MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
“Igor Sikorsky Kyiv Polytechnic Institute”

APPROVE

Academic Council of "Igor Sikorsky Kyiv Polytechnic Institute"

(Meeting protocol __from «__» _____2021p.)

Head of Academic Council

_____ Mykhailo ILCHENKO

Engineering of Intelligent Electrotechnical and Mechatronic Complexes

EDUCATIONAL PROFESSIONAL PROGRAM

first (bachelor's) level of higher education

specialty	**141 Electric Power Engineering, Electrotechnics and Electromechanics**
field of knowledge	**14 Electrical Engineering**
qualification	**Bachelor of Electrical Engineering and Electromechanics**

Put into effect by the Rector's Order Igor Sikorsky Kyiv Polytechnic Institute

from _____ № _____

Kyiv - 2021

PREFACE

DEVELOPED by a working group:

Chairman of the working group
Danilin Alexander, Candidate of Engineering Sciences (Ph.D.),
Associate Professor at the Department of
Automation of Electrical and Mechatronic Complexes

Members of the working group:

Mayta Oleksandr, Candidate of Engineering Sciences (Ph.D.),
Associate Professor at the Department of
Automation of Electrical and Mechatronic Complexes

Tishevich Boris Candidate of Engineering Sciences (Ph.D.),
Associate Professor at the Department of
Automation of Electrical and Mechatronic Complexes

Bosak Alla, Candidate of Engineering Sciences (Ph.D.),
Associate Professor at the Department of
Automation of Electrical and Mechatronic Complexes

Polishchuk Valentina, Senior Lecturer at the Department of
Automation of Electrical and Mechatronic Complexes

Horobets Andriy, student at the Department of
Automation of Electrical and Mechatronic Complexes

Head of the Department of
Automation of Electrical and Mechatronic Complexes
Rozen Viktor, Doctor of Technical Sciences, Professor

AGREED:

Scientific and methodical commission of Igor Sikorsky Kyiv Polytechnic Institute 141 specialty

"*Electric Power Engineering, Electrotechnics and Electromechanics*"

Head of Scientific and Methodological

Subcommittee on Specialty_____ Oleksandr Yandulskyi

(Meeting protocol № ___ of "___" January 2021)

Methodical council of Igor Sikorsky Kyiv Polytechnic Institute

Chairman of the Methodological Council_____ Yurii Yakymenko

(Meeting protocol № ___ from ___ _____ 2021)

INCLUDED:

According to the results of public discussion

- remarks and suggestions of stakeholders;

- graduates and applicants for higher education who study in the educational-professional program Engineering of intelligent electrical and mechatronic complexes specialty 141 Electric Power Engineering, Electrotechnics and Electromechanics;

- Industry specialists: Axion Energy Global Ukraine LLC General Director Bosak O., General Director of the Oil Transport Institute Kosyak O., SV Altera Kyiv LLC General Director Boloshenko D., Chairman of the Board of JSC Ukrainian Oil and Gas Institute ” Kramarev G., LLC“ Enercis Ukraine ”General Director Pryadko V.;

-specialists of the educational and methodical department of KPI named after Igor Sikorsky;

-scientific - pedagogical workers of the department of automation of electrotechnical and mechatronic complexes.

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Educational and professional program "Engineering of intelligent electrical and mechatronic complexes" was considered at a meeting of the Department of

Automation of Electrical and Mechatronic Complexes Meeting protocol №1 from January 18, 2021.

Reviews and feedback are attached to the EP.

CONTENT

1. PROFILE OF THE EDUCATIONAL PROGRAM

1 – General information	
Full name of the Higher Education Institution and Institute /Faculty	National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”, Institute for Energy Saving and Energy Management
Higher education degree and title of qualification in the original language	Degree – bachelor Qualification - Bachelor of Electric Power Engineering, Electrotechnics and Electromechanics
The official name of the Educational Program	Engineering of Intelligent Electrotechnical and Mechatronic Complexes
Type of diploma and volume of Educational Program	Bachelor's degree, single, 240 ECTS credits, term of study 3 years 10 months
Availability of accreditation	Certificate of Accreditation series НД-ІІ №1158091
Level of National Qualifications Framework	NRC of Ukraine - level 6 QF-EHEA - the first cycle EQF-LLL - 6 level
Prerequisites	Availability of complete general secondary education
Language (s) of teaching	Ukrainian / English
The duration of the Educational Program	Accredited for the first time
Internet address of the permanent placement of the Educational Program	https://osvita.kpi.ua/ section "Educational programs"
2 – The purpose of the Educational Program	
Training of specialists capable of solving specialized problems and practical problems in the field of power engineering, electrical engineering and electromechanics, which involve the development and improvement of intelligent control systems for electrical and mechatronic systems based on modern modeling technologies, control methods in complex systems. The purpose of the educational program corresponds to the development strategy of KPI. Igor Sikorsky for 2020-2025 on the formation of the society of the future on the basis of the concept of sustainable development.	
3 – Characteristics of the Educational Program	
Field of knowledge	Field of knowledge: 14 - Electrical Engineering; Specialty: 141 - Electric Power Engineering, Electrotechnics and Electromechanics *Objects of study and activity:* - electrical and electromechanical services of enterprises, scientific and design institutions; - enterprises of the electric power industry, including the fuel and energy complex; - systems for automation of production, transmission, distribution, and conversion of electric energy at power plants, electric networks and systems, and their engineering; - electrical equipment, electromechanical and switching equipment, electromechanical, electrical systems, and intelligent control systems. *Purpose of training:* training of specialists capable of developing and improving intelligent control systems of electrical and mechatronic complexes based on modern information technologies, conducting research on power, electrical, and electromechanics, justifying the choice of technical means,

	ensuring safety culture, performing installation, commissioning, and repair. The theoretical content of the subject area: basic concepts of the theory of electric, electromagnetic circuits and technical mechanics, the theory of automatic control, modeling, optimization, and analysis of modes of operation of electrical and mechatronic complexes. *Methods, techniques, and technologies:* analytical methods for calculating electrical circuits, power supply systems, electrical machines and devices, intelligent control systems for electrical, electromechanical, and mechatronic systems, electrical loads using specialized laboratory equipment, personal computers, microprocessors, and programmable logic systems. *Tools and equipment:* measuring instruments, electrical and electronic devices, microcontrollers, computers.
Orientation of the Educational Program	Educational-professional
The main focus of the Educational Program	The program is based on well-known provisions, taking into account the current state of development of energy, electrical engineering, electromechanics and mechatronics focuses on current specializations, within which further professional activity is possible. The program is aimed at forming such competencies of higher education students that make possible their comprehensive professional, scientific, intellectual and social development in the field of electrical engineering, engineering of intelligent electrical and mechatronic complexes. Emphasis on the development of intelligent control systems for electrical and mechatronic complexes, modern modeling technologies, control methods in complex systems using modern software. Key words: electrotechnical and electromechanical systems and complexes, devices and equipment, control systems, automation systems, engineering.
Features of the Program	Involvement of specialists from other educational institutions, specialists in the field in teaching disciplines; conducting internships and classes for students in the industry; participation of VO applicants in student research circles; possibility to teach separate courses in English.
4 – Eligibility of graduates for employment and further education	
Suitability for employment	According to the occupational classifier ДК003:2010 graduates can perform the following types of professional work: - specialist in electrical engineering, electrical engineering and electromechanics. Professional certification is possible
Further training	Continuation of education at the second (master's) level of higher education.
5 – Teaching and evaluation	
Teaching and learning	Lectures, practical and seminar classes, computer workshops and laboratory works; course projects and works; technology of blended learning, practice and excursions to objects of the branch; implementation of the diploma project.
Evaluation	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 complex specialized problems and practical problems, characterized by complexity and uncertainty of conditions, during professional activities in the industry, including energy-intensive production or in the learning process, which involves the application of certain theories and methods of the industry.	
General competencies (GC)	GC1	Ability to abstract thinking, analysis and synthesis.
	GC2	Ability to apply knowledge in practical situations.
	GC3	Ability to communicate in the state language both orally and in writing.
	GC4	Ability to communicate in a foreign language.
	GC5	Ability to search, process and analyze information from various sources.
	GC6	Ability to identify, pose and solve problems.
	GC7	Ability to work in a team.
	GC8	Ability to work autonomously.
	GC9	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.
	GC10	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 (PC)	PC1	Ability to solve practical problems using computer-aided design and calculation (CAD) systems.
	PC2	Ability to solve practical problems involving methods of mathematics, physics and electrical engineering.
	PC3	Ability to solve complex specialized problems and practical problems related to the operation of electrical systems and networks, electrical part of stations and substations and high voltage equipment.
	PC4	Ability to solve complex specialized problems and practical problems related to the problems of metrology, electrical measurements, operation of automatic control devices, relay protection and automation.
	PC5	Ability to solve complex specialized problems and practical problems related to the operation of electric machines, devices and automated electric drive.
	PC6	Ability to solve complex specialized problems and practical problems related to the problems of production, transmission and distribution of electricity.
	PC7	Ability to develop projects of electric power, electrotechnical and electromechanical equipment with observance of requirements of the legislation, standards

		and technical task.
	PC8	Ability to perform professional duties in compliance with the requirements of safety, labor protection, industrial sanitation and environmental protection.
	PC9	Awareness of the need to increase the efficiency of electrical, electrical and electromechanical equipment.
	PC10	Awareness of the need to constantly expand their knowledge of new technologies in power engineering, electrical engineering and electromechanics.
	PC11	Ability to promptly take effective measures in emergency (emergency) situations in power and electromechanical systems.
	PC12	Ability to provide modeling of electrical and electromechanical objects and technological processes of production with the use of standard packages and means of automation of engineering calculations, to conduct experiments according to specified methods with processing and analysis of results.
	PC13	Ability to develop working design and technical documentation to verify compliance of development projects and technical documentation with standards, specifications and other regulations.
	PC14	Ability to solve complex specialized problems and practical problems associated with the development of automatic control systems, to evaluate the experience gained.
	PC15	Ability to apply the methods of automatic control theory, systems analysis and numerical methods for the development of mathematical models of electrical and mechatronic complexes, analysis of the quality of their operation using the latest computer technology.

7 – Program learning outcomes

PLO1. Know and understand the principles 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.
PLO2. 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.
PLO3. 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.
PLO4. Know the principles of operation of bioenergy, wind, hydro and solar power plants.
PLO5. 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.
PLO6. Use application software, microcontrollers and microprocessor technology to solve practical problems in professional activities.
PLO7. Carry out analysis of processes in electrical, electrical and electromechanical equipment, relevant complexes and systems.
PLO8. Select and apply suitable methods for analysis and synthesis of electromechanical and electrical systems with specified parameters.
PLO9. Be able to evaluate the energy efficiency and reliability of electrical, electrical and electromechanical systems.

PLO10. Find the necessary information in the scientific and technical literature, databases and other sources of information, assess its relevance and reliability.
PLO11. To communicate freely on professional problems in the state and foreign languages orally and in writing, to discuss the results of professional activity with specialists and non-specialists, to argue their position on debatable issues.
PLO12. Understand the basic principles and objectives of technical and environmental safety of electrical engineering and electromechanics, take them into account when making decisions.
PLO13. Understand the importance of traditional and renewable energy for successful economic development of the country.
PLO14. Understand the principles of European democracy and respect for the rights of citizens, take them into account in decision-making.
PLO15. Understand and demonstrate good professional, social and emotional behavior, follow a healthy lifestyle.
PLO16. 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.
PLO17. Solve complex specialized problems in the design and maintenance of electromechanical systems, electrical equipment of power plants, substations, systems and networks.
PLO18. Be able to learn independently, acquire new knowledge and improve skills in working with modern equipment, measuring equipment and application software.
PLO19. Apply suitable empirical and theoretical methods to reduce electricity losses during its production, transportation, distribution and use.
PLO20. Apply optimization methods in the design of electrical and mechatronic systems and complexes.
PLO21. Use, calculate and investigate digital and nonlinear process controllers, using modern electrical equipment.
PLO22. Create universal most effective algorithms for modeling the processes of electrical and mechatronic systems and conduct their research on modern equipment with modern software.

8 – Resource support for the implementation of the program	
Personnel support	In accordance with the personnel requirements for ensuring the implementation of educational activities for the appropriate level, approved by the resolution of the Cabinet of Ministers of Ukraine dated December 30, 2015 № 1187 (as amended by the resolution of the Cabinet of Ministers of Ukraine dated May 10, 2018 № 347)
Material and technical support	In accordance with the technological requirements for material and technical support of educational activities of the relevant level of HE, approved by the Cabinet of Ministers of Ukraine dated December 30, 2015 № 1187 (as amended by the Cabinet of Ministers of Ukraine dated May 10, 2018 from 347)
Information and educational and methodological support	In accordance with the technological requirements for educational and methodological and informational support of educational activities of the relevant level of HE, approved by the Cabinet of Ministers of Ukraine dated December 30, 2015 № 1187 (as amended by the Cabinet of Ministers of Ukraine dated May 10, 2018 № 347)
9 – Academic mobility	
National Credit Mobility	Possibility of concluding agreements on academic mobility, double graduation, etc.
International Credit Mobility	Possibility of concluding agreements on international academic mobility (Erasmus + K1), on double graduation, on long-term international projects that include inclusive student education, etc.

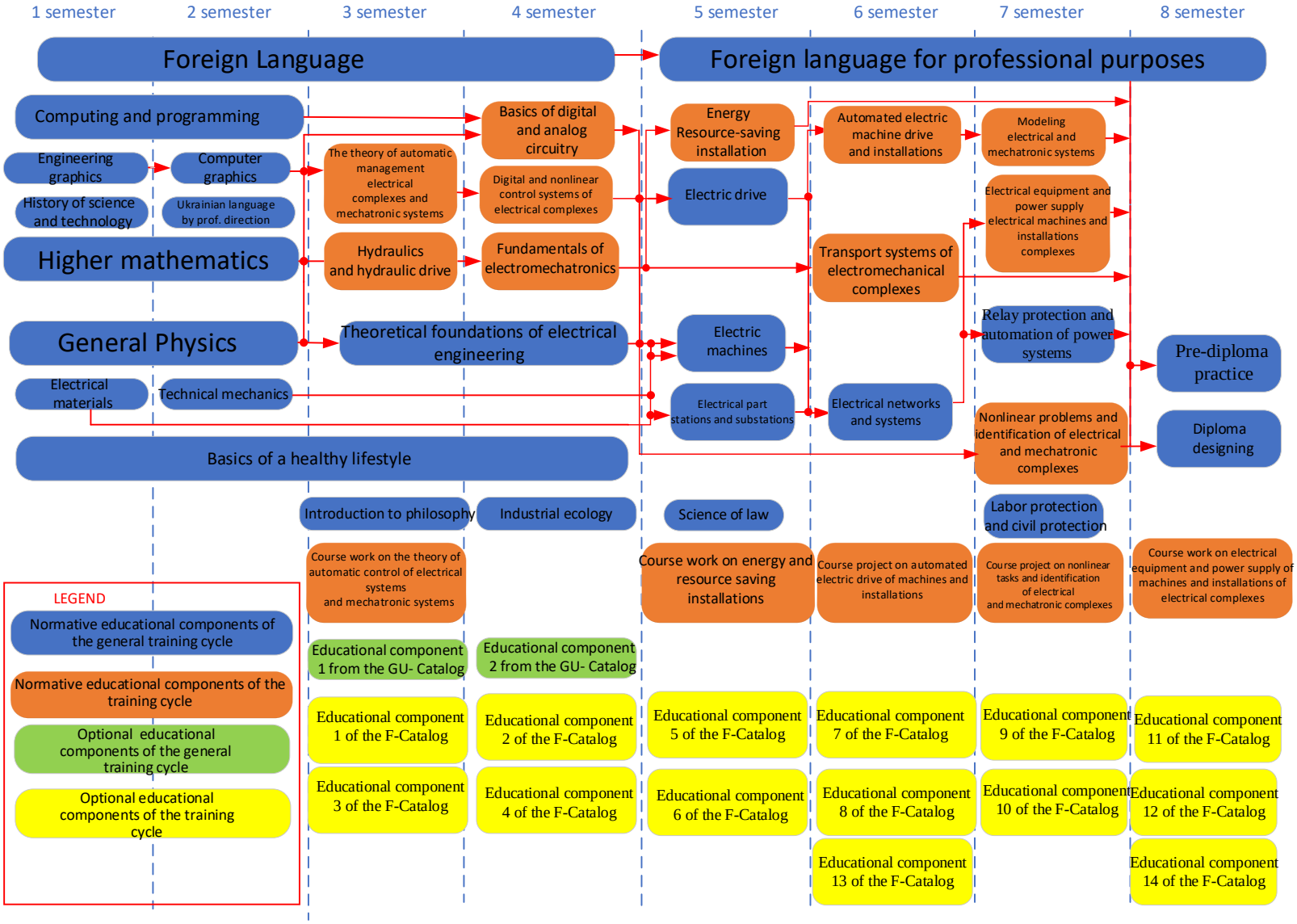
Teaching foreign applicants for higher education	For foreign citizens, education is provided in English, and Ukrainian is studied as a foreign language

2. LIST COMPONENTS OF THE EDUCATIONAL PROGRAM

Code Discipline	Components of the educational program (academic disciplines, practice, qualification work)	Amount of credits	Form of final control
1	2	3	4
NORMATIVE educational components			
General training cycle			
GT 1	Ukrainian language for professional purposes	2	Test
GT 2	History of science and technology	2	Test
GT 3	Basics of a healthy lifestyle	3	Test
GT 4	Foreign Language	6	Test
GT 5	Labor protection and civil protection	4	Test
GT 6	Science of law	2	Test
GT 7	Introduction to philosophy	2	Test
GT 8	Industrial ecology	2	Test
GT 9	Foreign language for professional purposes	6	Exam
GT 10	Higher mathematics	15	Exam
GT 11	General Physics	11	Exam
GT 12	Computing and programming	9,5	Exam
GT 13	Engineering graphics	4	Test
GT 14	Technical mechanics	4	Test
GT 15	Computer Graphics	3,5	Test
GT 16	Electrical materials	3	Test
GT 17	Theoretical foundations of electrical engineering	10	Exam
GT 18	Electric machines	5	Exam
GT 19	Electrical part of stations and substations	4	Exam
GT 20	Electric drive	3	Test
GT 21	Electrical networks and systems	5	Exam
GT 22	Relay protection and automation of power systems	3,5	Exam
Vocational training cycle			
VT 1	Fundamentals of electromechatronics	4	Exam
VT 2	Fundamentals of digital and analog circuitry	4	Test
VT 3	Automated electric drive of machines and installations	5	Exam
VT 4	Course project on automated electric drive of machines and installations	1,5	Test
VT 5	Theory of automatic control of electrotechnical complexes and mechatronic systems	5,5	Exam
VT 6	Course work on the theory of automatic control of electrical systems and mechatronic systems	1	Test
VT 7	Electrical equipment and power supply of machines and installations of electrical complexes	5,5	Exam
VT 8	Course work on electrical equipment and power supply of machines and installations of electrical complexes	1	Test
VT 9	Energy and resource saving installations	5	Exam

1	2	3	4
VT 10	Course work on energy and resource saving installations	1	Test
VT 11	Nonlinear problems and identification of electrical and mechatronic complexes	5	Exam
VT 12	Course project on nonlinear problems and identification of electrical and mechatronic complexes	1,5	Test
VT 13	Transport systems of electromechanical complexes	5	Exam
VT 14	Modeling of electrical and mechatronic systems	5	Exam
VT 15	Digital and nonlinear control systems of electrical complexes	4,5	Exam
VT 16	Hydraulics and hydropneumatics drive	4	Exam
VT 17	Pre-diploma practice	6	Test
VT 18	Diploma design	6	defense
SELECTIVE educational components			
General training cycle (Optional subjetcs from University catalogue)			
GO 1	Educational component from 1 GU-Catalog	2	Test
GO 2	Educational component from 2 GU-Catalog	2	Test
Vocational training cycle (Optional subjetcs from Faculty catalogue)			
VO 1	Educational component 1 of the F-Catalog	4	Test
VO 2	Educational component 2 of the F-Catalog	4	Test
VO 3	Educational component 3 of the F-Catalog	4	Test
VO 4	Educational component 4 of the F-Catalog	4	Test
VO 5	Educational component 5 of the F-Catalog	4	Test
VO 6	Educational component 6 of the F-Catalog	4	Test
VO 7	Educational component 7 of the F-Catalog	4	Test
VO 8	Educational component 8 of the F-Catalog	4	Test
VO 9	Educational component 9 of the F-Catalog	4	Test
VO 10	Educational component 10 of the F-Catalog	4	Test
VO 11	Educational component 11 of the F-Catalog	4	Test
VO 12	Educational component 12 of the F-Catalog	4	Test
VO 13	Educational component 13 of the F-Catalog	4	Test
VO 14	Educational component 14 of the F-Catalog	4	Test
The total amount of required components:		180	
The total amount of sample components**:**		60	
The amount of educational components that provide the acquisition **competencies defined by the standard of higher education:**		180	
TOTAL VOLUME OF THE EDUCATIONAL PROGRAM:		**240**	

3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



4. FORM OF EXECUTIVE APPROACHES OF HIGHER EDUCATION GRADUATES

Graduation certification of applicants for higher education under the educational-professional program "Engineering of intelligent electrical and mechatronic complexes" specialty 141 " Electric Power Engineering, Electrotechnics and Electromechanics " is carried out in the form of public defense of the qualification work and ends with the issuance of a standard document**. Bachelor of Electric Power Engineering, Electrotechnics and Electromechanics**. Qualification work is checked for plagiarism and after the defense is placed in the repository of scientific and technical library University for free access.

Graduation certification is open and public.

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

	GT 1	GT 2	GT 3	GT 4	GT 5	GT 6	GT 7	GT 8	GT 9	GT 10	GT 11	GT 12	GT 13	GT 14	GT 15	GT 16	GT 17	GT 18	GT 19	GT 20	GT 21	GT 22	VT 1	VT 2	VT 3	VT 4	VT 5	VT 6	VT 7	VT 8	VT 9	VT 10	VT 11	VT 12	VT 13	VT 14	VT 15	VT 16	VT 17	VT 18
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PC14																									+		+									+	+			
PC15																																	+	+	+					

6. MATRIX OF PROVIDING SOFTWARE LEARNING RESULTS BY RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM

	GT 1	GT 2	GT 3	GT 4	GT 5	GT 6	GT 7	GT 8	GT 9	GT 10	GT 11	GT 12	GT 13	GT 14	GT 15	GT 16	GT 17	GT 18	GT 19	GT 20	GT 21	GT 22	VT 1	VT 2	VT 3	VT 4	VT 5	VT 6	VT 7	VT 8	VT 9	VT 10	VT 11	VT 12	VT 13	VT 14	VT 15	VT 16	VT 17	VT 18
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