems. Typical closed-loop control systems for electric drives. Servo drive. Program control. Design elements of the electric drive. *Electrical Drive Control Circuits* Standard junctions and circuits control of electric drives of a direct current. Typical units and control circuits of asynchronous electric drives. Typical units and control circuits of synchronous electric drives. Electric drives with asynchronous motors. Electric drives with stepper motors. *Electrical Drive Integrated Automation* General principles of regulation of electric drive. Relay-contactor control of electric drives. Logic control circuits for electric drives. Pulse-phase control systems. Systems of subordinate control of DC electric drives. Microprocessor controls of electric drives.
Examination Form, module mark:	Comprehensive examination including: *Industrial Safety*– free-form examination *Power Safety* – free-form examination *Control in Electric Power Systems* – written control examination *Power System Automation and Control* – written control examination *Electric Power System Automation* – computer-based testing *Technical Means of Power System Automation* – computer-based testing *Special Electrical Drive* – free-form examination *Electrical Drive Control Circuits* – written control examination *Electrical Drive Integrated Automation* – written control examination Module mark: free-form examination *Elective Subject*
Technical/Multimedia Facilities:	Multimedia system. Laboratories of Electrical Power Engineering and Automation and Power Safety
Study Materials:	1. A. F. Monakhov. Protective Measures of Power Safety in Electrical Equipment. Textbook. - M.: ZAO Energoservis, 2008. 2. R. N. Karyakin. Grounding Devices of Electrical Equipment. Reference Book. - M.: Energoservis. 2006. 3. Y. D. Sibikin. Power Safety at Operation of Electrical Equipment of Industrial Enterprises. - M: Akademiya Publishing Center, 2008. 4. V. D. Mankov, S. F. Zagranichniy. Types of Protection to

	ensure the Safety of Electrical Equipment. - SPb.: Electro Servis, 2008. 5. Control and Measuring Instruments and Tools: Textbook / comp. S. A. Zaytsev. - 3rd ed., updated and revised. - M.: Akademiya, 2008. 6. B. A. Alekseyev, Maintenance of Relay Protection and Automation of Power Plants and Electrical Networks. Part 1. Electromagnetic Relays. Ed M. Publishing House of NC ENAS, 2000 7. N. I. Ovcharenko. Automation of Power Systems: Textbook for universities / Ed. by A. F. Dyakov. – M.: MPEI Publishing House, 2007. 8. V. V. Krivenkov. Emergency Automation. – M: MPEI, 2004. 9. Electric Power System Automation: Textbook for high schools / Ed. by V. P. Moroshkin, D. Engelage. – M: Energoatomizdat, 2014. 10. V. A. Andreyev. Relay Protection and Automation of Power Supply Systems. – Moscow: Vysshaya shkola, 2006. 11. N. F. Ilyinskiy. Basics of Electric Drives, Publishing House of MPEI,2003 12. Under the editorship of Y.N.Petrenko. Computer-Aided Control of Electric Drives, M: ACADEMA, 2005. 13. M. P. Belov et al. Automated Electric Drive of Typical Production Mechanisms and Technological Complexes", M.: ACADEMIA, 2005. 14. V. M. Terekhov, O. I. Osipov. Control Systems of Electric Drives. - M: Akademiya, 2005 15. Automated Electric Drive of Industrial Plants/ Edited by G. B. Onishchenko. --M: RASKHN, 2011 16. V. V. Moskalenko. Automated Control Systems of Electric Drives. – M.: INFRA-M, 2007. 17. V. I. Klyuchev. Electric Drive Theory: Textbook for universities.— M: Energoatomizdat, 2001.
Date of last amendment	26.01.2023