MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
"Igor Sikorsky KYIV POLYTECHNIC INSTITUTE "

APPROVED
Academic Council of Igor Sikorsky KPI
(protocol № ___ from "___" _____ 20___)
Head of the Academic Council
_____ Mykhailo ILCHENKO

ELECTROMECHANICAL AUTOMATION SYSTEMS, ELECTRICAL DRIVE AND ELECTROMOBILITY

EDUCATIONAL AND PROFESSIONAL PROGRAM

second (master's) degree of the higher education

specialty	**141 - "Electric power engineering, electrotechnics and electromechanics"**
field of knowledge	**14 - "Electrical Engineering"**
educational qualification	**Master's degree in electric power engineering, electrotechnics and electromechanics**

Enacted by the decree of the
Igor Sikorsky KPI Rector
order № _____ of "___" _____ 20___

Kyiv - 2021

PREAMBLE

DEVELOPED BY THE PROJECT GROUP:

Project team leader:

Burian Serhii Oleksandrovych, associate Professor, candidate of technical sciences

Project team members:

Kovbasa Serhiy Mykolayovych, associate professor, doctor of technical sciences

Tolochko Olga Ivanivna, professor, doctor of technical sciences

Korol Sergei Viktorovich, associate professor, candidate of technical sciences

The Department of Automation of Electromechanical Systems and Electrical Drives is responsible for the training of higher education students according to the educational program.

AGREED:

Scientific and methodical commission of the Igor Sikorsky KPI of the specialty "Electric power engineering, electrotechnics and electromechanics"

Head of the commission 141_____ Alexander YANDULSKY

(meeting protocol №__ of ___ _____ 2021)

Methodical council of the Igor Sikorsky KPI

Head of the Council _____ Yuriy YAKYMENKO

(meeting protocol №__of ___ _____ 2021)

INCLUDED:

Comments and suggestions of stakeholders on the results of the discussion on updating the educational components:

- *scientific and pedagogical staff of the Department of Automation of Electromechanical Systems and Electrical Drives (*meeting protocol *№17 of February 10, 2021);*

- *applicants for higher education who study under the educational program "Electromechanical automation systems, electrical drive and electromobility";*

- *review by Ivan Andriyovych Shapoval, Deputy Director for Research at the Institute of Electrodynamics of the National Academy of Sciences of Ukraine, Senior Researcher, Doctor of Technical Sciences.*

CONTENT

1. PROFILE OF THE EDUCATIONAL PROGRAM

in specialty 141 - "Electric power, electrical engineering and electromechanics"

1 - General information	
Full name of ZVO and institute / faculty	National Technical University of Ukraine, Kyiv Polytechnic Institute named after IGTr Sikorsky, Faculty of Electrical Engineering and Automation
Degree of higher education and title of qualification in the original language	Degree - Master Qualification - Master of Electric Power Engineering, Electrotechnics and Electromechanics
The official name of the OP	Electromechanical automation systems, electric drive and electromobility
Type of diploma and scope of OP	Master's degree, single, 90 credits, term of study 1 year, 4 months
Availability of accreditation	ND certificate № 1192630 (070932) dated 25.09.2017, issued by the Ministry of Education and Science of Ukraine, valid until 01.07.2024.
Cycle / level of VO	NRC of Ukraine - level 7, FQ-EHEA - second cycle, EQF-LLL - level 7
Prerequisites	Having a bachelor's degree
Language (s) of instruction	Ukrainian
Validity of the OP	Until the next accreditation
Internet address of the permanent placement of the educational program	https://fea.kpi.ua https://osvita.kpi.ua
2 - The purpose of the educational program	
Training of a highly qualified specialist capable of solving complex problems and problems in the power, electrical and electromechanical industries and to carry out professional activities, which involves the application of theories and principles electromobility, operation of electromechanical automation systems, electric drives and is able to work in the conditions of sustainable innovative scientific and technical development of society also in the conditions of labor market transformation through interaction with employers and other stakeholders.	
3 - Characteristics of the educational program	
Subject area	Field of knowledge: 14 - "Electrical Engineering" Specialty: 141 - "Electric power, electrical engineering and electromechanics" *Objects of study and activity:*- scientific institutions, establishments and organizations in the field of electric power, electrical engineering and electromechanics, enterprises of the electric power complex, electrotechnical and electromechanical companies; processes of production, transmission, distribution and consumption of electric energy at power plants, in electric networks and systems; processes of conversion of electric energy in electromechanical systems; safety analysis, increase of reliability and increase of service life of electric power, electrotechnical and electromechanical equipment. *Learning purpose:* training of specialists capable of designing, designing, operating, ensuring a safety culture,

	performing installation, commissioning and repair, creating new equipment and implementing the latest technologies, conducting research and teaching. *Theoretical content of the subject area:* fundamental knowledge of the theory of electrical engineering, modeling and optimization of electric power, electrotechnical and electromechanical systems and complexes, their use for innovations and researches of operating modes of power stations, networks and systems, electric machines and electric drives. *Methods, techniques and technologies:* methods and means of research of processes in the equipment in electric power and electromechanical systems and complexes, the automated designing, designing and production. *Tools and equipment:* means, devices, systems, technologies of design, operation, control, monitoring.
Orientation OP	Educational and professional
The main focus of the OP	The program is based on well-known scientific principles taking into account the current state of development of the energy sector, focuses on innovation and current areas in which further professional and scientific career is possible: development, research and implementation of electromechanical automatic control systems for various industries, transport (including electric), agriculture and other areas of activity based on intelligent computer technology using modern microcontroller systems. Keywords: electromechanics, electromechanical systems, electric drive, electric mobility, automation, control.
Features of OP	General higher education in the field of electrical engineering, electrical engineering and electromechanics, which is a field of technology that includes a set of tools, methods and techniques of human activity designed to use electricity, control its flows and convert other energy into electricity, including electromechanical automation systems and electric drives , including electromechanical, electronic, electrotechnical, mechanical, mechatronic and information converters and devices designed to convert electrical energy into mechanical (and vice versa) to optimize the operation of machines and mechanisms, technological processes in industry, utilities and agriculture, transport, energy , household and medical appliances, as well as their control, automation, control and diagnostic systems. The possibility of training foreign students at the Center for International Education KPI. IGTr Sikorsky. Ability to teach individual educational components in English. Carrying out of practice of students on manufactures of branch.
4 - Suitability of graduates for employment and further study	
Suitability for employment	Graduates are able to hold positions whose qualification requirements include a master's degree in electrical

	engineering, electrical engineering and electromechanics. Graduates can be employed in positions (according to the current Classifier of Professions of Ukraine DK 003: 2010): 2143.1. Junior researcher (electrical engineering) 2143.1. Researcher (electrical engineering) 2143.1. Researcher-consultant (electrical engineering) 2143.2 Engineer for operation of emergency automation 2143.2 Electrification engineer of an agricultural enterprise 2143.2 Relay protection and electrical automation engineer 2143.2 Engineer for repair and adjustment of electric power equipment of a nuclear power plant 2143.2 Technical Audit Engineer 2143.2 Power Engineer 2143.2 Design engineer (electrical engineering) 2143.2 Professional in energy management 2149.2 Research Engineer
Further training	Continuation of education at the third (educational and scientific) level of higher education and / or acquisition of additional qualifications in the system of adult education.
5 - Teaching and assessment	
Teaching and learning	Lectures, practical and seminar classes, computer workshops and laboratory works; course projects and works; technology of blended learning, practice; execution of a master's dissertation
Evaluation	Rating system, assessment, oral and written exams, testing
6 - Program competencies	
Integral competence	Ability to solve complex problems and problems in power engineering, electrical engineering and electromechanics or in the learning process, which involves research and / or innovation and is characterized by uncertainty of conditions and requirements.
General Competences (GC)	GC1. Ability to search, process and analyze information from various sources. GC2. Ability to use information and communication technologies. GC3. Ability to apply knowledge in practical situations. GC4. Ability to use a foreign language to carry out scientific and technical activities. GC5. Ability to make informed decisions. GC6. Ability to learn and master modern knowledge. GC7. Ability to identify and assess risks. GC8. Ability to work independently and in a team. GC9. Ability to detect feedback and adjust their actions to suit them. GC10. Ability to communicate with representatives of other professional groups of different levels.
Professional competencies (PC)	PC1. Ability to apply existing and develop new methods, techniques, technologies and procedures to solve

	engineering problems of power engineering, electrical engineering and electromechanics. PC2. Ability to develop and implement measures to improve the reliability, efficiency and safety in the design and operation of equipment and facilities of electricity, electrical engineering and electromechanics. PC3. Ability to analyze technical and economic indicators and examination of design decisions in the field of power engineering, electrical engineering and electromechanics. PC4. Ability to demonstrate knowledge and understanding of mathematical principles and methods required for use in power engineering, electrical engineering and electromechanics. PC5. Ability to understand and take into account social, environmental, ethical, economic and commercial considerations that affect the implementation of technical solutions in power engineering, electrical engineering and electromechanics. PC6. Ability to manage projects and evaluate their results. PC7. Ability to develop plans and projects to ensure the achievement of a specific GTal, taking into account all aspects of the problem to be solved, including the production, operation, maintenance and disposal of equipment of electric power, electrical and electromechanical complexes. PC8. Ability to demonstrate awareness and ability to use regulations, norms, rules and standards in power engineering, electrical engineering and electromechanics. PC9. Ability to use software for computer modeling, computer-aided design, automated production and automated development or design of elements of electrical, electrical and electromechanical systems. PC10. Ability to demonstrate awareness of intellectual property and contracts in power engineering, electrical engineering and electromechanics. PC11. Ability to design robust and adaptive control alGTrithms for electromechanical automation systems and electric drives, to develop optimal and intelligent control laws using identification and observation methods. PC12.Ability to solve problems of automation of technical systems using integrated technologies, network interfaces and computer-aided design systems. PC13. Ability to develop electromechanical vehicle automation systems using the latest environmentally friendly technologies. PC14. Ability to apply the basic tools of innovation management, to form a comprehensive understanding of the problems of innovation management of the enterprise. PC15. Ability to use software for computer modeling, automated design, automated production and automated

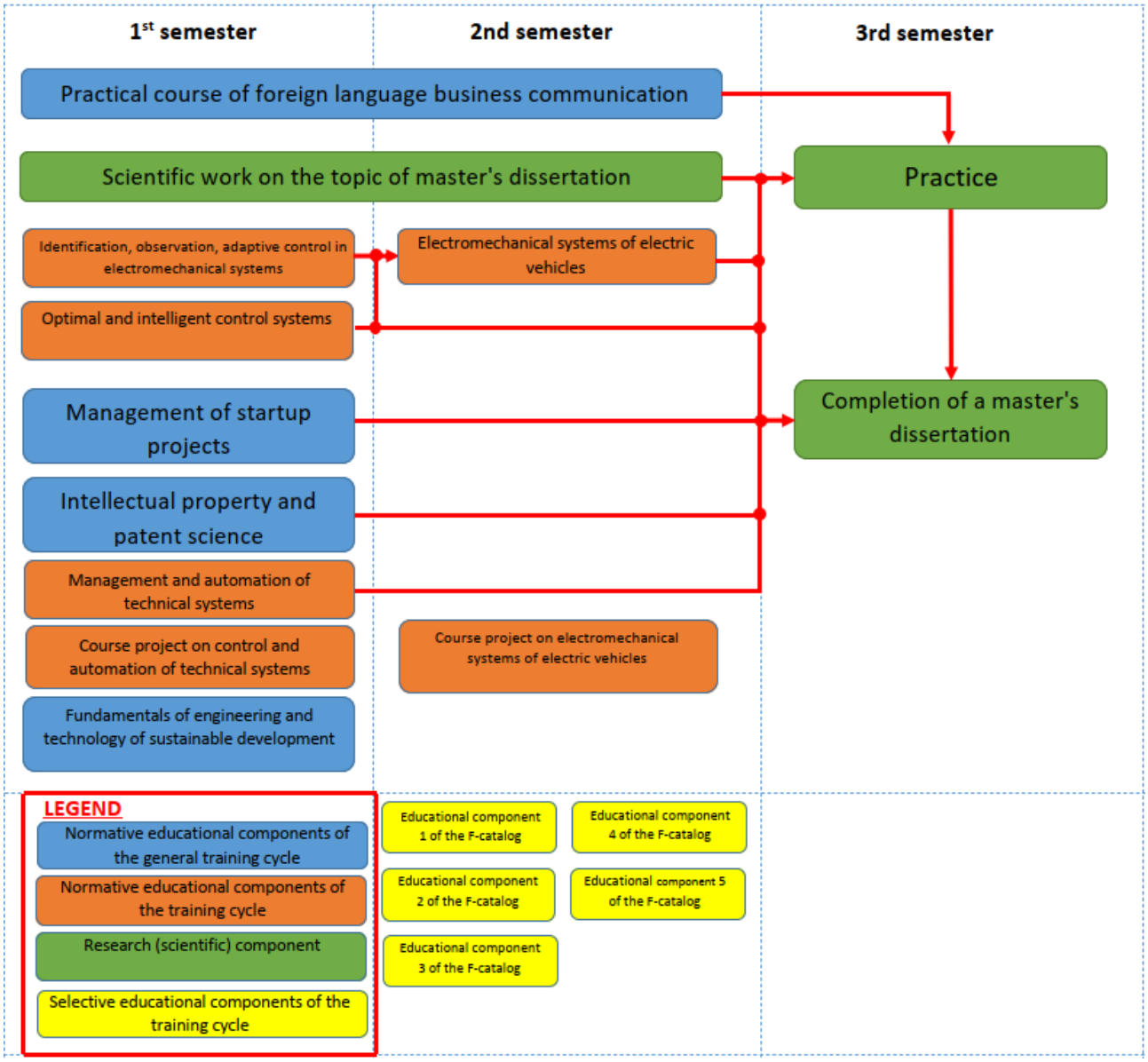
	development or design of elements of electrical, electrical and electromechanical systems PC16. Ability to develop electromechanical vehicle automation systems using the latest environmentally friendly technologies. PC17. Ability to perform research and development work involving the development of new and modernization of existing electromechanical automation systems and electric drives.
7 - Program learning outcomes	
LO01. To reproduce processes in electric power, electrotechnical and electromechanical systems at their computer modeling. LO02. Outline a plan of measures to improve the reliability, operational safety and life of electrical, electrical and electromechanical equipment and related complexes and systems. LO03. Analyze the processes in electrical, electrical and electromechanical equipment and related complexes and systems. LO04. Reconstruct existing electrical networks, stations and substations, electrical and electromechanical complexes and systems in order to increase their reliability, operational efficiency and resource life. LO05. Have methods of mathematical and physical modeling of objects and processes in electrical, electrical and electromechanical systems. PH06. Search for sources of resource support for additional training, research and innovation. PH07. Plan and implement research and innovative projects in the field of power engineering, electrical engineering and electromechanics. PH08. Take into account the legal and economic aspects of research and innovation. PH09. Adhere to the principles and directions of the strategy of development of energy security of Ukraine. LO10. To substantiate the choice of direction and methods of scientific research taking into account modern problems in the field of electric power, electrical engineering and electromechanics. LO11. Fluently communicate orally and in writing in state and foreign languages on modern scientific and technical problems of power engineering, electrical engineering and electromechanics. LO12. Demonstrate an understanding of regulations, norms, rules and standards in the field of power engineering, electrical engineering and electromechanics. LO13. Identify the main factors and technical problems that may hinder the introduction of modern control methods for power, electrical and electromechanical systems. LO14. Master new versions or new software designed for computer modeling of objects and processes in electrical, electrical and electromechanical systems. LO15.To synthesize alGTrithms of robust and adaptive, vector control, tracking and program control of movement. LO16.Design fuzzy regulators, neural networks, genetic alGTrithms, estimators of technological coordinates and parameters for electromechanical control systems of automatic and electric drives. LO17. Design automation systems using modern software, advanced network technologies and smart panels. LO18. Develop intelligent automatic control systems, new control alGTrithms for dynamic systems, perform digital signal processing in electromechanical systems. LO19. Apply energy-efficient control methods in the development of new electromechanical automation systems and electric drives, electric vehicles.	
8 - Resource support for program implementation	
Staffing	In accordance with the personnel requirements for ensuring the implementation of educational activities for

	the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine №347 dated 10.05.2018.
Logistics	In accordance with the technological requirements for material and technical support of educational activities of the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine №347 dated 10.05.2018. Use of equipment for lectures in the format of presentations, network technologies, in particular on the Sikorsky distance learning platform.
Information and educational and methodical support	In accordance with the technological requirements for educational and methodological and informational support of educational activities of the relevant level of HE (Annex 5 to the Licensing Conditions), approved by the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 as amended in accordance with the Cabinet of Ministers of Ukraine №347 from 10.05.2018 Use of the Scientific and Technical Library of KPI named after IGTr Sikorsky.
9 - Academic mobility	
National credit mobility	Possibility of concluding agreements on academic mobility, double graduation, etc.
International credit mobility	It is possible to conclude agreements on international academic mobility, on double graduation, on long-term international projects, which provide for the included education of students, etc. International projects: **Erasmus + project (KA1)** with West Pomeranian University of Technology in Szczecin, Poland **DAAD project** with the Technical University of Hesse - University of Applied Sciences, Hesse, Germany (Technische Hochschule Mittelhessen - University of Applied Sciences) **Erasmus + project (KA1)** with the University of Lorraine, Minnes Nancy High School, Nancy, France (Universite de Lorraine Ecole Nationale Superieur des Mines Nancy, ville Nancy, France) **Erasmus + project (KA1)**with the University of Le Mans, city of Le Mans, France (Université du Maine, ville Le Mans, France) **Erasmus + project (KA1)** with the University of Applied Sciences in Giessen, Germany (Technische Hochschule Mittelhessen)
Training of foreign applicants VO	Teaching in Ukrainian

2. LIST OF COMPONENTS OF THE EDUCATIONAL-PROFESSIONAL PROGRAM

Code n / a	Components of the educational program (academic disciplines, term papers, term projects, practices, qualification work)	Number of credits	Form of final control
1	2	3	4
Mandatory (regulatory) components of OP			
General training cycle			
GT 1	Intellectual property and patent science	3	Test
GT 2	Fundamentals of engineering and technology of sustainable development	2	Test
GT 3	Practical course of foreign language business communication	3	Test
GT 4	Management of startup projects	3	Test
Cycle of professional training			
PT 1	Identification, observation, adaptive control in electromechanical systems	5	Examination
PT 2	Optimal and intelligent control systems	6	Examination
PT 3	Management and automation of technical systems	6	Examination
PT4	Electromechanical systems of electric vehicles	6	Test
PT 5	Course project on control and automation of technical systems	1.5	Test
PT 6	Course project on electromechanical systems of electric vehicles	1.5	Test
PT 7	Scientific work on the topic of master's dissertation	4	Test
PT 8	Practice	14	Test
PT 9	Completion of a master's dissertation	12	MD protection
Selective components of OP			
Cycle of professional training			
PV 1	Educational component 1 of the F-Catalog	5	Examination
PV 2	Educational component 2 of the F-Catalog	5	Examination
PV 3	Educational component 3 of the F-Catalog	5	Examination
PV 4	Educational component 4 of the F-Catalog	4	Test
PV 5	Educational component 5 of the F-Catalog	4	Test
Total amount of compulsory educational components:		67 credits	
The total amount of selective educational components:		23 credits	
TOTAL VOLUME OF THE EDUCATIONAL PROGRAM:		**90 credits**	

3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



4. FORM OF CERTIFICATION OF APPLICANTS FOR HIGHER EDUCATION

Certification of higher education students in the educational program "Electromechanical automation systems, electric drive and electric mobility" specialty 141 "Electric power, electrical engineering and electromechanics" is carried out in the form of defense of the qualification work and ends with the issuance of a standard document. and electromechanics according to the educational-professional program "Electromechanical automation systems, electric drive and electric mobility".

The qualification work is checked for the absence of academic plagiarism, fabrication and falsification and after the defense is placed in the repository of the NTB of the University for free access. Certification is carried out openly and publicly.

5. MATRIX OF CORRESPONDENCE OF PROGRAM COMPETENCIES TO THE COMPONENTS OF THE EDUCATIONAL PROGRAM

	GO 1	GO 2	GO 3	GO 4	PT 1	PT 2	PT 3	PT 4	PT 5	PT 6	PT 7	PT 8	PT 9
GC 1	+	+		+	+	+			+	+	+	+	+
GC 2	+	+	+	+									
GC 3	+	+	+	+	+	+	+	+	+	+	+	+	+
GC 4			+								+	+	+
GC 5	+	+		+									
GC 6	+	+	+	+	+	+	+	+	+	+	+	+	+
GC 7	+	+	+	+	+	+	+	+	+	+	+	+	+
GC 8	+	+		+									
GC 9	+	+	+	+									
GC 10	+	+	+	+									
PC 1					+	+							
PC 2							+	+	+				
PC 3							+	+	+				
PC 4					+	+							
PC 5		+		+							+	+	+
PC 6		+		+							+	+	
PC 7				+							+	+	
PC 8				+			+	+	+				
PC 9					+	+	+	+	+	+	+	+	+
PC 10	+										+	+	
PC 11					+	+	+	+	+	+	+	+	+
PC 12											+	+	+
PC 13							+						
PC 14		+									+	+	
PC 15											+	+	
PC 16					+	+				+			
PC 17					+	+				+			

6. MATRIX OF PROVIDING PROGRAM LEARNING OUTCOMES WITH RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM

	GO 1	GO 2	GO 3	GO 4	PT 1	PT 2	PT 3	PT 4	PT 5	PT 6	PT 7	PT 8	PT 9
LO 01					+	+	+	+	+	+	+	+	+
LO 02							+		+				
LO 03													
LO 04							+	+	+	+	+	+	
LO 05					+	+							
LO 06	+	+	+	+	+	+	+	+	+	+	+	+	+
LO 07											+	+	
LO 08	+			+							+	+	
LO 09		+											
LO 10											+	+	
LO 11	+	+	+	+	+	+	+	+	+	+	+	+	+
LO 12	+	+		+							+	+	
LO 13					+	+							
LO 14					+	+	+	+	+	+	+	+	+
LO 15						+	+	+	+	+			
LO 16	+	+											
LO 17											+	+	
LO 18											+	+	+
LO 19													