MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
“Igor Sikorsky Kyiv Polytechnic Institute”

APPROVED
Academic Council of "Igor Sikorsky Kyiv Polytechnic Institute"
(Protocol № 3 from 15.03.2021)
Head of Academic Council
_____ Mykhaylo ILCHENKO

ELECTRIC POWER DISTRIBUTION SYSTEMS ENGINEERING

EDUCATIONAL AND PROFESSIONAL PROGRAM

The first (bachelor's) level of higher education

Speciality	**141 - Electrical Power Engineering, Electrical Engineering and Electromechanics**
Field of knowledge	**14 - Electrical Engineering**
Qualification	**Bachelor of Electrical Power Engineering, Electrical Engineering and Electromechanics**

Put into effect by order of the rector ofIgor Sikorsky Kyiv Polytechnic Institute (Decree № NON/89/2021 from 19.04.2021)

Kyiv – 2021

PREFACE

Developed by a working group

Head of the working group

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Members of the working group:

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Teaching Assistant of the Department of Electric Power Supply

Head of the power supply department

Popov Vladimir, Doctor of Technical Sciences, Associate professor,
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AGREED:

Scientific and Methodological Commission of Igor Sikorsky Kyiv Polytechnic Institute by specialty 141 - Electric Power Engineering, Electrical Engineering and Electromechanics

Head of the Commission _____ ***Oleksandr YANDULSKYI***

(Protocol № 3 from 17.12.2020)

Methodological Counsil of Igor Sikorsky Kyiv Polytechnic Institute

Head of the Counsil _____ ***Yurii YAKYMENKO***

(Protocol № 6 from 25.02.2021)

According to the results of monitoring the educational-professional program "Electrical power distribution systems engineering" of the second (master's) level of higher education in the specialty 141 Electrical power engineering, electrical engineering and electromechanics, approved by the decision of the Academic Council from 02.04.2018, protocol № 4, taking into account the proposals of the members of the educational process, which are involved in the implementation of the educational program, the proposals of graduates, employers and other external stakeholders, it was updated.

The project team reviewed the balance, rational use of credits, the ability of students to master certain disciplines (educational components) and the entire educational program, to keep within the certain time, the completeness of documentary, staffing, information, other forms of the educational program support and compliance of the educational program with the License Conditions.

To ensure the possibility of forming an individual educational trajectory, including the individual choice of academic disciplines in the amount provided by law, it was decided to replace the existing sample units by the separate educational components.

The educational-professional program "Electrical power distribution systems engineering" was discussed and approved by teaching staff of the Department of Electric Power Supply Systems (Protocol № 7 from 17.12.2020).

CONTENTS

1. EDUCATIONAL PROGRAM PROFILE

Speciality: 141 - Electrical Power Engineering, Electrical Engineering and Electromechanics

1 – General information	
Full name of the Institution of Higher Education and Institute / Faculty	National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Institute of Energy Saving and Energy Management
Higher education degree and title of qualification in the original language	Degree – bachelor Qualification - Bachelor of Electrical Power Engineering, Electrical Engineering and Electromechanics
The official name of the educational program	Energy management and energy efficient technologies
Type of diploma and scope of educational program	Bachelor's diploma, single, 240 credits, term of study 3 years 10 months
Availability of accreditation	Certificate of accreditation НД -IV № 1158095, issued by the Ministry of Education and Science of Ukraine Accreditation period since 30.05.2013 till 01.07.2023
Cycle / level of Higher Education	NRC of Ukraine - level 6 QF-EHEA - the first cycle EQF-LLL – level 6
Background	Degree of complete general secondary education
Language (s) teaching	Ukrainian
Term of the educational program	Until the next accreditation
Internet address of the permanent placement of the educational program	http://ep.kpi.ua/ department website http://osvita.kpi.ua/ section of educational programs
2 – The purpose of the educational program	
Training of specialists capable of solving complex specialized theoretical and practical problems in the field of providing consumers with electricity; to carry out professional activity in the conditions of liberalization of the electricity market and integration of the electric power system of Ukraine into the united energy zones of Europe ENTSO-E; to introduce the latest technologies of design, construction and operation of power supply systems of industrial enterprises, cities and agricultural facilities on the basis of sustainable energy development within the Smart Grid concept.	
3 – Educational program characteristics	
Subject area	**Objects of study and activity:** - enterprises of the energy sector, electrotechnical and electromechanical services of the organizations; - production, transmission, distribution and conversion of electricity at power plants, power grids and systems; electrotechnical equipment, electromechanical and switching equipment, electromechanical and electrotechnical complexes and systems. **Study objective:** Training of specialists capable of solving specialized problems and practical problems of Electrical Power

	Engineering, Electrical Engineering and Electromechanics, which involves the application of theories and methods of physics and engineering and is characterized by complexity and uncertainty of conditions. **Theoretical content of the subject area:** basic concepts of the theory of electric and electromagnetic circuits, modeling, optimization and analysis of modes of operation of power plants, networks and systems, electric machines, electric drives, electrotechnical and electromechanical systems and complexes using traditional and renewable energy sources. **Methods, techniques and technologies:** analytical methods for calculating electrical circuits, power supply systems, electrical machines and apparatus, control systems for electrical and electromechanical systems, electrical loads using specialized laboratory equipment, personal computers and other equipment. **Tools and equipment:** measuring instruments, electrical and electronic devices, microcontrollers, computers.
Orientation of the educational program	Educational and professional
The main focus of the educational program and specialization	***The main focuses of the program:*** 1. Enhanced training in electrical engineering, power engineering and electromechanics. 2. Enhanced training in the field of providing consumers with electricity, taking into account energy saving factors and improving energy efficiency. 4. Fundamental training in the design, construction and operation of power supply systems. 5. Fundamental training in the installation of power and electrical equipment. 6. Application of methods and means of monitoring indicators of reliability of electricity supply and quality of electricity and conducting energy audit. 7. Fundamental training in the development and implementation of energy efficiency measures and technologies in the field of distribution and conversion of electricity. 8. Fundamental training in the design and use of renewable energy sources. 9. Work plans for training higher education seekers are reviewed annually to include sections related to the development of knowledge and current trends in the provision of electricity to consumers on the basis of benchmarking and the results of analysis of new scientific, technological and educational achievements. ***Keywords***: electricity, electricity consumers, power supply systems, power supply quality, electricity networks, energy markets.
Features of the Educational Program	1. Enhanced training in the field of natural sciences (mathematics, physics), as well as technical sciences (electrical engineering, electrical measurements, information technology, power electronics). 2. Fundamental training in the design, construction and operation of systems for providing consumers of industrial enterprises, cities and facilities of the agricultural complex with electricity, taking into

	account the factors of economy, reliability, quality and energy efficiency. 3. Study of the possibility and economic feasibility of increasing the levels of energy efficiency of industry and housing and communal services by implementing appropriate measures, the feasibility of which is based on indicators of economy, environmental friendliness, energy efficiency and social factors. 4. The use of elements of dual education, in particular, interuniversity programs with the world's leading institutions and internships at leading companies certified according to energy and environmental management standards
4 – Graduates suitability for employment and further education	
Suitability for employment	According to the classifier of professions ДК003: 2010 graduates can perform the following types of professional work: 3113 Substation dispatcher 3113 Dispatcher of the district (local) dispatching point 3113 Electrician of the station 3113 Electrician of the shop 3113 Energetic 3113 Power engineer of production 3113 Power engineer of a site 3113 Power engineer of the shop Possible professional certification
Further education	Continuation of education at the second (master's) level of higher education and / or acquisition of additional qualifications in the system of postgraduate education).
5 – Teaching and assessment	
Teaching and study	Lectures, practical and seminar classes, computer workshops and laboratory works; course projects and works; technology of blended learning, practice and excursions; execution of diploma project (work)
Assesment	Current and semester control in the form of laboratory reports, presentations, written and oral examinations and defense of qualification work are evaluated in accordance with the defined criteria of the Rating system
6 – Program competencies	
Integral competence	Ability to solve specialized problems and solve practical problems during professional activities in the field of Electrical Power Engineering, Electrical Engineering and Electromechanics or in the study process, which involves the application of theories and methods of physics and engineering and are characterized by complexity and uncertainty.
General competencies	
К 1	Ability to abstract thinking, analysis and synthesis
К 2	Ability to apply knowledge in practical situations
К 3	Ability to communicate in the state language both orally and in writing
К 4	Ability to communicate in a foreign language
К 5	Ability to search, process and analyze information from various sources
К 6	Ability to identify, state and solve problems
К 7	Ability to work in a team
К 8	Ability to work autonomously

К9	Ability to exercise their rights and responsibilities as a member of society, to realize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, human and civil rights and freedoms in Ukraine
К10	Ability to preserve and increase moral, cultural, scientific values and achievements of society based on understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, techniques and technologies. active recreation and a healthy lifestyle
Professional competencies	
К11	Ability to solve practical problems using computer-aided design and calculation (CAD) systems
К12	Ability to solve practical problems involving methods of mathematics, physics and electrical engineering
К13	Ability to solve complex specialized problems and practical problems related to the operation of electrical systems and networks, the electrical part of stations and substations and high voltage equipment
К14	Ability to solve complex specialized problems and practical problems related to the problems of metrology, electrical measurements, the operation of automatic control devices, relay protection and automation
К15	Ability to solve complex specialized problems and practical problems associated with the operation of electric machines, devices and automated electric drive
К16	Ability to solve complex specialized problems and practical problems related to the problems of production, transmission and distribution of electricity
К17	Ability to develop projects of electric power, electrotechnical and electromechanical equipment with observance of requirements of the legislation, standards and the technical task
К18	Ability to perform professional duties in compliance with the requirements of safety, labor protection, industrial sanitation and environmental protection
К19	Awareness of the need to increase the efficiency of electrical, electrical and electromechanical equipment
К20	Awareness of the need to constantly expand their knowledge of new technologies in Electrical Power Engineering, Electrical Engineering and Electromechanics
К21	Ability to promptly take effective measures in emergency situations in power and electromechanical systems
К22	Ability to design and operate power supply systems of cities, industrial enterprises and agricultural facilities, taking into account the conditions of quality assurance of electricity supply
К23	Ability to carry out safe operation of electrical installations of consumers in accordance with the requirements of current norms and rules
К24	Ability to optimize the parameters of power consumption modes and control power supply modes using the latest methods and modern software and hardware
К25	Ability to implement advanced technologies to provide consumers with electricity based on alternative and renewable energy sources according to the Smart Grid concept
К26	Ability to apply modern scientific approaches and experimental basis for research in the field of power supply systems
К27	Ability to organize commercial electricity metering and interact with commercial metering service providers

K28	Ability to manage the demand for electricity (electricity) and provide other ancillary services in the functioning of liberalized electricity markets
K29	Ability to implement information interaction with market operators, electricity transmission and distribution systems, other subjects of the liberalized electricity market
K30	Possess modern methods of calculation of indoor and outdoor lighting, electrical and technical and economic performance of power and electrical consumers of electricity

7 – Program study results

PR1. Know and understand the principles of operation of electrical systems and networks, power equipment of power plants and substations, protective earthing and lightning protection devices and be able to use them to solve practical problems in professional activities.
PR2. Know and understand the theoretical foundations of metrology and electrical measurements, the principles of automatic control devices, relay protection and automation, have the skills to perform appropriate measurements and use these devices to solve professional problems.
PR3. Know the principles of operation of electric machines, devices and automated electric drives and be able to use them to solve practical problems in professional activities.
PR4. Know the principles of operation of bioenergy, wind, hydro and solar power plants.
PR5. Know the basics of the theory of the electromagnetic field, methods of calculating electric circuits and be able to use them to solve practical problems in professional activities.
PR6. Use application software, microcontrollers and microprocessor technology to solve practical problems in professional activities.
PR7. To carry out the analysis of processes in the electric power, electrotechnical and electromechanical equipment, the corresponding complexes and systems.
PR8. Select and apply suitable methods for analysis and synthesis of electromechanical and electrical systems with specified parameters.
PR 9. Be able to assess the energy efficiency and reliability of electrical, electrical and electromechanical systems.
PR10. Find the necessary information in the scientific and technical literature, databases and other sources of information, assess its relevance and reliability.
PR11. Communicate freely on professional issues in state and foreign languages orally and in writing, discuss the results of professional activities with specialists and non-specialists, argue their position on issues of discussion.
PR12. Understand the basic principles and objectives of technical and environmental safety objects of electrical engineering and electromechanics, take them into account when making decisions.
PR13. Understand the importance of traditional and renewable energy for successful economic development of the country.
PR14. Understand the principles of European democracy and respect for the rights of citizens, take them into account in decision-making.
PR15. Understand and demonstrate good professional, social and emotional behavior, follow a healthy lifestyle.
PR16. Know the requirements of regulations relating to engineering, protection of intellectual property, labor protection, safety and industrial sanitation, take them into account when making decisions.
PR17. Solve complex specialized problems in the design and maintenance of electromechanical systems, electrical equipment of power plants, substations, systems and networks.
PR18. Be able to learn independently, acquire new knowledge and improve skills in working with modern equipment, measuring equipment and application software.

PR19. Apply suitable empirical and theoretical methods to reduce electricity losses during its production, transportation, distribution and use. PR20. To know and be able to apply methods of calculation of indicators of quality of power supply and ways of their increase.	
PR21. Know and be able to apply methods for calculating steady-state and transient processes in power supply systems. PR22. Know and be able to apply methods for calculating the values of shock and steady-state short-circuit currents in power supply systems. PR23. Calculate the electrical load for a wide range of consumers of industrial enterprises, cities, agro-industrial complex and electrified urban transport. PR24. To choose the parameters of the elements of power supply systems on the basis of feasibility study. PR25. Carry out an analysis of the quality of electricity supply and substantiate the ways of its provision. PR26. Carry out a comprehensive solution to the issues of reactive power compensation in the systems of providing consumers with electricity. PR27. Be able to build and establish business communications in the enterprise, endogenous and exogenous, in particular, departmental communications, communication between levels and departments, to implement the preparation and organization of communication in crisis situations. PR28. Be able to organize and plan information and communication processes in a modern enterprise, know and own office automation technologies and the basics of electronic document management. PR29. Calculate the electrical load and choose the drive of power consumers of electricity (cranes, conveyors, pumps, fans, compressors, etc.). PR30. Calculate electrical and technical and economic performance of electrical installations, as well as assess the feasibility of using different types of consumers for a particular process.	
8 – Resource support for program implementation	
Staffing	In accordance with the personnel requirements to ensure the implementation of educational activities for the relevant level of HE (Annex 2 to the License Conditions), approved by the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (as amended by the Cabinet of Ministers of Ukraine dated 10 May 2018 № 347)
Technical support	In accordance with the technological requirements for material and technical support of educational activities of the relevant level of HE (Annex 4 to the License Conditions) approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 №1187 (as amended by the Cabinet of Ministers of Ukraine dated 10 May 2018 № 347). Use of equipment: training rooms with multimedia projectors, computer equipment with appropriate software, laboratory equipment for educational (teaching, research, scientific) activities.
Information, educational and methodical support	In accordance with the technological requirements for educational, methodological and informational support of educational activities of the relevant level of HE (Annex 5 to the Licensing Conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 №1187 (as amended by the Cabinet of Ministers of Ukraine dated May 10, 2018). № 347).

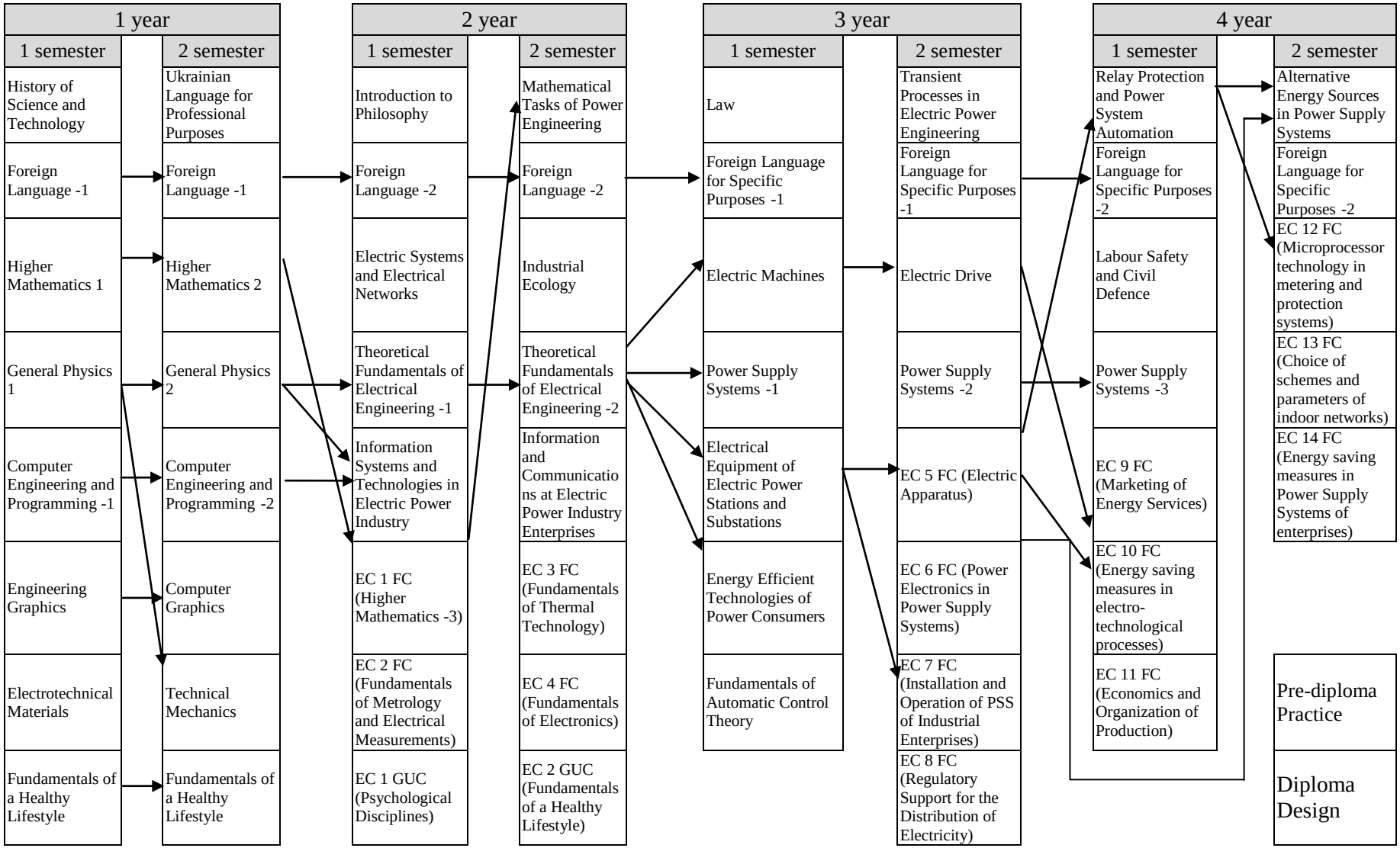
	Use of the Scientific and Technical Library of the Igor Sikorsky Kyiv Polytechnic Institute.
9 – Academic mobility	
National credit mobility	Possibility to conclude agreements on academic mobility, double graduation, etc.
International credit mobility	Possibility of concluding agreements on international academic mobility (Erasmus + K1), on double diplomas, on long-term international projects that include inclusive student education, etc.
Training of foreign applicants for higher education	Teaching in English

2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Code e/d	Components of the educational program (academic disciplines, practices, course works, course projects, qualification work)	Number of credits	Form of final control
1	2	3	4
Mandatory (regulatory) components of EP			
General training cycle			
GM 1	Ukrainian Language for Professional Purposes	2	credit
GM 2	History of Science and Technology	2	credit
GM 3	Fundamentals of a Healthy Lifestyle	3	credit
GM 4	Foreign Language	6	credit
GM 5	Labour Safety and Civil Defence	4	credit
GM 6	Law	2	credit
GM 7	Introduction to Philosophy	2	credit
GM 8	Industrial Ecology	2	credit
GM 9	Foreign Language for Specific Purposes	6	examination
GM 10	Higher Mathematics	15	examination
GM 11	General Physics	11	examination
GM 12	Computer Engineering and Programming	9,5	examination
GM 13	Engineering Graphics	4	credit
GM 14	Technical Mechanics	4	credit
GM 15	Computer Graphics	3,5	credit
GM 16	Electrotechnical Materials	3	credit
GM 17	Theoretical Fundamentals of Electrical Engineering	10	examination
GM 18	Electric Machines	5	examination
GM 19	Electrical Equipment of Electric Power Stations and Substations	4	examination
GM 20	Electric Drive	3	examination
GM 21	Electric Systems and Electrical Networks	5	examination
GM 22	Relay Protection and Power System Automation	3,5	examination
Cycle of professional training			
PM 1	Information Systems and Technologies in Electric Power Industry	5,5	examination
PM 2	Information and Communications at Electric Power Industry Enterprises	6	examination
PM 3	Mathematical Tasks of Power Engineering	6,5	examination
PM 4	Power Supply Systems	16,5	examination
PM 5	Energy Efficient Technologies of Power Consumers	6,5	examination
PM 6	Fundamentals of Automatic Control Theory	5	credit
PM 7	Transient Processes in Electric Power Engineering	4,5	examination
PM 8	Alternative Energy Sources in Power Supply Systems	3,5	examination

1	2	3	4
PM 9	Energy Efficient Technologies of Power Consumers (Coursework)	1	credit
PM 10	Transient Processes in Electric Power Engineering (Coursework)	1	credit
PM 11	Power Supply Systems (Course Project)	1,5	credit
PM 12	Alternative Energy Sources in Power Supply Systems (Coursework)	1	credit
PM 13	Pre-diploma Practice	6	credit
PM 14	Diploma Design	6	protection
Selective components of EP			
General training cycle (from the general university Catalog)			
GS 1	Educational component 1 GU-Catalog	2	credit
GS 2	Educational component 2 GU-Catalog	2	credit
Cycle of professional training (from the faculty Catalog)			
PS 1	Educational component 1 F-Catalog	4	credit
PS 2	Educational component 2 F-Catalog	4	credit
PS 3	Educational component 3 F-Catalog	4	credit
PS 4	Educational component 4 F-Catalog	4	credit
PS 5	Educational component 5 F-Catalog	4	credit
PS 6	Educational component 6 F-Catalog	4	credit
PS 7	Educational component 7 F-Catalog	4	credit
PS 8	Educational component 8 F-Catalog	4	credit
PS 9	Educational component 9 F-Catalog	4	credit
PS 10	Educational component 10 F-Catalog	4	credit
PS 11	Educational component 11 F-Catalog	4	credit
PS 12	Educational component 12 F-Catalog	4	credit
PS 13	Educational component 13 F-Catalog	4	credit
PS 14	Educational component 14 F-Catalog	4	credit
The total amount of **mandatory components**:		180	
The total amount of **selective components**:		60	
The amount of **educational components that provide the acquisition competencies defined by the HES**		180	
TOTAL VOLUME OF THE EDUCATIONAL PROGRAM		**240**	

3. STRUCTURAL LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



EC – Educational Component; GUC – General University Catalog; FC – Faculty Catalog

4. FORM OF CERTIFICATION OF APPLICANTS FOR HIGHER EDUCATION

Certification of higher education applicants under the educational program "Electrical power distribution systems engineering" specialty 141 "Electrical Power Engineering, Electrical Engineering and Electromechanics" is carried out in the form of defense (demonstration) of qualification work and ends with the issuance of a standard document to award its author with a bachelor's degree in “Electrical Power Engineering, Electrical Engineering and Electromechanics” according to the educational-professional program "Electrical power distribution systems engineering".

Qualification work is checked for plagiarism, fabrication and falsification and after protection is placed in the repository of NTL of the University for free access.

Certification is carried out openly and publicly.

5. MATRIX OF COMPLIANCE OF SOFTWARE COMPETENCIES WITH COMPONENTS OF THE EDUCATIONAL PROGRAM

	GM 1	GM 2	GM 3	GM 4	GM 5	GM 6	GM 7	GM 8	GM 9	GM 10	GM 11	GM 12	GM 13	GM 14	GM 15	GM 16	GM 17	GM 18	GM 19	GM 20	GM 21	GM 22	PM 1	PM 2	PM 3	PM 4	PM 5	PM 6	PM 7	PM 8	PM 9	PM 10	PM 11	PM 12	PM 13	PM 14
K1							+			+	+	+	+	+	+																					+
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6. MATRIX OF PROVIDING PROGRAM RESULTS OF STUDY BY THE RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM

	GM 1	GM 2	GM 3	GM 4	GM 5	GM 6	GM 7	GM 8	GM 9	GM 10	GM 11	GM	GM	GM	GM	GM	GM	GM	GM	GM	GM	PM 1	PM 2	PM 3	PM 4	PM 5	PM 6	PM 7	PM 8	PM 9	PM 10	PM 11	PM 12	PM 13	PM 14
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