

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE**

**NATIONAL TECHNICAL UNIVERSITY  
«KHARKIV POLYTECHNIC INSTITUTE»**

**APPROVED BY**

Rector of NTU "KhPI"

\_\_\_\_\_ Ye.Sokol

« \_\_\_\_ » \_\_\_\_\_ 20\_\_\_\_

**EDUCATIONALLY - PROFESSIONAL PROGRAM  
«ELECTROMECHANICS»**

**The Second (Master) Level**

by specialty **141 «Electric Power Engineering, Electrical Engineering  
and Electromechanics»**

Knowledge field title **14 «Electrical Engineering»**

Qualification: **Master of Electric Power Engineering, Electrical Engineering and  
Electromechanics**

**APPROVED BY**

**Academic Council of NTU "KhPI"**

Chairman of the Scientific Council

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Protocol № \_\_\_\_\_

« \_\_\_\_ » \_\_\_\_\_ 20\_\_\_\_

**Kharkiv 2019**

## INTRODUCTION

**Developed by the working group on specialty 141 "Electric Power Engineering, Electrical Engineering and Electromechanics" on the basis of the draft higher education standard developed by the scientific-methodical subcommittee of NTU "KhPI" and approved by the Academic Council (protocol No. 8 dated November 2, 2018).**

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**APPROVAL PAGE**

educationally - professional program «Electromechanics»

Рівень вищої освіти **The Second (Master) Level**

Knowledge field title **14 Electrical Engineering**

Specialty **141 « Electric Power Engineering, Electrical Engineering and Electromechanics »**

Specializations  
141-06 «Electrical Machines»  
141-07 «Electrical Apparatus»  
141-08 «Electrical Household Appliances»  
141-11 «Electrical Transport»

Qualification **Master of Electric Power Engineering, Electrical Engineering and Electromechanics**

**APPROVED**

Chairman of the support  
group for the specialty

Head \_\_\_\_\_ O.P. Lazurenko  
« \_\_\_\_ » \_\_\_\_\_ 20 \_\_\_\_.

**RECOMMENDED**

Methodical Council of NTU "KhPI"

\_\_\_\_\_ R.P. Mygushchenko  
« \_\_\_\_ » \_\_\_\_\_ 20 \_\_\_\_.

**APPROVED AND PROVIDED**

By order of the Rector of the National Technical University "Kharkiv Polytechnic Institute" of « \_\_\_\_ » \_\_\_\_\_ 20 \_\_\_\_ . No. \_\_\_\_\_

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## INTRODUCTION

**Educational-professional program** is a system of educational components at the appropriate level of higher education within the specialty that defines the requirements for the level of education of persons who can begin education under this program, the list of academic disciplines and the logical sequence of their study, the number of ECTS credits required for this program, as well as the expected learning outcomes (competencies) that a graduate of the relevant higher education level must possess.

**Educational-professional program is used during:**

- inspection of educational activities in the specialty;
- development of a curriculum and programs of academic disciplines;
- formation of working programs of educational disciplines, practices, individual tasks;
- formation of individual student curricula;
- development of means of diagnostics of higher education quality;
- certification of applicants for higher education;
- professional orientation of the applicant and in the specialty;
- external quality control of training specialists;

**Consumers of the educational-professional program are:**

- applicants for higher education;
- scientific and pedagogical workers of higher educational institutions (research institutions);
- applicants of the corresponding level of higher education;
- scientific and pedagogical workers who carry out training of specialists in the speciality “Electric Power Engineering, Electrical Engineering and Electromechanics“;
- attestation commission on specialty “Electric Power Engineering, Electrical Engineering and Electromechanics “;
- admission commission of NTU "KhPI";
- employers for information on the academic and professional profile of graduates;
- competent specialists in recognition of documents on higher education;
- accreditation institutions.

The educational program extends to the Departments involved in the training of specialists of the Master degree in specialty “Electric Power Engineering, Electrical Engineering and Electromechanics“.

## 1. Profile of the educational program «Electromechanics» by specialty 141 «Electric Power Engineering, Electrical Engineering and Electromechanics»

<b>1 – General information</b>	
Full name of higher educational institution and structural unit	National Technical University "Kharkiv Polytechnic Institute" Institute of Education and Science in Power Engineering, Electronics and Electromechanics Departments of: Electrical Machines, Electrical Apparatus, Electrical Transport and Diesel Locomotive Engineering
The degree of Higher education and the name of the qualification in the original language title	Degree of higher education - Master Educational qualification - Master of Electric Power Engineering, Electrical Engineering and Electromechanics Diploma qualification - Electrical Engineer
The official name of the educational program	Educational-professional program of the second (Master's) level of higher education
Type of diploma and volume of educational program	Master's Diploma, unitary, 90 ECTS credits, term of training 1 year 4 month
Availability of accreditation	- Certificate of Accreditation: НД-IV №2158893: - Ministry of Education and Science of Ukraine; - Validity: until July 1, 2026
Cycle / Level	FQ-EHEA – second cycle, EQF LLL – 7 level, NQF Ukraine – 8 level (Master's degree)
Prerequisites	Complete general secondary education or secondary specialized education By results of external testing. The remaining requirements are determined by the rules of admission to the educational and professional program of the bachelor.
Language (s) of teaching	Ukrainian, English, Russian
The validity of the educational program	According to the validity period of the certificate of accreditation
Internet address of the educational program	<a href="http://web.kpi.kharkov.ua/eee/">http://web.kpi.kharkov.ua/eee/</a>
<b>2 – The purpose of the educational program</b>	
<p>The combination of theoretical knowledge, practical skills, skills and competences sufficient for the successful performance of professional duties in specialty 141 "Electric Power Engineering, Electrical Engineering and Electromechanics" and prepare students for further employment in the chosen specialty in the subject area "Electrical Engineering", mastering of the programs of the following levels (Doctor of Philosophy) for researchers.</p> <p>The achievement of the stated goal is based on the principles of continuity and individualization of learning, the fundamental and integral provision of knowledge, practical orientation and awareness of the place of the received competencies, symbiosis of scientific and systemic approaches, etc.</p>	

<b>3 - Characteristics of the educational program</b>	
<b>Subject area (area of knowledge, specialty, specialization)</b>	<p>Knowledge field title: 14 «Electrical engineering»  Specialty title: 141 « Electric Power Engineering, Electrical Engineering and Electromechanics »  Specializations:  Block 06 «Electrical Machines»  Block 07 «Electrical Apparatus»  Block 08 «Electrical Household Appliances»  Block 11 «Electrical Transport»</p>
<b>Orientation of the educational program</b>	<p>The educational and professional master's program has an applied orientation, focuses on topical specialization, within which further professional and scientific careers are possible: електричні машини, електричні апарати, електропобутова техніка, електричний транспорт</p>
<b>The main focus of the educational program and specialization</b>	<p>General, specialized education and training in the field of electric power engineering, electrical engineering and electromechanics with the possibility of acquiring the necessary practical (engineering) and research skills for a professional in the field and scientific careers.  <b>Key words:</b> electrical machines electrical apparatus, electrical household appliances, electrical transport.</p>
<b>Features of the program</b>	<p>The main aspect of the program is the orientation towards professional engineering activities. During the period of study in a magistracy student must take part in a scientific conference and have scientific publications</p>
<b>4 – Eligibility of graduates to employment and further training</b>	
<b>Suitability for work placement</b>	<p>Positions in research centers and companies of electric power engineering, electrical engineering and electromechanical profile, enterprises and institutions of branches of electrical machine engineering, electrical apparatus engineering, electrical household appliances, electrical transport.  Types of economic activity according to DK003: 2010 codes of KP from 2143.1 to 2144.1</p>
<b>Further training</b>	<p>Graduates have the right to continue their education at the third (higher education) education level (FQ-EHEA), EQF-8 level 8, and the 8th level of the NQF Ukraine on a competitive basis, and to continue studying abroad to obtain a doctorate in philosopher's degree.</p>
<b>5 – Teaching and evaluation</b>	
<b>Teaching and training</b>	<p>Lectures, practical and laboratory lessons, computer practical skills; individual lessons, consultations, master's degree work.  The use of mixed learning technologies: information and communication, student-centered, modular, technology research training, collaborative learning technologies, and pro-active education techniques.</p>
<b>Evaluation</b>	<p>Evaluation of students' educational achievements is carried out according to the ECTS system (with grades A, B, C, D, E, F), the national system (with grades “excellent”, “good”, “satisfactory” and “unsatisfactory”), as well as 100 point system of universities with an established system of compliance.</p>
<b>6 - Program competencies</b>	
<b>Integral competence</b>	<p>Ability to solve complex specialized tasks and solve practical problems, including innovative character, during professional activity in the field of electric power engineering, electrical engineering and</p>

	<p>electromechanics, or in the process of training involving the application of theories and methods of electrical engineering and electromechanics and is characterized by complexity and uncertainty of the conditions.</p>
<p><b>General competency (GC)</b></p>	<p><b>GC 1.</b> Ability to think, analyze and synthesize.  <b>GC 2.</b> Ability to search, process and analyze information from different sources.  <b>GC 3.</b> Ability to use information and communication technologies.  <b>GC 4.</b> Ability to apply knowledge in practical situations.  <b>GC 5.</b> Ability to use a foreign language for carrying out scientific and technical activities.  <b>GC 6.</b> Ability to make informed decisions.  <b>GC 7.</b> Ability to learn and master modern knowledge.  <b>GC 8.</b> Ability to detect and assess risks.  <b>GC 9.</b> Ability to produce new ideas, show creativity, ability to think systematically.  <b>GC 10.</b> Ability to work independently and in a team, the ability to communicate with colleagues in the field of research and development.  <b>GC 11.</b> Ability to detect feedback and adjust their actions with their consideration.  <b>GC 12.</b> Ability to assess and maintain the quality of work performed.  <b>GC 13.</b> Ability to demonstrate awareness of intellectual property issues in the field of electronics and telecommunications.</p>
<p><b>Professional competence of the specialty (PC)</b></p>	<p><b>PC 1.</b> Ability to apply the obtained theoretical knowledge, scientific and technical methods and corresponding software for the decision of scientific and technical problems and carry out scientific researches in the field of electroenergy, electrical engineering and electromechanics.  <b>PC 2.</b> Ability to apply existing and develop new methods, techniques, technologies and procedures for solving engineering tasks, including at the design and operation of power engineering, electrical engineering and electromechanics.  <b>PC 3.</b> Ability to apply analytical methods of analysis, mathematical modeling and perform physical, mathematical and computational experiments for the solution of engineering tasks and in conducting research.  <b>PC 4.</b> Ability to apply information and communication technologies and programming skills to solve typical tasks of engineering activities in power engineering, electrical engineering and electromechanics.  <b>PC 5.</b> Ability to understand and take into account social, environmental, ethical, economic and commercial considerations that influence the implementation of technical solutions in power engineering, electrical engineering and electromechanics.  <b>PC 6.</b> Ability to manage projects and critically evaluate their results.  <b>PC 7.</b> Knowledge and understanding of the laws, mechanisms and consequences of equipment failures, the ability to develop and implement measures to improve the reliability, efficiency and safety of designing and operating equipment and facilities of electric power, electrical engineering and electromechanics.  <b>PC 8.</b> Knowledge and understanding of modern technological processes and systems of technological preparation of production, technical characteristics, design features, purpose and rules of operation of electric power, electrical and electromechanical equipment and equipment.</p>

**PC 9.** Ability to use the acquired knowledge and skills for work in the subject field and understand the necessity of observance of safety rules during performance of official duties in power engineering, electrical engineering and electromechanics.

**PC 10.** Ability to demonstrate understanding of normative legal acts, norms, rules and standards in electric power engineering, electrical engineering and electromechanics

**PC 11.** Ability to use the acquired knowledge and skills for carrying out scientific research of the corresponding level.

**PC 12.** Ability to prepare and publish the results of their research in scientific journals.

**PCs 13.** Ability to apply methods of calculation, measurement, diagnostics of noise and vibrations sources in electromechanical devices

**PCs 14.** Ability to understand processes of energy conversion in special electromechanical devices, to carry out calculations of special modes in electromechanical devices

**PCs 15.** Ability to investigate, analyze, apply technological methods in the production of electrical machines

**PCs 16.** Ability to scientifically substantiate the choice of materials, equipment and application of technological measures for the implementation of the latest technologies in electrical machine engineering

**PCs 17.** Ability to understand the nature of ferromagnetism, processes in electrical machines with permanent magnets, to determine the design features of electrical machines with permanent magnets

**PCs 18.** Ability to choose methods, investigate and analyze the thermal and venting processes occurring during the operation of electromechanical energy converters

**PCs 19.** Ability to use the methods of research and testing of electrical apparatus and apply modern measuring equipment for research and testing of electrical apparatus

**PCs 20.** Ability to use skills in programming and development of microprocessor devices in electrical apparatus

**PCs 21.** Ability to develop and calculate the circuits of electrical installations of various purposes, to determine the composition of their equipment and to calculate their operating modes

**PCs 22.** Readiness for reception and mastering of new equipment, preparation of applications for equipment and spare parts, preparation of technical documentation for repair

**PCs 23.** Ability to use modern production technologies, to develop technological documentation for manufacturing, to choose the best methods and materials for the manufacture of parts and components of electrical apparatus

**PCs 24.** Ability to collect and interpret the necessary data and on this basis to propose and defend arguments regarding the characteristics of the electrical equipment of own needs, as well as trends of their development, in particular, with the use of modern information and computer technologies

**PCs 25.** Ability to own the methods of research and testing of electrical household appliances and apply modern measuring equipment for research and testing of electrical household appliances.

**PCs 26.** Ability to design, program, configure and diagnose electronic microprocessor control systems of electrical household appliances

**PCs 27.** Ability to design the main structural elements of electrical household appliances; to select materials and components used in elec-



	<p>trical household appliances</p> <p><b>PCs 28.</b> Ability to analyze, simulate, develop and technically implement automatic control systems for electrical household appliances</p> <p><b>PCs 29.</b> Ability to organize, schedule and carry out testing, certification and accreditation of electrical household appliances</p> <p><b>PCs 30.</b> Ability to investigate, analyze and improve the technological processes of electrical transport</p> <p><b>PCs 31.</b> Ability to detect objects of electrical transport and its power supply systems for improvement of equipment and technologies according to specialization</p> <p><b>PCs 32.</b> Ability to effectively apply modern methods of ensuring the production processability and reliability in operation of microprocessor systems used in electrical transport</p> <p><b>PCs 33.</b> Ability to scientifically substantiate the choice of materials, equipment and measures for the implementation of the latest technologies in electrical transport</p> <p><b>PCs 34.</b> Ability to properly analyze and synthesize at the study of technical systems the objects of electrical transport and its power supply systems</p> <p><b>PCs 35.</b> Ability to use the laws and principles of engineering in specialization, high-level mathematical apparatus for developing, designing, manufacturing, assembling, operating, technical maintenance and utilization of objects, phenomena and processes in the field of electrical transport and its power supply systems</p> <p><b>PCs 36.</b> Ability to choose and apply in practice the methods of research, schedule and carry out the necessary experiments, interpret the results and draw conclusions about the optimality of decisions taken in the field of production, operation and repair of electrical transport objects and its power supply systems</p>
<b>7 - Program learning outcomes</b>	
	<p><b>PLO 1.</b> To recreate processes in electric power, electrotechnical and electromechanical systems during their simulation on a personal computer.</p> <p><b>PLO 2.</b> To analyze processes in electric power, electro-technical and electromechanical equipment and corresponding complexes and systems.</p> <p><b>PLO 3.</b> Find options for increasing the energy efficiency of electric energy, electrotechnical and electromechanical equipment and related complexes and systems.</p> <p><b>PLO 4.</b> Determine the plan of measures for increasing the reliability, safety of operation and continuation of the resource of electric power, electrotechnical and electromechanical equipment and corresponding complexes and systems.</p> <p><b>PLO 5.</b> Develop and implement systemic measures to increase the reliability, efficiency of operation and continuation of the resource of equipment and facilities of electric power industry, electrical engineering and electromechanics.</p> <p><b>PLO 6.</b> To possess methods of mathematical and physical modeling of objects and processes in electric power and electromechanical systems.</p> <p><b>PLO 7.</b> Controlling new versions or new software designed for computer simulation of objects and processes in electric power, electrical and electromechanical systems.</p> <p><b>PLO 8.</b> Estimate the total cost of research and development.</p>

**PLO 9.** Protecting your intellectual property rights and respecting similar rights of others, applying a system of legal protection and intellectual property rights.

**PLO 10.** Find information on resources to find educational programs, grants and scholarships of the European Union and Member States of the European Union.

**PLO 11.** To choose the direction of scientific research and take part in it taking into account the current problems in the field of electrical energy, electrical engineering and electromechanics.

**PLO 12.** Participate in international scientific conferences and seminars devoted to modern problems in the field of electromechanics, electrical engineering and electromechanics.

**PLO 13.** To solve professional tasks in design, installation and operation of electric, electrical, electromechanical complexes and systems.

**PLO 14.** To control new methods of synthesis of electric power, electrotechnical and electromechanical installations and systems with given parameters

**PLO 15.** Combine the methods of empirical and theoretical research to find ways to reduce the loss of electric energy in its production, transportation, distribution and use.

**PLO 16.** Ability to apply pedagogical and psychological techniques in professional and managerial activity.

**PLOs 17.** Be able to determine sources of noise and vibration of electrical machines, to calculate, measure and eliminate the vibrations of electrical machines, to know the latest achievements of the theory of noise and vibration of electrical machines

**PLOs 18.** Be able to substantiate the choice of the design of special electrical machines, to calculate, analyze and investigate the special modes of operation of electrical machines

**PLOs 19.** Be able to choose methods and equipment for the implementation of technological processes used in the production of electrical machines

**PLOs 20.** Be able to evaluate the parameters and physical and technical properties of materials used in the production of electrical machines

**PLOs 21.** Be able to analyze, calculate, evaluate the design and characteristics of electrical machines with permanent magnets

**PLOs 22.** To study, to calculate and analyze the thermal state of electrical machines of various design performances, to carry out the ventilation calculations of electrical machines

**PLOs 23.** To know the basic types of experiments in the study of electrical apparatus; modern equipment for research and testing of electrical apparatus. Be able to apply modern measuring equipment for conducting researches and tests of electrical apparatus; to prepare documentation on experiments carried out

**PLOs 24.** To know the principles of building microprocessor devices in electrical apparatus, and use the skills of programming and development of microprocessor devices

**PLOs 25.** To know the principles of structural and functional organization of groups of low, medium and high voltage electrical apparatus, requirements to them, operating conditions, principles of operation and characteristics.

**PLOs 26.** To know the basic types of reception and mastering of new equipment, preparation of applications for equipment and spare parts,

preparation of technical documentation for repair

**POs 27.** Solving professional tasks in the design, installation and operation of electrical power engineering, electrical engineering, electromechanical complexes and systems

**POs 28.** Be able to collect and interpret the necessary data and determine the current state and trends of the development of indicators and characteristics of electrical equipment for own needs, in particular, with the use of modern information and computer technologies

**POs 29.** To know the main types of experiments in the study of electrical household appliances; modern equipment for research and testing of electrical household appliances. Be able to apply modern measuring equipment for research and testing; to prepare documentation on experiments carried out

**POs 30.** To know electronic and microprocessor components of electrical household appliances, their features and capabilities; Be able to use applied software packages for designing and modeling electronic and microprocessor devices in electrical household appliances

**POs 31.** To know the basic regulatory documents on the design of electrical household appliances; basic methods of calculation and design of electrical household appliances. Be able to calculate the basic design elements of electrical household appliances; to select materials and components used in electrical household appliances

**POs 32.** To know the purpose, functions, principles of construction, features of design and technical implementation, trends in the development of automatic control systems for electrical household appliances; the basic requirements and international terminology concerning the systems of automatic control of electrical household appliances. Be able to analyze, model, develop and technically implement automatic control systems for electrical household appliances

**POs 33.** To know the basic information about tests of electrical household appliances, types of tests (electrical, thermal, mechanical, climatic), basic methods of research and testing; the structure of certification bodies of Ukraine, the procedure for certification and accreditation of electrical household appliances. Be able to compile test methods for electrical household appliances, carry out mathematical processing of measurement data using mathematical statistics methods.

**POs 34.** Capability and ability to investigate, analyze and improve the technological processes of electrical transport

**POs 35.** Ability to detect objects of electrical transport and its power supply systems for improvement of equipment and technologies according to specialization

**POs 36.** Capability and ability to effectively apply modern methods of ensuring the production processability and reliability in operation of microprocessor systems used in electrical transport

**POs 37.** Capability and ability to scientifically substantiate the choice of materials, equipment and measures for the implementation of the latest technologies in electrical transport

**POs 38.** Ability to competently carry out analysis and synthesis when studying technical systems of objects of electrical transport and its power supply systems

**POs 39.** Capability and ability to use the laws and principles of engineering in specialization, high-level mathematical apparatus for the design, construction, production, installation, operation, maintenance and disposal of objects, phenomena and processes in the field of electrical

	<p>transport and its power supply systems</p> <p><b>PLOs 40.</b> Ability to choose and apply in practice the methods of research, planning and conduct the necessary experiments, interpret the results and draw conclusions about the optimality of decisions taken in the field of production, operation and repair of electrical transport objects and their power supply systems</p>
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<b>8 - Resource support for the implementation of the program</b>	
<b>Personnel support</b>	All the scientific and pedagogical staff providing the educational-professional program in accordance with the qualification correspond to the profile and the direction of the disciplines being taught, have the necessary experience of teaching work and experience of practical work. In the process of organization of the educational process, professionals are attracted from the research / management / innovation / creative work and / or work in the specialty. 100% of teachers providing English language education are certified according to the European language guidance guidelines (level B2) or qualifications relating to the use of a foreign language.
<b>Material and technical support</b>	Material and technical support allows you to fully ensure the educational process throughout the training cycle for the educational program. The condition of the premises is certified by sanitary and technical passports, which correspond to the existing normative acts.
<b>Information and educational and methodological support</b>	Information support is provided by textbooks, educational aids, etc. and electronic resources (the library is provided with at least five titles of domestic and foreign professional periodical professional publications of the corresponding or related profile, including in electronic form). Methodical support is realized by the obligatory accompaniment of educational activity with the corresponding educational and methodological materials for each educational discipline of the educational plan.
<b>9 - Academic mobility</b>	
<b>National Credit Mobility</b>	On the basis of bilateral agreements between the National Technical University "Kharkiv Polytechnic Institute" and higher educational institutions of Ukraine
<b>International Credit Mobility</b>	On the basis of bilateral agreements between the National Technical University "KhPI" and the educational institutions of the partner countries.
<b>Teaching foreign applicants for higher education</b>	<p>According to the license of NTU "KhPI" foreigners and / or stateless persons can study for the educational program. Curricula for this contingent have expanded language training in the Ukrainian language.</p> <p>In order to create conditions for international academic mobility, a higher education institution has the right to decide on the presentation of one / several / all disciplines in English and / or other foreign languages, while ensuring the knowledge of higher education students of the relevant discipline in the state language.</p> <p>For the teaching of academic disciplines in foreign (English), separate groups are formed for foreign citizens, stateless persons who wish to obtain higher education for the funds of individuals or legal entities, or develop individual programs. At the same time, programs of higher education institutions provide for the study of such persons of the state language as a separate educational discipline.</p>

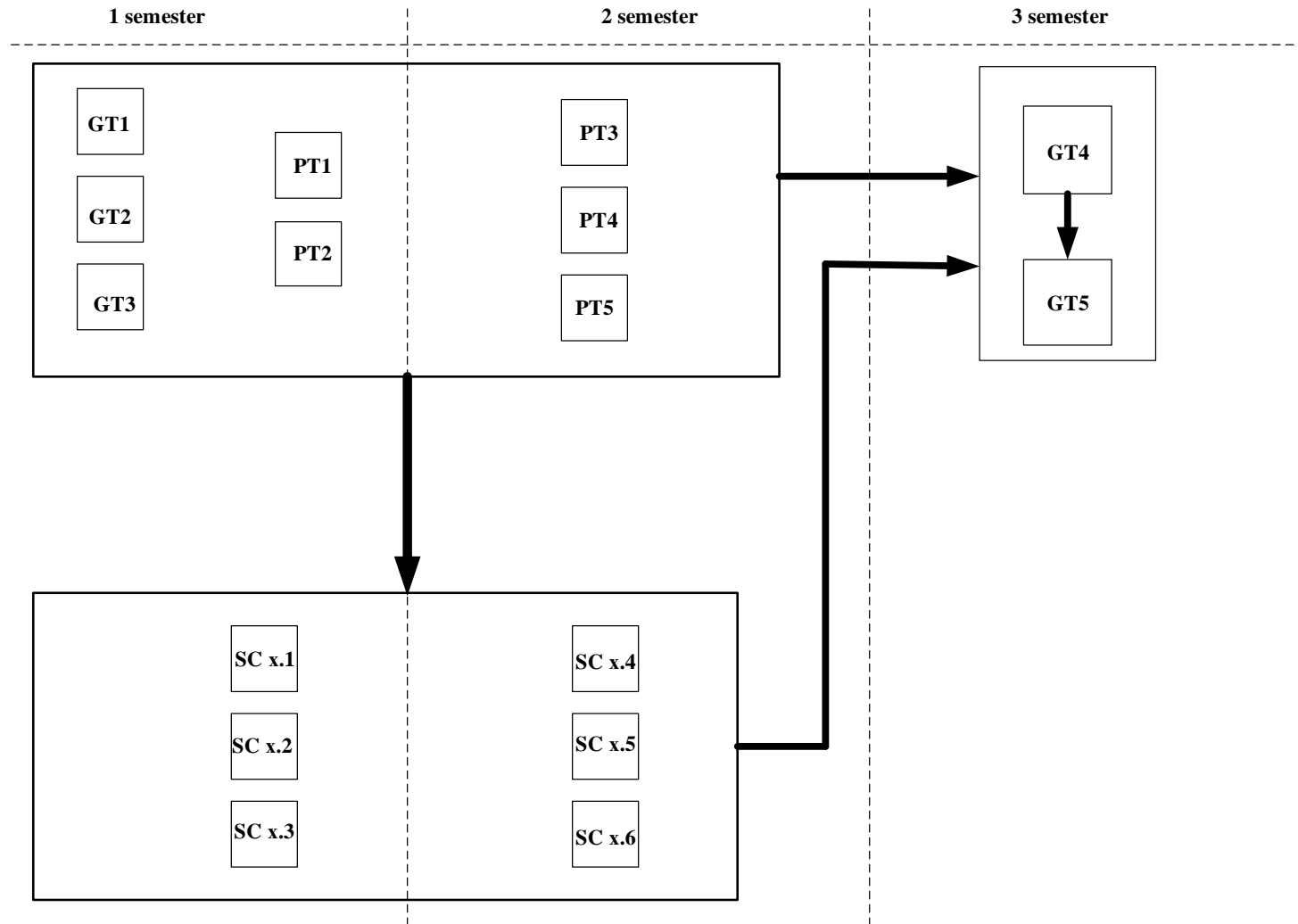
## 2. List of components of educational-professional program "Electromechanics" and their logical consistency

### 2.1. List of components of educational-professional program

Key	Components of the educational program (educational disciplines, course projects (works), practical work, qualification work)	Amount of credits	Form final control
1	2	3	4
<b>Compulsory components of educational-professional program</b>			
GT 1	Organization of production and marketing	3	Test
GT 2	Safety of work and professional activity	3	Test
GT 3	Intellectual Property	3	Test
PT 1	Basics of the scientific research	3.0	Test
PT 2	Simulation of electrical and electromechanical systems and devices	5.0	Exam
PT 3	Technologies, problems and prospects of the industry	4.0	Exam
PT 4	Reliability and diagnostics	5.0	Exam
PT 5	Design of electric and electromechanical systems and devices	6.0	Exam
GT 4	Pre-diploma practice	11	Test
GT 5	Attestation (diploma project)	19	Test
<b>Total volume of required components:</b>		<b>62</b>	
<b>Selective components of educational-professional program</b>			
<b>Discipline block 01 «Electrical Machines»</b>			
SC 1.1.	Noise and vibration of electrical machines	4.0	Exam
SC 1.2.	Special designs and modes of electrical machines	5.0	Exam
SC 1.3.	Technology of production of electrical machines	4.0	Exam
SC 1.4.	Design and technology of production of electrical micromachines	6.0	Exam
SC 1.5.	Electrical machines with permanent magnets	4.0	Test
SC 1.6.	Research of thermal and ventilation processes in electrical machines	5.0	Exam
	<b>Total:</b>	<b>28</b>	
<b>Discipline block 02 «Electrical Apparatus»</b>			
SC 2.1.	Methods of research and testing of electrical apparatus	4.0	Exam
SC 2.2.	Microprocessor devices in electromechanical systems	5.0	Exam
SC 2.3.	Complete devices of distribution networks	4.0	Exam
SC 2.4.	Servicing of electromechanical devices	4.0	Exam
SC 2.5.	Technology of production of electromechanical devices	6.0	Test
SC 2.6.	Newest methods of information search and processing	5.0	Test
	<b>Total:</b>	<b>28</b>	
<b>Discipline block 03 «Electrical Household Appliances»</b>			
SC 3.1.	Methods of research and testing of electrical household appliances	4.0	Exam
SC 3.2.	Microprocessor devices in electromechanical systems	5.0	Exam
SC 3.3.	Design of electrical household appliances	4.0	Exam
SC 3.4.	Automatic control systems for electrical household appliances	4.0	Exam
SC 3.5.	Technology of production of electromechanical devices	6.0	Test
SC 3.6.	Newest methods of information search and processing	5.0	Test

	<b>Total:</b>	<b>28</b>	
<b>Discipline block 04 «Electrical transport»</b>			
SC 4.1.	Electric drives of electric rolling stock	4.0	Exam
SC 4.2.	Electrical equipment of electric rolling stock and traction networks	5.0	Exam
SC 4.3.	Microprocessor devices	4.0	Exam
SC 4.4.	Modern information technology on electrical transport	4.0	Exam
SC 4.5.	Systems of structural and technological design of electrical transport	4,0	Test
SC 4.6.	Accreditation, testing and certification of electrical transport vehicles	4.0	Test
SC 4.7	Electric power supply modes of railways. Special course	3.0	Exam
	<b>Total:</b>	<b>28</b>	
<b>Total volume of components</b>		<b>28</b>	
<b>Total volume of educational-professional program</b>		<b>90</b>	

## 2.2. Structural-logical scheme of the educational program



### 2.3 Distribution of content of the educational program by groups of components and training cycles

No.	Training cycle	Amount of educational load of the applicant of higher education (ECTS credits / %)		
		Compulsory components of an educational-professional program	Selective components of the educational-professional program	Total for the whole period of study
1	General training cycle	39 / 43	-	<b>39 / 43</b>
2	Professional training cycle	23 / 26	-	<b>23 / 26</b>
3	Disciplines of free choice	-	28 / 31	<b>28 / 31</b>
Total for the whole period of study		<b>62 / 69</b>	<b>28 / 31</b>	<b>90 / 100</b>



### **3. Form of certification of applicants for higher education**

The certification of the graduates of the educational program of **specialty 141 " Electric Power Engineering, Electrical Engineering and Electromechanics "** is carried out in the form of defense of the qualification master's work and ends with the issuing of the document of the established model on awarding the master's degree with the qualification: **"Master of Electric Power Engineering, Electrical Engineering and Electromechanics"** related specialties. The certification is carried out openly and publicly.

The qualification work should represent the solution of a complex special-purpose task or practical problem in the field of electric power engineering, electrical engineering and electromechanics, which involves research and / or innovation and is characterized by uncertainty of conditions and requirements

The qualification work should be verified for plagiarism using software and hardware, and should be placed in the repository of a higher educational institution or a relevant structural unit.

#### 4. Matrix of compliance of program competencies to the components of the educational program

	GT1	GT2	GT3	PT1	PT2	PT3	PT4	PT5	GT6	GT7	
GC 1						•				•	
GC 2	•	•				•			•	•	
GC 3	•	•			•		•			•	
GC 4	•	•					•	•	•	•	
GC 5										•	
GC 6										•	
GC 7				•	•	•			•	•	
GC 8	•	•					•			•	
GC 9				•		•				•	
GC 10				•				•		•	
GC 11				•						•	
GC 12										•	
GC 13			•	•						•	
PC 1						•	•		•	•	
PC 2				•			•	•		•	
PC 3					•				•	•	
PC 4					•	•	•			•	
PC 5	•					•		•		•	
PC 6				•	•					•	

	<b>GT1</b>	<b>GT2</b>	<b>GT3</b>	<b>PT1</b>	<b>PT2</b>	<b>PT3</b>	<b>PT4</b>	<b>PT5</b>	<b>GT6</b>	<b>GT7</b>	
<b>PC 7</b>		•				•	•	•		•	
<b>PC 8</b>	•					•				•	
<b>PC 9</b>				•				•		•	
<b>PC 10</b>		•				•				•	
<b>PC 11</b>										•	
<b>PC 12</b>				•						•	

	SC 1.1	SC 1.2	SC 1.3	SC 1.4	SC 1.5	SC 1.6	SC 2.1	SC 2.2	SC 2.3	SC 2.4	SC 2.5	SC 2.6	SC 3.1	SC 3.2	SC 3.3	SC 3.4	SC 3.5	SC 3.6	SC 4.1	SC 4.2	SC 4.3	SC 4.4	SC 4.5	SC 4.6	SC 4.7				
GC 1	•	•	•	•	•	•													•	•	•	•							
GC 2	•	•	•	•	•	•													•	•	•	•							
GC 3	•	•	•	•	•	•																							
GC 4	•	•	•	•	•	•																	•	•					
GC 5	•	•	•	•	•	•													•										
GC 6	•	•	•	•	•	•																							
GC 7	•	•	•	•	•	•													•	•	•				•				
GC 8	•	•	•	•	•	•																							
GC 9	•	•	•	•	•	•																							
GC 10	•	•	•	•	•	•																•							
GC 11	•	•	•	•	•	•																			•				
GC 12	•	•	•	•	•	•																							
GC 13	•	•	•	•	•	•																							
PC 1	•			•	•	•																							
PC 2	•					•																	•		•				
PC 3		•		•	•																	•			•				
PC 4	•					•																			•	•			
PC 5			•	•															•	•	•			•		•			
PC 6	•	•		•	•	•														•		•			•				



	SC 1.1	SC 1.2	SC 1.3	SC 1.4	SC 1.5	SC 1.6	SC 2.1	SC 2.2	SC 2.3	SC 2.4	SC 2.5	SC 2.6	SC 3.1	SC 3.2	SC 3.3	SC 3.4	SC 3.5	SC 3.6	SC 4.1	SC 4.2	SC 4.3	SC 4.4	SC 4.5	SC 4.6	SC 4.7			
PCs 28																•												
PCs 29																	•											
PCs 30																							•		•			
PCs 31																			•	•								
PCs 32																					•							
PCs 33																								•				
PCs 34																			•	•					•			
PCs 35																						•	•					
PCs 36																							•		•			

### 5. The Matrix of Providing Program Learning Outcomes (PLO) by the relevant components of the curriculum

	GT1	GT2	GT3	PT1	PT2	PT3	PT4	PT5	GT6	GT7	SS1	SS2	
PLO 1					•	•				•			
PLO 2					•	•		•	•	•			
PLO 3							•			•			
PLO 4		•					•	•	•	•			
PLO 5							•			•			
PLO 6					•			•		•			
PLO 7					•	•		•	•	•			
PLO 8	•									•			
PLO 9			•	•						•		•	
PLO 10										•			
PLO 11				•						•			
PLO 12				•						•			
PLO 13		•							•	•			
PLO 14					•	•				•			
PLO 15				•						•			
PLO 16										•	•		

	SC 1.1	SC 1.2	SC 1.3	SC 1.4	SC 1.5	SC 1.6	SC 2.1	SC 2.2	SC 2.3	SC 2.4	SC 2.5	SC 2.6	SC 3.1	SC 3.2	SC 3.3	SC 3.4	SC 3.5	SC 3.6	SC 4.1	SC 4.2	SC 4.3	SC 4.4	SC 4.5	SC 4.6	SC 4.7			
PLO 1	•	•		•	•														•	•	•	•	•	•	•			
PLO 2			•	•															•	•	•	•		•	•			
PLO 3																												
PLO 4	•	•			•	•																			•			
PLO 5	•	•	•	•	•	•																						
PLO 6																						•	•					
PLO 7																												
PLO 8																												
PLO 9																												
PLO 10																												
PLO 11	•	•	•	•	•	•																						
PLO 12																												
PLO 13	•	•	•	•	•	•																	•					
PLO 14																												
PLO 15																												
PLO 16																												
PLOs 17	•																											
PLOs 18		•																										
PLOs 19			•	•																								
PLOs 20			•	•																						•		



	SC 1.1	SC 1.2	SC 1.3	SC 1.4	SC 1.5	SC 1.6	SC 2.1	SC 2.2	SC 2.3	SC 2.4	SC 2.5	SC 2.6	SC 3.1	SC 3.2	SC 3.3	SC 3.4	SC 3.5	SC 3.6	SC 4.1	SC 4.2	SC 4.3	SC 4.4	SC 4.5	SC 4.6	SC 4.7			
PLOs 21					•																							
PLOs 22						•																						
PLOs 23							•																					
PLOs 24								•																				
PLOs 25									•																			
PLOs 26										•																		
PLOs 27											•																	
PLOs 28												•						•										
PLOs 29													•															
PLOs 30														•														
PLOs 31															•													
PLOs 32																•												
PLOs 33																	•											
PLOs 34																							•		•			
PLOs 35																			•	•								
PLOs 36																					•							
PLOs 37																								•				
PLOs 38																			•	•					•			
PLOs 39																						•	•					
PLOs 40																								•				