NJSC "Kazakh National Research Technical University named after K. I. Satbayev"

Institute of Industrial Automation and Digitalization

Department of Power Engineering

«ELECTRICAL ENGINEERING AND POWER ENGINEERING»
Master of Engineering Science in the educational program

on the basis of the following specialty of the invalidated Classifier of specialties:
6M071800- «Electrical Power engineering »

1st edition
in accordance with the State Educational Standard of Higher Education 2018

Almaty 2020

The program is drawn up and signed by the parties:

From KazNRTU named after K.I.Satpayev:

1 Head of the Department of Power Engineering, PhD, associate professor — Ye. Sarsenbayev

2 Director of the Institute of Industrial Automation and Digitalization, PhD — B.Omarbekov

3 Chairman of the educational and methodological group of the Department of Power Engineering, Candidate of Technical Sciences, Associate Professor — Ye. Khidolda

From employers - Director LLP "Lighting Technologies Kazakhstan" — G.E.Abdykalykov

Approved at a meeting of the Educational and Methodological Council of the Kazakh National Research Technical University named after K.I. Satbayev. Minutes No. 4 dated 14.01.2020

Qualification:
Level 7 of the National Qualifications Framework:
7M071 Engineering and Engineering (Master)

Professional competencies: Electric power engineering, electric power systems and networks, relay protection and automation, power supply, renewable energy

Brief description of the program

1 Aims

The goal of the Master's educational program "Electrical Engineering and Energy" is to train scientific and scientific-pedagogical personnel with the appropriate professional knowledge and practical skills in the field of electrical energy, capable of solving the problems of improving society, economy, production, science and education.

2 Types of work

The master of technical sciences in the educational program "Electrical Engineering and Energy" must have competencies in accordance with the types of professional activity:

- carry out search, analysis and processing of information to solve the scientific and industrial problems;
- demonstrate the ability to plan and conduct experiments, interpret the data obtained and draw conclusions;
- use modern information technologies to solve applied problems;
- choose analytical and numerical methods in the development of mathematical models of electrical installations and systems, technological processes in the electric power industry;
- to demonstrate knowledge for the analysis and synthesis of automatic control systems in the electric power industry;
- demonstrate the scientific and mathematical principles of the reliability of technical systems;
- know the methods of calculation and selection of power converters of energy and converting equipment;
- choose methods of calculating relay protection devices and analyze the reliability of their operation;
- know the methods of calculation and selection of elements of an automated electric drive;
- use modern systems and methods of electromechanical energy conversion;
- know the methods of calculation and selection of renewable energy sources;
- develop plans for the organization of innovative activities at the enterprise;
- evaluate innovation and technological risks in the introduction of new technologies;
- to know the principles of operation and the specifics of emergency and technological automation of power systems;
- have practical skills in maintenance, repair and diagnostics of industrial digital control systems for electric drives;

- demonstrate the ability to select and use methods and techniques for optimizing energy networks;
- have the ability to install, test, commission and commission electrical and electrical equipment;
- organize and carry out the operation, repair and maintenance of industrial electrical installations;
- know the methods of overvoltage protection, methods of insulation testing and the principles of operation of test installations;
- know the types of high-voltage electrical technologies used;
- be able to use methods of modeling electrical installations and electrical systems.

Educational program "Electrical Engineering and Energy" to provide training for masters in the following activities:

Design and engineering activities

- Ability to compose and develop various simulation models and electrical circuits;
- knowledge to carry out technological and electrical power calculations, to choose electrical and electromechanical equipment;

Design and technological activities

- the ability to substantiate effective operating parameters and indicators of the electric power system;
- knowledge to develop energy-efficient, resource-saving technologies and measures to protect the environment;
- skills to draw up a business plan for a technological project;

Research activities

- Ability to conduct literary and patent searches;
- the ability to plan and conduct research;
- ability to analyze and generalize research results;
- skills to draw up reports and conclusions, publish research results;

Organizational and management activities

- the ability to organize the activities of the team, draw up work plans and set tasks;
- the ability to carry out activities for the organization of production, to develop and draw up the necessary documentation;
- Ability to resolve issues of material and technical support and control over the execution of tasks.

3 Objects of professional activity

Graduates of this specialty can make a career:

- in research organizations;
- in the design and development area of activity;
- in organizations of higher and secondary technical education;
- in national, transnational energy companies and industrial enterprises.

During the training, research practice is provided at such enterprises as: NC KEGOC, JSC AZHK, JSC AlES, JSC Kazatomprom, Karachaganak Petroleum Operating and others.

Scientific internships at Tomsk Polytechnic University (Russia), Peter the Great St. Petersburg Polytechnic University (Russia) are also provided.

PASSPORT OF THE EDUCATIONAL PROGRAM

1 Scope and content of the program

The term of study in the master's program is determined by the amount of acquired academic credits. Upon mastering the established amount of academic credits and achieving the expected learning outcomes for obtaining a master's degree, the master's educational program is considered fully mastered. In the scientific and pedagogical magistracy, at least 120 academic credits for the entire period of study, including all types of educational and scientific activities of the master student.

The planning of the content of education, the method of organizing and conducting the educational process is carried out by the university and the scientific organization independently on the basis of credit technology of education.

The master's degree in scientific and pedagogical direction implements educational programs of postgraduate education for the preparation of scientific and scientific and pedagogical personnel for universities and scientific organizations with in-depth scientific, pedagogical and research training.

The content of the Master's degree program consists of:

1) theoretical training, including the study of cycles of basic and major disciplines;

2) practical training of undergraduates: various types of practices, scientific or professional internships;

3) research work, including the implementation of a master's thesis - for a scientific and pedagogical magistracy

4) final certification.

The professional activity of the graduates of the program covers the field of electric power industry, electric power networks and systems, power supply, relay protection and automation of power systems, electromechanics and renewable

energy.

The direction of the program of specialty and specialization relates to engineering and engineering.

Objectives of the educational program

Based on the achievements of modern science, technology and production, give knowledge and skills in the field of:

- electricity generation and substation;
- electric power networks and systems;
- power supply of enterprises;
- automated electric drive;
- relay protection and automation of electric power systems;
- renewable energy.

In case of successful completion of the full Master's degree course, the graduate is awarded the academic degree "Master of Engineering Sciences in the field of electricity".

The educational program of the Master's program "Electrical Engineering and Energy" differs from the existing educational program in the specialty 6M071800 - "Electrical Engineering" by updating the internal content of the disciplines. In the EP of the master's degree, further deepening of the competencies acquired in the bachelor's degree is provided. In this connection, modern innovative disciplines have been introduced into the program:

- energy management system in accordance with international standards;
- modern high voltage equipment;
- modeling of elements of electric power systems;
- management of the energy complex and regulation of the energy sector;
- theory and practice of technical experiment in energy efficiency;
- digital control systems for electric drives;
- emergency and technological automation of power systems;
- special and special systems of automatic control in energy efficiency.

In the process of mastering the educational program, the master of technical sciences in the field of electricity must acquire the following key competencies:

- carry out search, analysis and processing of information to solve the scientific and industrial problems;
- demonstrate the ability to plan and conduct experiments, interpret the data obtained and draw conclusions;
- use modern information technologies to solve applied problems;
- choose analytical and numerical methods in the development of mathematical models of electrical installations and systems, technological processes in the electric power industry;

- to demonstrate knowledge for the analysis and synthesis of automatic control systems in the electric power industry;
- demonstrate the scientific and mathematical principles of the reliability of technical systems;
- know the methods of calculation and selection of power converters of energy and converting equipment;
- choose methods of calculating relay protection devices and analyze the reliability of their operation;
- know the methods of calculation and selection of elements of an automated electric drive;
- use modern systems and methods of electromechanical energy conversion;
- know the methods of calculation and selection of renewable energy sources;
- develop plans for the organization of innovative activities at the enterprise;
- evaluate innovation and technological risks in the introduction of new technologies;
- to know the principles of operation and the specifics of emergency and technological automation of power systems;
- have practical skills in maintenance, repair and diagnostics of industrial digital control systems for electric drives;
- demonstrate the ability to select and use methods and techniques for optimizing energy networks;
- have the ability to install, test, commission and commission electrical and electrical equipment;
- organize and carry out the operation, repair and maintenance of industrial electrical installations;
- know the methods of overvoltage protection, methods of insulation testing and the principles of operation of test installations;
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- skills to draw up a business plan for a technological project;

Research activities

- Ability to conduct literary and patent searches;
- the ability to plan and conduct research;
- ability to analyze and generalize research results;
- skills to draw up reports and conclusions, publish research results;

Organizational and management activities

- the ability to organize the activities of the team, draw up work plans and set tasks;
- the ability to carry out activities for the organization of production, to develop and draw up the necessary documentation;
- Ability to resolve issues of material and technical support and control over the execution of tasks.

2 Requirements for applicants

The previous level of education of applicants is higher professional education (bachelor's degree). The applicant must have a diploma of the established sample and confirm the level of knowledge of the English language with a certificate or diplomas of the established sample.

The procedure for the admission of citizens to the magistracy is established in accordance with the "Standard rules for admission to training in educational institutions that implement educational programs of postgraduate education."

The formation of a contingent of undergraduates is carried out by placing a state educational order for the training of scientific and pedagogical personnel, as well as paying for training at the expense of citizens' own funds and other sources. The state provides citizens of the Republic of Kazakhstan with the right to receive, on a competitive basis, in accordance with the state educational order, free postgraduate education, if they receive education of this level for the first time.

At the "entrance", a master's student must have all the prerequisites necessary for mastering the corresponding educational master's program. The list of required prerequisites is determined by the higher education institution independently.

In the absence of the necessary prerequisites, the master student is allowed to master them on a paid basis.

Admission to the university is carried out according to the applications of the applicant who has completed the full bachelor's course in the program "Electricity" in accordance with the points of the certificate issued based on the results of testing in the Republican Testing Center in: English, theoretical foundations of electrical engineering, electrical machines

Special requirements for admission to the program apply to graduates of related educational programs: heat power engineering, automation and control.

3 Requirements for completing studies and obtaining a diploma

Awarded degree / qualifications: The graduate of this educational program is awarded the academic degree "master", master of technical sciences in the direction.

A graduate who has mastered master's programs must have the following general professional competencies:

- the ability to independently acquire, comprehend, structure and use new knowledge and skills in professional activity, to develop their innovative abilities;
- the ability to independently formulate research goals, establish a sequence for solving professional problems;
- the ability to apply in practice the knowledge of fundamental and applied disciplines that determine the focus (profile) of the master's program;
- the ability to professionally choose and creatively use modern scientific and technical equipment for solving scientific and practical problems;
- the ability to critically analyze, represent, defend, discuss and disseminate the results of their professional activities;
- possession of the skills of compiling and preparing scientific and technical documentation, scientific reports, reviews, reports and articles;
- willingness to lead a team in the field of their professional activities, tolerantly perceiving social, ethnic, confessional and cultural differences;
- readiness to communicate in oral and written forms in a foreign language to solve the problems of professional activity.

A graduate who has mastered the master's program must have professional competencies corresponding to the types of professional activity that the master's program is focused on:

research activities:

- the ability to form diagnostic solutions to professional problems by integrating the fundamental sections of science and specialized knowledge gained during the master's program;
- the ability to independently conduct scientific experiments and research in the professional field, generalize and analyze experimental information, draw conclusions, formulate conclusions and recommendations;
- the ability to create and research models of the objects under study based on the use of in-depth theoretical and practical knowledge in the field of production, transmission and consumption of electrical energy;

research and production activities:

- the ability to independently carry out production and research and production field, laboratory and interpretation work in solving practical problems;

- the ability to professionally operate modern field and laboratory equipment and instruments in the field of the mastered master's program;
- the ability to use modern methods of processing and interpreting complex information to solve production problems;

project activity:

- the ability to independently compose and submit projects of research and development work;
- readiness to design complex research and development work in solving professional problems;

organizational and management activities:

- the readiness to use the practical skills of organizing and managing research and development work in solving professional problems;
- readiness for the practical use of regulatory documents in the planning and organization of scientific and industrial work;

scientific and pedagogical activity:

- the ability to conduct seminars, laboratory and practical classes;
- the ability to participate in the management of scientific and educational work of students in the field of production, transmission and consumption of electrical energy.

When developing a master's program, all general cultural and general professional competencies, as well as professional competencies related to those types of professional activities that the master's program is focused on, are included in the set of required results of mastering the master's program.

Compulsory standard requirements for graduating from a magistracy and awarding an academic degree master of technical sciences: mastering at least 59 academic credits of theoretical training, passing the state exam in the specialty, preparing and defending the final dissertation work before the SJSC.

Special requirements for graduating from a master's degree in this program

the graduate should know:

- methods of constructing modern electric power and electromechanical systems;
- modern trends in the development of electrical equipment and electrical installations, technical means and automation systems for power facilities;
- standards and industry rules, methodological and regulatory materials accompanying the operation, installation, commissioning and design of electric power systems;

be able to:

- to develop and research traditional and autonomous power systems using modern technical and technological means.

4. Working curriculum of the educational program

4.1. The term of study is 2 years

WORKING CURRICULUM

Education program 7M07113 - "Electrical engineering and power engineering"
Group of Educational Programs M099 - "Power engineering and electrical engineering"
enrolment for 2020 - 2021 academic year

Form of study: daytime | Term of study: 2 years | Academic degree: Master

year of study	Code	Name of course	Component	Academic credits	lecture/ laboratory/ practice/MSIW	Prerequisites	Code	Name of course	Component	Academic credits	lecture/ laboratory/ practice/IWS	Prerequisites
1	**1 semester**						**2 semester**					
	HUM201	History and philosophy of science	BD IC	4	1/0/1/2	no	AAP244	Pedagogical practice	BD IC	4	0/0/2/2	
	HUM207	Higher school pedagogy	BD IC	4	1/0/1/2	no	LNG202	Foreign language (professional)	BD IC	6	0/0/3/3	no
							HUM204	Management psychology	BD IC	4	1/0/1/2	no
	ERG258	Theory and practice of relay protection	BD OC	6	2/0/1/3	no	ERG218	Reliability in power industry	BD OC	6	2/0/1/3	no
							ERG214	Modeling of elements of electric power systems			2/1/0/3	no
	ERG259	Microprocessor relay protection				no	ERG222	Specific and special automatic control systems in the power industry			2/1/0/3	no
							ERG221	Optimal and adaptive control systems				no
	ERG265	Scientific and technical problems of power industry	PS IC	6	2/0/1/3	no	ERG235	The theory of electromechanical energy conversion	PS IC	6	2/0/1/3	no
							ERG252	Power electronics	PS IC	6	2/1/0/3	no
	AAP242	Master's student scientific research, including an internship and a master's thesis	MSSR	6			AAP242	Master's student scientific research, including an internship and a master's thesis	MSSR	6		
		In total		**26**				**In total**		**44**		
2	**3 semester**						**4 semester**					
	ERG217	Installation, commissioning and operation of eletrical equipment	PS OC	6	2/1/0/3	ERG235	AAP236	Research practice	PS	7		
	ERG241	Operation of electric power systems and networks			2/1/0/3	no						
	ERG239	Digital control systems of electric drives	PS OC	6	2/1/0/3	ERG235						
	ERG229	Against emergency and technological automation of power supply systems			2/0/1/3	ERG222						
	ERG247	Energy management system according to international standards	PS OC	6	1/1/1/3	no	ECA205	Registration and defense of the master's thesis (RaDMT)	FA	12		
	ERG256	Monitoring and energy audit of power complexes			2/0/1/3	no						
	ERG269	Renewable energy sources	PS OC	6	2/0/1/3	ERG265						
	ERG253	ASDC and optimization of the modes of power supply systems			2/1/0/3	no						
	AAP242	Master's student scientific research, including an internship and a master's thesis	MSSR	6			AAP242	Master's student scientific research, including an internship and a master's thesis	MSSR	6		
		In total		**30**				**In total**		**25**		
								In all		**125**		

MODULAR CURRICULUM

Education program 7M07113 – **«Electrical engineering and power engineering»**

Full-time study Term of study: 2 years Academic degree: Master of Engineering Science

Component	Code.	Name of course	Semester	Academic credits	lecture	laboratory	practice	MSIW	Control type	Department
Profile training module										
Basic disciplines (BD) (40 credits)										
University component (22 credits)										
BD 1.1.1	LNG202	Foreign language (professional)	2	6	0	0	3	3	Exam	EL
BD 1.2.1	HUM201	History and philosophy of science	1	4	1	0	1	2	Exam	SD
BD 1.3.1	HUM207	Higher school pedagogy	1	4	1	0	1	2	Exam	SD
BD 1.4.1	HUM204	Management psychology	2	4	1	0	1	2	Exam	S&EPMC
Practice-oriented module										
	AAP244	Pedagogical practice	2	4					Report	Power Engineering
Choice component (18 credits)										
Electrical and Energy Special Issues Module										
BD 1.5.1	ERG258	Theory and practice of relay protection	1	6	2	0	1	3	Exam	Power Engineering
BD 1.5.2	ERG259	Microprocessor relay protection							Exam	Power Engineering
BD 1.6.1	ERG218	Reliability in power industry	2	6	2	0	1	3	Exam	Power Engineering
BD 1.6.2	ERG214	Modeling of elements of electric power systems			2	1	0	3	Exam	Power Engineering
BD 1.7.1	ERG222	Specific and special automatic control systems in the power industry	2	6	2	1	0	3	Exam	Power Engineering
BD 1.7.2	ERG221	Optimal and adaptive control systems							Exam	Power Engineering
Major disciplines (MD) (49 credits)										
University component (UC)										
Electrical engineering and power engineering theory and practice module										
MD 1.1.1	ERG265	Scientific and technical problems of power industry	1	6	2	0	1	3	Exam	Power Engineering
MD 1.2.1	ERG235	The theory of electromechanical energy conversion	2	6	2	0	1	3	Exam	Power Engineering
MD 1.3.1	ERG252	Power electronics	2	6	2	1	0	3	Exam	Power Engineering
Practice-oriented module										
MD	AAP236	Research practice	4	7					Report	Power

										Engineering
Choice component (CC)										
Professional Research Module										
MD 1.4.1	ERG217	Installation, commissioning and operation of eletrical equipment	3	6	2	1	0	3	Exam	Power Engineering
MD 1.4.2	ERG241	Operation of electric power systems and networks							Exam	Power Engineering
MD 1.5.1	ERG239	Digital control systems of electric drives	3	6	2	1	0	3	Exam	Power Engineering
MD 1.5.2	ERG229	Against emergency and technological automation of power supply systems			2	0	1	3	Exam	Power Engineering
MD 1.6.1	ERG247	Energy management system according to international standards	3	6	1	1	1	3	Exam	Power Engineering
MD 1.6.2	ERG256	Monitoring and energy audit of power complexes			2	0	1	3	Exam	Power Engineering
MD 1.7.1	ERG269	Renewable energy sources	3	6	2	0	1	3	Exam	Power Engineering
MD 1.7.2	ERG253	ASDC and optimization of the modes of power supply systems							Exam	Power Engineering
Research module (24 credits)										
MSSR	AAP242	Master's student scientific research, including an internship and a master's thesis	1	6					Report	Power Engineering
MSSR	AAP242	Master's student scientific research, including an internship and a master's thesis	2	6					Report	Power Engineering
MSSR	AAP242	Master's student scientific research, including an internship and a master's thesis	3	6					Report	Power Engineering
MSSR	AAP242	Master's student scientific research, including an internship and a master's thesis	4	6					Report	Power Engineering
Module of final attestation (12 credits)										
FA	ECA205	Registration and defense of the master's thesis (RaDMT)	4	12					Defense of dissertations	Power Engineering
Total credits				**125**						

5 Descriptors of the level and amount of knowledge, abilities, skills and competencies

The requirements for the level of preparation of a master's student are determined on the basis of the Dublin descriptors of the second level of higher education (master's degree) and reflect the acquired competencies, expressed in the achieved learning outcomes.

Learning outcomes are formulated both at the level of the entire educational program of the master's program, and at the level of individual modules or academic discipline.

Descriptors reflect learning outcomes that characterize the student's abilities:

1) demonstrate developing knowledge and understanding in the field of electrical power networks and systems, power supply, relay protection and automation, renewable energy, based on advanced knowledge in the field of electrical energy, electrical engineering and electromechanics, while developing and / or applying ideas in the context of research;

2) apply at a professional level their knowledge, understanding and ability to solve problems in a new environment, in a wider interdisciplinary context;

3) collect and interpret information to form judgments, taking into account social, ethical and scientific considerations;

4) clearly and unambiguously communicate information, ideas, conclusions, problems and solutions, both to specialists and non-specialists;

5) learning skills necessary for self-continued further education in the field of electrical power engineering, electrical engineering and electromechanics.

6 Competencies on completion of training

6.1 Requirements for the key competencies of graduates of the scientific and pedagogical magistracy must:

1) have an idea:

- about the role of science and education in public life;
- about current trends in the development of scientific knowledge;
- on topical methodological and philosophical problems of natural (social, humanitarian, economic) sciences;
- about the professional competence of a higher school teacher;
- about the contradictions and socio-economic consequences of globalization processes;

2) know:

- methodology of scientific knowledge;
- principles and structure of the organization of scientific activity;
- the psychology of students' cognitive activity in the learning process;

- psychological methods and means of increasing the efficiency and quality of education;

3) be able to:

- use the knowledge gained for the original development and application of ideas in the context of scientific research;
- critically analyze existing concepts, theories and approaches to the analysis of processes and phenomena;
- to integrate the knowledge gained in different disciplines to solve research problems in new unfamiliar conditions;
- by integrating knowledge, make judgments and make decisions based on incomplete or limited information;
- to apply the knowledge of pedagogy and psychology of higher education in their teaching activities;
- apply interactive teaching methods;
- to carry out information-analytical and information-bibliographic work with the involvement of modern information technologies;
- think creatively and be creative in solving new problems and situations;
- be fluent in a foreign language at a professional level, allowing for research and teaching special disciplines in universities;
- to summarize the results of research and analytical work in the form of a dissertation, scientific article, report, analytical note, etc .;

4) have skills:

- research activities, solving standard scientific problems;
- implementation of educational and pedagogical activities on credit technology of education;
- methods of teaching professional disciplines;
- the use of modern information technologies in the educational process;
- professional communication and intercultural communication;
- oratory, correct and logical design of your thoughts in oral and written form;
- expanding and deepening the knowledge required for daily professional activities and continuing education in doctoral studies.

5) be competent:

- in the field of research methodology;
- in the field of scientific and scientific-pedagogical activities in higher educational institutions;
- in matters of modern educational technologies;
- in the implementation of scientific projects and research in the professional field;

- in ways to ensure constant updating of knowledge, expanding professional skills and abilities.

B – basic knowledge, skills and abilities

B1 - capable of philosophical analysis of social phenomena, personality behavior and other phenomena. I am ready to conduct a philosophical assessment of social phenomena;

B2 - know and apply in practice the fundamentals of engineering professional ethics;

B3 - be able to analyze topical problems of the modern history of Kazakhstan.

P - professional competencies

P1 - a wide range of theoretical and practical knowledge in the professional field;

P2 is able to analyze electrical schematic and wiring diagrams of electric power systems.

P3 - ready to install, commission and operate electromechanical and electrical systems;

P4 - ready to participate in the development and design of new objects of traditional and alternative energy.

O - universal, social and ethical competences

O1 - is able to use English fluently as a means of business communication, a source of new knowledge in the field of electrical engineering and energy; ready to use English in professional activities in the field of electrical energy;

O2 - is able to fluently speak Kazakh (Russian) as a means of business communication, a source of new knowledge in the field of electrical engineering and energy. I am ready to use the Kazakh (Russian) language in professional activities in the field of electric power industry;

O3 - know and apply in work and life the basics of applied ethics and ethics of business communication;

O4 - know and apply the basic concepts of professional ethics;

O5 - to know and solve the problems of human influence on the environment.

C - special and managerial competencies

C1 - independent management and control of the processes of labor and educational activities within the framework of the strategy, policy and goals of the organization, discussion of problems, reasoning of conclusions and competent handling of information;

C2 - to be a specialist in conducting experimental studies of electric power facilities;

C3 - to be a researcher in the study of modern electromechanical and electrical systems;

C3 - to be an engineer for the development and design of power systems.

6.2 Requirements for the research work of a master student in a scientific and pedagogical magistracy:

1) corresponds to the profile of the master's educational program, according to which the master's thesis is performed and defended;

2) is relevant and contains scientific novelty and practical significance;

3) is based on modern theoretical, methodological and technological achievements of science and practice;

4) carried out using modern scientific research methods;

5) contains research (methodological, practical) sections on the main protected provisions;

6) is based on advanced international experience in the relevant field of knowledge.

6.3 Requirements for organizing practices:

The educational program of the scientific and pedagogical magistracy includes two types of practices that are conducted in parallel with theoretical training or in a separate period:

1) pedagogical in the DB cycle - at the university;

2) research in the PD cycle - at the place of the dissertation.

Pedagogical practice is carried out with the aim of developing practical skills in teaching and learning methods. At the same time, undergraduates are involved in conducting classes in a bachelor's degree at the discretion of the university.

The research practice of the undergraduate is carried out with the aim of acquainting with the latest theoretical, methodological and technological achievements of domestic and foreign science, modern methods of scientific research, processing and interpretation of experimental data.

7 Diploma Supplement according to ECTS and MES RK

The application was developed according to the standards of the European Commission, Council of Europe and UNESCO / CEPES. This document is for academic recognition only and is not an official proof of education. Not valid without a university degree. The purpose of completing the European Supplement is to provide sufficient information about the holder of the diploma, the qualification obtained, the level of this qualification, the content of the study program, the results, the functional purpose of the qualification, as well as information about the national education system. The application model that will be used to translate grades uses the European Credit Transfer or Transfer System (ECTS).

The European Diploma Supplement provides an opportunity to continue education at foreign universities, as well as to confirm national higher education for foreign employers. When going abroad for professional recognition, additional legalization of the educational diploma will be required. The European Diploma Supplement is completed in English upon individual request and is issued free of charge.

8 Description of disciplines

Foreign language (professional)
CODE – LNG202
CREDIT – 6 (0/0/3/3)
PRE-REQUISIT – Academic English, Business English, IELTS 5.0-5.5

PURPOSE AND OBJECTIVES OF THE COURSE
The aim of the course is to develop students' knowledge of the English language for their ongoing academic research and improve their performance in the field of project management.

SHORT DESCRIPTION OF THE COURSE
The course is aimed at building vocabulary and grammar for effective communication in the field of project management and improving reading, writing, listening and speaking skills at the "Intermediate" level. Students are expected to develop their Business English vocabulary and learn grammatical structures that are often used in a management context. The course consists of 6 modules. The 3rd module of the course ends with an intermediate test, and the 6th module is followed by a test at the end of the course. The course ends with a final exam. Master students also need to study independently (MIS). MIS is an independent work of undergraduates under the guidance of a teacher.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Upon successful completion of the course, students are expected to be able to recognize the main idea and message as well as specific details while listening to monologues, dialogues and group discussions in the context of business and management; understand written and spoken English on topics related to management; write management texts (reports, letters, emails, minutes of meetings) following a generally accepted structure with a higher degree of grammatical accuracy and using business words and phrases, talk about different business situations using appropriate business vocabulary and grammatical structures - in pairs and groups discussions, meetings and negotiations.

History and philosophy of science
CODE – HUM201
CREDIT – 4 (1/0/1/2)
PRE-REQUISIT – HUM124

GOALS AND OBJECTIVES OF THE COURSE
To reveal the connection between philosophy and science, to highlight the philosophical problems of science and scientific knowledge, the main stages of the history of science, the leading concepts of the philosophy of science, modern problems of the development of scientific and technical reality

SHORT DESCRIPTION OF THE COURSE
The subject of philosophy of science, dynamics of science, specificity of science, science and pre-science, antiquity and the formation of theoretical science, the main stages of the historical development of science, features of classical science, non-classical and post-non-classical science, philosophy of mathematics, physics, technology and technology, specificity of engineering sciences, ethics of science , social and moral responsibility of a scientist and engineer

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Know and understand the philosophical issues of science, the main historical stages of the development of science, the leading concepts of the philosophy of science, be able to critically assess and analyze scientific and philosophical problems, understand the specifics of engineering science, possess the skills of analytical thinking and philosophical reflection, be able to substantiate and defend one's position, master techniques conducting discussion and dialogue, possess the skills of communication and creativity in their professional activities

Higher education pedagogy
CODE – HUM207
CREDIT – 4 (1/0/1/2)
PRE-REQUISIT – no

PURPOSE AND OBJECTIVES OF THE COURSE The course is aimed at studying the psychological and pedagogical essence of the educational process of higher education; formation of ideas about the main trends in the development of higher education at the present stage, consideration of the methodological foundations of the learning process in higher education, as well as psychological mechanisms affecting the success of learning, interaction, management of subjects of the educational process. Development of psychological and pedagogical thinking of undergraduates. BRIEF DESCRIPTION OF THE COURSE in the course of studying the course, undergraduates get acquainted with the didactics of higher education, the forms and methods of organizing education in higher education, psychological factors of successful learning, the peculiarities of psychological influence, mechanisms of educational influence, pedagogical technologies, characteristics of pedagogical communication, mechanisms for managing the learning process. Analyze organizational conflicts and ways to resolve them, psychological destruction and deformation of the teacher's personality.

KNOWLEDGE, ABILITIES, SKILLS TO COMPLETE THE COURSE at the end of the course, the master student must know the features of the modern system of higher professional education, the organization of pedagogical research, the characteristics of the subjects of the educational process, the didactic foundations of the organization of the learning process in higher education, pedagogical technologies, patterns of pedagogical communication, the peculiarities of educational influences on students, as well as problems of pedagogical activity.

Psychology of management
CODE – HUM 204
CREDIT – 4 (1/0/1/2)
PRE-REQUISIT – no

PURPOSES AND OBJECTIVES OF THE COURSE To familiarize future teachers with the methodological and theoretical foundations of higher education pedagogy, modern technologies of analysis, planning and organization of training and education, communication technologies of subject-subject interaction between teacher and student In the educational process of the university.

BRIEF DESCRIPTION OF THE COURSE the subject of higher education pedagogy, methodology of pedagogical science, aspects and trends in the development of modern education, pedagogical activity, the personality of a higher school teacher, the essence and structure of pedagogical activity, modern requirements for competence, communicative competence of a higher school teacher, didactics of higher education, modern pedagogical technologies, educational process of higher education. active methods and forms of training in the preparation of future specialists, educational work in higher education, the organization of independent work of students in conditions of credit technology, the organization of pedagogical control in conditions of credit technology.

KNOWLEDGE, ABILITY, SKILLS ON COURSE COMPLETION To recognize and understand the current problems of pedagogical science, the laws of pedagogical theories, the essence of the pedagogical activity of a university teacher. To master the skills of designing the educational process, based on new concepts of training and education; creation of a creative and developing environment in the process of teaching and upbringing. Be competent in solving problems of higher pedagogical education and the prospects for its further development; in the application of effective university teaching technologies; the main types of pedagogical communicative interaction, organization and management of students' activities.

Relay protection practice theory
CODE – ERG258
CREDIT – 6 (2/0/1/3)
PRE-REQUISIT – no

PURPOSE AND OBJECTIVES OF THE COURSE Master students gain knowledge in the field of principles of construction of relay protection, applied modern methods of calculation, basic elements and means of relay protection. The task of studying the discipline is to expand the understanding of the possibilities of relay protection; consolidation and concretization of theoretical material related to the principles of operation and the device of relay protection, their main properties, methods of application; obtaining skills in calculating the parameters necessary for setting up relay protection; the correct choice of methods and means of relay protection; assessment of the effectiveness and reliability of the selected relay protection.

BRIEF DESCRIPTION OF THE COURSE characteristics of relay protection, algorithms of functioning and principles of construction of protection and methods for calculating various relay protection

KNOWLEDGE, ABILITY, SKILLS ON COMPLETION OF THE COURSE Information, methodological and mathematical support for the implementation of relay protection systems; domestic and foreign experience, as well as development prospects in the field of application of relay protection systems; methods for calculating relay protection systems.

know:

- basic concepts, definitions and purpose of relay protection;
- requirements for relay protection;
- principles of construction of relay protection;
- elements and functional parts of relay protection devices;
- operating principles of basic protection circuits with relative and absolute selectivity;

Should be able to:

- calculate the main parameters of relay protection schemes;
- to choose modern elements and devices of relay protection, to analyze their efficiency and reliability;
- read various electrical schematic and wiring diagrams of relay protection of power systems.

Microprocessor relay protection
CODE – ERG259
CREDIT – 6 (2/0/1/3)
PRE-REQUISIT – no

PURPOSE AND OBJECTIVES OF THE COURSE Master students gain knowledge in the field of principles of construction of relay protection, applied modern methods of calculation, basic elements and means of relay protection. The task of studying the discipline is to expand the understanding of the possibilities of relay protection; consolidation and concretization of theoretical material related to the principles of operation and the device of relay protection, their main properties, methods of application; obtaining skills in calculating the parameters necessary for setting up relay protection; the correct choice of methods and means of relay protection; assessment of the effectiveness and reliability of the selected relay protection.

BRIEF DESCRIPTION OF THE COURSE characteristics of relay protection, algorithms of functioning and principles of building protection and methods for calculating various relay protection.

KNOWLEDGE, ABILITY, SKILLS ON COMPLETION OF THE COURSE Information, methodological and mathematical support for the implementation of relay protection systems; domestic and foreign experience, as well as development prospects in the field of application of relay protection systems; methods for calculating relay protection systems.

know:

- basic concepts, definitions and purpose of relay protection;
- requirements for relay protection;
- principles of construction of relay protection;
- elements and functional parts of relay protection devices;
- operating principles of basic protection circuits with relative and absolute selectivity;

Should be able to:

- calculate the main parameters of relay protection schemes;
- to choose modern elements and devices of relay protection, to analyze their efficiency and reliability;
- read various electrical schematic and wiring diagrams of relay protection of power systems.

Scientific and technical problems of the electric power industry
CODE – ERG265
CREDIT – 6 (2/0/1/3)
PRE-REQUISIT – no

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

The purpose of teaching the discipline is to prepare a specialist to solve the problems of design, research and operation of electric power and electrotechnical installations and systems, capable of analyzing the efficiency of energy conversion schemes, assess the prospects of new methods of energy production and introduce innovative developments into practice.

SHORT DESCRIPTION OF THE COURSE

The discipline covers the following theoretical information about the state of development of modern electric power industry:

- the structure and operation of modern power plants of various types and electrical networks;
- principles of construction, structure and optimization of the electric power system of an industrial enterprise;
- the scale, direction and perspective of the production and distribution of energy resources;
- methods of obtaining and requirements for the quality of new types of electrical technology;
- legal and regulatory framework for energy saving;
- fundamentals of energy audit of power facilities;
- principles of wasteless technology, fuel and energy indicators of wastelessness;
- environmental aspects of energy saving.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE

As a result of studying the discipline, undergraduates should know:

- about the structure and functioning of modern power plants and electrical networks;
- on the general principles, structure and functioning of electric power systems and networks;
- about the energy characteristics of electrical processes and installations;
- on the principles of construction, structure and optimization of the electric power system of an industrial enterprise;
- on the variety of electrical processes and installations, on the main types and classification of electrical equipment;

- on the scale, directions and prospects of production and distribution of energy carriers;
- on the methods of obtaining and requirements for the quality of new types of electrical technology;
- on the legal and regulatory framework for energy conservation;
- about the basics of energy audit of power facilities;
- on the principles of wasteless technology, on the fuel and energy indicators of wastelessness.

As a result of studying the discipline, undergraduates should have an idea of:

- on the main directions of fundamental research in electrical power engineering and electrical technology;
- on the structure and functioning of power plants of various types and on the combined generation of electricity and heat at CHP;
- on the principles and methods of developing energy saving measures.

As a result of studying the discipline, undergraduates must possess:

-the methods of calculating the energy indicators of power plants;
- methods for calculating the energy characteristics of electricity production;
- methods for calculating the characteristics of energy carriers used in electrotechnical production;
- methods for calculating the main characteristics of energy carriers;
- methods of optimization of power plants and systems.

Reliability in the power industry
CODE – ERG218
CREDIT – 6 (2/1/0/3)
PRE-REQUISIT – no

PURPOSE AND OBJECTIVES OF THE COURSE Formation of a fundamental knowledge base among undergraduates about the basic concepts, definitions of the theory of reliability and indicators of reliability of electric power systems and installations.

BRIEF DESCRIPTION OF THE COURSE Basic methods of ensuring and increasing reliability; methods for assessing the reliability of elements, maintaining and restoring the performance and resource of power equipment; methods of engineering calculation of the reliability of complex systems; methods of testing systems for reliability.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE, you should know:
- basic concepts, definitions and terms from the theory of reliability;
- types of failures and their characteristics;
- qualitative and quantitative indicators of the reliability of objects;
- principles of development of mathematical models of reliability in the event of gradual, sudden and joint failures of an object;
- principles of redundancy of elements of complex power systems;
Should be able to:
- calculate the main indicators of the reliability of power facilities;
- to select and compose the optimal reliability systems for electric power facilities, as well as analyze their efficiency.

Simulation in electrical power systems
CODE – ERG214
CREDIT – 6 (2/1/0/3)
PRE-REQUISIT – нет

PURPOSE AND OBJECTIVES OF THE COURSE
Acquaintance of students with the basics of modeling elements of electric power systems (EPS) and their mathematical and virtual models, the formation of students' skills in the simulation of electric power objects in the MATLAB software environment.

SHORT DESCRIPTION OF THE COURSE
The course covers the following main topics: research of operating modes of single-phase and three-phase power transformers, research of operating modes of direct current machines, research of operating modes of asynchronous machines, synchronous machines, modeling of power lines, modeling loads, modeling switching devices.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of mastering the discipline "Modeling in electric power systems" the student will:
know:
- EES modeling methods;
- the principle of operation of the main elements of the EPS;
- mathematical models of the main equipment of the EPS;
- methods for regulating the parameters of the EPS mode;
be able to:
- work in the MATLAB software environment;
- calculate the parameters of the main electrical equipment;
- collect simulation models of EPS objects;
- to investigate the modes of operation of the EPS;
own:
- methods of regulating the parameters of electrical equipment;
- skills in working with EPS circuits.

Special and special automatic control systems in energy efficiency
CODE – ERG222
CREDIT – 6 (2/1/0/3)
PRE-REQUISIT – no

PURPOSE AND OBJECTIVES OF THE COURSE Teaching undergraduates by methods of mathematical description of control objects, methods of synthesis of ACS with the use of modern technical means.

BRIEF DESCRIPTION OF THE COURSE Mastering the methods of mathematical description of control objects, methods of synthesizing ACS with the use of modern technical means, included VT, methods of automating individual technical objects and technical lines in general.

KNOWLEDGE, ABILITY, SKILLS ON COMPLETION OF THE COURSE Acquaintance of students with the basic mathematical descriptions of control objects, methods of synthesis of automatic control systems using modern technical means. To develop undergraduates the ability to effectively solve the problems of rational use of the automatic control system in the electric power industry. To be able to determine the actual state of the object, synthesize its structure, choose the right criterion for controlling the object, synthesize the structure of the control system, evaluate the advantages of the vibran structure, predict the behavior of the synthesized control system, pick control, alarm and regulation, evaluate the merits and demerits of the system.

Optimal and adaptive control systems
CODE – ERG221
CREDIT – 6 (2/1/0/3)
PRE-REQUISIT – no

PURPOSE AND OBJECTIVES OF THE COURSE
The goal of teaching the discipline "Optimal and adaptive control systems" is to inform undergraduates of knowledge on the analysis of a priori and current information about the properties of an object, determining the type of disturbances, formulating limiting conditions, target criteria, basic classes and methods of synthesis of optimal and adaptive control systems. As well as the acquisition by undergraduates of skills in the calculation and modeling of optimal and adaptive control systems for use in production activities related to the operation, configuration and development of systems and control devices of these classes.

SHORT DESCRIPTION OF THE COURSE
Basic concepts and definitions of the theory of optimal control. Statement of the problem of synthesis of an optimal control system. Definition of an adaptive control system. Statement of the problem of adaptive control. Stages of synthesis of an adaptive system, the main methods of synthesis of the main loop and adapter in systems of direct adaptive control.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of mastering the discipline, undergraduates should know:
Types of disturbances acting on the control object characteristics of the main classes of adaptive systems, features of methods for the synthesis of optimal and adaptive controllers, properties and scope of the main types of optimal and adaptive controllers
Should be able to:

- ✓ Analyze a priori and current information about the properties of the object;
- ✓ Determine the type of disturbance;
- ✓ Formulate limiting conditions;
- ✓ Define target criteria;
- ✓ Formulate the problem of synthesis of optimal and adaptive controllers;
- ✓ Choose an algorithm for the synthesis of an adaptive system;
- ✓ Calculate adaptive controllers to ensure the specified properties of the systems.

The theory of electromechanical energy conversion
CODE – ERG235
CREDIT – 6 (2/1/0/3)
PRE-REQUISIT – no

PURPOSE AND OBJECTIVES OF THE COURSE
Formation of general scientific knowledge and in-depth professional training of the undergraduate on the basis of students studying the basics of the theory of electromechanical energy conversion, modern electromechanical systems, methods of mathematical description and modeling of electromechanical energy conversion processes.

SHORT DESCRIPTION OF THE COURSE
Discipline "Theory of electromechanical conversion of electricity", where students study issues related to the basic laws of electromechanical conversion of energy, the device and the principle of operation of electromechanical converters. Learn to calculate the electromagnetic forces and electromagnetic moments in electromechanical energy converters.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Basic methods, ways and means of obtaining, storing and processing information; basic concepts and content of classical sections of electromechanics of basic physical phenomena and laws of mechanics, electrical engineering, power engineering and their mathematical description; the main methods of experimental research of objects and systems of electric power and electrical engineering.
Use of modern technical means and information technologies in the professional field; methods of mathematical and physical modeling of modes, processes, states of objects of electric power industry and electrical engineering, analysis of physical phenomena in technical devices and systems.
Apply and analyze information, solve engineering problems in the field of electromechanical energy conversion. Perform various tasks of analyzing the operation of electromechanical converters using mathematical modeling methods, develop recommendations for optimizing EMF operating modes. Development of design solutions for the execution of electromechanical converters for various applications.

Power electronics
CODE – ERG252
CREDIT – 6 (2/1/0/3)
PRE-REQUISIT – no

PURPOSE AND OBJECTIVES OF THE COURSE
Familiarization of undergraduates with the basics of power electronics, with the main elements of power electronics, about their application in industrial conversion devices and the formation of master's students' skills in working with them.

SHORT DESCRIPTION OF THE COURSE
The course covers the following main topics: power electronic devices; element base and typical units of control systems; converters with network switching; DC to DC conversion; controlled converters; pulse-width modulation in converters; resonant converters; the use of power electronics devices.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of mastering the discipline "Power Electronics" the student will:
know:
- the main element base of power electronics;
- the principle of operation and characteristics of the main electronic devices;
- device of power converters;
- the use of power converters;
be able to:
- read electronic circuits;
- to carry out basic calculations of power electronic devices;
- to collect circuits of power converters;
- identify faults in the converter circuits;
own:
- methods of calculating the most common converting devices;
- skills in working with electronic converters.

Installation, adjustment and operation of electrical equipment
CODE – ERG217
CREDIT – 6 (2/1/0/3)
PRE-REQUISIT – ERG235

PURPOSE AND OBJECTIVES OF THE COURSE
The purpose of studying the discipline is the formation of theoretical knowledge and mastery of organizational and technical issues of rational operation and advanced industrial methods of installation, commissioning, operation and diagnostics of electrical equipment.

SHORT DESCRIPTION OF THE COURSE
The discipline "Installation, adjustment and operation of electrical equipment" is a basic subject, where students study the accumulated experience of modern methods of organizing and performing work on installation, commissioning and maintenance of electrical installations and automation equipment based on regulatory documents; safety rules, device and technical operation.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of studying this discipline, the undergraduate must have a systematic, integrated approach in solving issues of selection, placement of equipment, installation, adjustment, operation, maintenance and repair, as well as its use for its intended purpose.
Master students will acquire skills in industrial installation, repair and operation of elements of the electric power network in accordance with the requirements of the rules for the technical operation of electrical installations of consumers, safety rules for the operation of electrical installations of consumers and rules for electrical installations.

Operation of electric power systems and networks
CODE – ERG241
CREDIT – 6 (2/1/0/3)
PRE-REQUISIT – no

PURPOSE AND OBJECTIVES OF THE COURSE
Familiarization with the main tasks and organizational issues of technical operation, as well as issues of operational reliability.
Smart planning and execution of preventive maintenance, planning and calculating the number of spare parts, and ways to improve operational reliability.

SHORT DESCRIPTION OF THE COURSE
The discipline is based on the knowledge gained in the courses: electrical power engineering, electromechanics and electrical equipment, electrical machines, electrical machines, electrical devices, power supply of enterprises, power grids and systems, the electrical part of power plants, relay protection and automation of power supply systems, the basics of electrical safety.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
The knowledge gained by undergraduates in the study of the discipline "Operation of electric power systems and networks" should provide the final cycle of training on the operation of electrical equipment of industrial enterprises and electrical installations, electric power systems and networks, as well as on some issues of operational reliability.

Digital control systems for electric drives
CODE – ERG239
CREDIT – 6 (2/1/0/3)
PRE-REQUISIT – ERG235

PURPOSE AND OBJECTIVES OF THE COURSE
Study of issues related to the choice of hardware and software, as well as the use of applied programs for modeling and analysis of modern digital control systems for electric drives. Know the methods of developing generalized options for solving electric drive problems, analyzing options, predicting the consequences, finding compromise solutions in conditions of multicriteria, uncertainty

SHORT DESCRIPTION OF THE COURSE
Discipline "Digital control systems for electric drives", where students study issues related to the choice of hardware and software, as well as the use of an application package for modeling and analysis of modern digital control systems for electric drives.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of studying this discipline, the undergraduate must know the devices, principles of operation and properties of the main elements of microprocessor devices, software of automation equipment.
Master's students will acquire knowledge and practical skills in the development, design of digital control systems for electric drives of industrial installations.

Emergency and technological automation of power systems
CODE – ERG229
CREDIT – 3 (2/0/1)
PRE-REQUISIT – ERG222

PURPOSE AND OBJECTIVES OF THE COURSE
This standard is included in the group of standards of SO UES JSC, which regulate the issues of automatic emergency control of power systems modes and establish requirements for devices and complexes of emergency automation. The standard contains the rules for organizing automatic emergency control of electric power modes of power systems, defines the purpose, functions, scope of types of emergency automation and general requirements for devices and complexes of emergency automation. In the development of this standard, the following are being developed: standards that establish the basic functional and technical requirements for emergency control devices; standards establishing the rules for determining the logic of action and setting up devices and complexes of emergency control automation.

SHORT DESCRIPTION OF THE COURSE
Emergency automation is designed to limit the development and termination of emergency modes in the power system. Its most important task is to prevent system-wide accidents accompanied by a disruption in power supply to consumers in a large area.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
Guidelines for emergency automation of power systems (basic provisions) contain a general description of different types of emergency automation (PA), determine their purpose, conditions of use and functions.
The guidelines are intended for organizations of the USSR Ministry of Energy that develop and operate emergency control devices: the requirements of the Guidelines should also be taken into account when developing technological automation systems for the main equipment.

ASDU and optimization of power systems modes
CODE – ERG253
CREDIT – 6 (2/1/0/3)
PRE-REQUISIT – нет

PURPOSE AND OBJECTIVES OF THE COURSE
The objectives of mastering the discipline are: the formation of knowledge about the tasks, structure, features of energy and energy systems, technological features of energy systems, about electrical modes and the possibilities of managing them, tasks of operational control in conditions of automated dispatch control systems (ASDU), compatibility of the control system in the power industry with biological environments, the formation of skills and abilities to manage the modes of power systems, optimization calculations and analysis of technical and economic indicators of networks; planning and forecasting modes, choosing the optimal composition of operating equipment in the power system.

SHORT DESCRIPTION OF THE COURSE
The discipline belongs to the "Professional Cycle" of the basic part of the "Power Engineering" module. The specified discipline is one of the basic ones; has both independent significance and is the basis for a number of special disciplines.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
To successfully master the discipline, the student must:
know: laws of electrical engineering; basic elements of electrical systems;
be able to: draw up equivalent circuits for the elements of the power system;
Apply and analyze information, solve engineering problems in the field of electromechanical energy conversion. Perform various tasks of analyzing the operation of electromechanical converters using mathematical modeling methods, develop recommendations for optimizing EMF operating modes. Development of design solutions for the execution of electromechanical converters for various applications.

Energy management system according to international standards
CODE – ERG247
CREDIT – 6 (1/1/1/3)
PRE-REQUISIT – нет

PURPOSE AND OBJECTIVES OF THE COURSE
To prepare a specialist to solve the problems of design, research and operation of electric power and electrotechnological installations and systems, able to analyze the efficiency of energy conversion schemes, assess the prospects of new methods of energy production and introduce innovative developments into practice.

SHORT DESCRIPTION OF THE COURSE
The discipline covers the following theoretical information about the state of development of modern electric power industry:
- the structure and operation of modern power plants of various types and electrical networks;
- principles of construction, structure and optimization of the electric power system of an industrial enterprise;
- the scale, direction and perspective of the production and distribution of energy resources;
- methods of obtaining and requirements for the quality of new types of electrical technology;
- legal and regulatory framework for energy saving;
- fundamentals of energy audit of power facilities;
- principles of wasteless technology, fuel and energy indicators of wastelessness;
- environmental aspects of energy saving.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
- the ability to identify promising areas in the energy sector;
- to understand general and particular problems in the energy sector;
- read and cite scientific literature;
- analyze a scientific publication;
- use scientific methods of analysis.

Renewable energy sources
CODE – ERG269
CREDIT – 6 (2/0/1/3)
PRE-REQUISIT – ERG265

PURPOSE AND OBJECTIVES OF THE COURSE
The discipline orients the knowledge gained in chemistry, biology, physics, theoretical foundations of electrical engineering. Carries out their connection with special disciplines, processes and technologies in renewable energy sources, industries. And also shows their connection with special disciplines, processes and technologies for obtaining renewable energy sources from the corresponding applied materials.

SHORT DESCRIPTION OF THE COURSE
The main factors that determine the degree of use of any energy source are its estimated reserves, the net yield of useful energy, cost, potential hazardous impacts on the environment, as well as social consequences and impact on state security.
Renewable energy sources include hydrogen, bioethanol and biogas, artificially obtained from biological waste from agriculture, as well as energy from the sun, water, wind, sea waves, tides, and hydroelectric power plants.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
In the course of studying the discipline, students must understand the concept of providing electricity to consumers, understand the structure of the electric power industry, the relationship between its various links, have an idea of the latest achievements in obtaining renewable energy sources, get an idea of the composition of electricity consumers in various industries.

Monitoring and energy audit of power complexes
CODE – ERG256
CREDIT – 6 (2/0/1/3)
PRE-REQUISIT – no

PURPOSE AND OBJECTIVES OF THE COURSE
To prepare a specialist to solve the problems of design, research and operation of electric power and electrotechnological installations and systems, able to analyze the efficiency of energy conversion schemes, assess the prospects of new methods of energy production and introduce innovative developments into practice.

SHORT DESCRIPTION OF THE COURSE
The discipline covers the following theoretical information about the state of development of modern electric power industry:
- the structure and operation of modern power plants of various types and electrical networks;
- principles of construction, structure and optimization of the electric power system of an industrial enterprise;
- the scale, direction and perspective of the production and distribution of energy resources;
- methods of obtaining and requirements for the quality of new types of electrical technology;
- legal and regulatory framework for energy saving;
- fundamentals of energy audit of power facilities;
- principles of wasteless technology, fuel and energy indicators of wastelessness;
- environmental aspects of energy saving.

KNOWLEDGE, ABILITY, SKILLS TO COMPLETE THE COURSE
As a result of studying the discipline, the student must know: the elements of metering and control of energy consumption, the possibilities of energy management and elements of the analysis of investments in energy saving

The educational program of the scientific and pedagogical magistracy includes two types of practices:

- pedagogical;
- research.

Pedagogical practice is carried out with the aim of developing practical skills and teaching methods.

Pedagogical practice can be carried out during the period of theoretical training without interrupting the educational process.

The research practice of the undergraduate is carried out with the aim of acquainting with the latest theoretical, methodological and technological achievements of domestic and foreign science, with modern methods of scientific research, processing and interpretation of experimental data.

Research work of a master student

Research work in the scientific and pedagogical magistracy should:

- correspond to the main problematics of the specialty in which the master's thesis is being defended;
- be relevant, contain scientific novelty and practical significance;
- be based on modern theoretical, methodological and technological achievements of science and practice;
- carried out using modern methods of scientific research;
- contain research (methodological, practical) sections on the main protected provisions;
- be based on advanced international experience in the relevant field of knowledge.
- performed using advanced information technologies;
- contain experimental and research (methodological, practical) sections on the main protected provisions.

Registration and defense of the master's thesis
CODE – ECA205
CREDIT – 12

The purpose of the master's thesis is:
demonstration of the level of scientific / research qualifications of a master student, the ability to independently conduct scientific research, test the ability to solve specific scientific and practical problems, knowledge of the most general methods and techniques for their solution.

SHORT DESCRIPTION
A master's thesis is a final qualifying scientific work, which is a generalization of the results of an independent study by a master student of one of the urgent problems of a specific specialty of the corresponding branch of science, which has internal unity and reflects the course and results of the development of the chosen topic.
The master's thesis is the result of the research / experimental research work of the master student, carried out during the entire period of the master's student's training.
The defense of a master's thesis is the final stage of the master's preparation. A master's thesis must meet the following requirements:
- in the work, research should be carried out or urgent problems in the field of electrical engineering and power engineering should be solved;
- the work should be based on the definition of important scientific problems and their solution;
- decisions must be scientifically grounded and reliable, have internal unity;
- the thesis should be written individually.

Content