MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"

IT IS RATIFIED

By scientific advice of Igor Sikorsky KPI

(protocol № 6 from September, "7", 2020)

Chairman of the Academic Council
Mykhailo Ilchenko

ELECTROMECHANICAL AUTOMATION SYSTEMS, ELECTRICAL DRIVE AND ELECTROMOBILITY

EDUCATIONALLY-SCIENTIFIC PROGRAM
third (educational and scientific) level of higher education

after speciality	**141 – «Electric energy, electrical engineering and electromechanics»**
areas of knowledge	**14 – «Electric engineering»**
qualification	**Doctor of philosophy in electric energy, electrical engineering and electromechanics**

Put into effect by the order of the rector of Igor Sikorsky KPI from 17.09 2020 № 1/282

Kyiv – 2020

ПРЕАМБУЛА

РОЗРОБЛЕНО проектною групою:

Керівник проектної групи:

Яндульський Олександр Станіславович – д.т.н., професор, декан факультету електроенерготехніки та автоматики

Члени проектної групи:

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Розен Віктор Петрович – завідувач кафедри автоматизації управління електротехнічними комплексами інституту енергозбереження та енергоменеджменту, д.т.н., професор
Толочко Ольга Іванівна – в.о. завідувача кафедри автоматизації енергосистем факультету електроенерготехніки та автоматики, д.т.н., професор
Шевчук Степан Прокопович – завідувач кафедри електромеханічного обладнання енергоємних виробництв інституту енергозбереження та енергоменеджменту, д.т.н., професор
Шинкаренко Василь Федорович – завідувач кафедри електромеханіки факультету електроенерготехніки та автоматики, д.т.н., професор

ПОГОДЖЕНО:

Науково-методична комісія КПІ ім. Ігоря Сікорського зі спеціальності 141 «Електроенергетика, електротехніка та електромеханіка»

Голова НМКУ(141) _____Олександр ЯНДУЛЬСЬКИЙ
(протокол №_3_ від «_19_»_06_____2020 р.)

Методична рада КПІ ім. Ігоря Сікорського

Голова Методичної ради _____Юрій ЯКИМЕНКО
(протокол №_1_від «_03»_____09_____ 2020 р.)

ВРАХОВАНО:

ВРАХОВАНО:
зовнішню апробацію ОП (отримано відгуки та рецензії, які додаються), ураховано пропозиції стейкхолдерів та рекомендації професійних асоціацій.

CONTENTS

1. EDUCATIONAL PROGRAM PROFILE

from speciality 141 – «Electric energy, electrical engineering and electromechanics»

1 - General information	
Full name of IHE and institute / faculty	A national technical university of Ukraine is the "Igor Sikorsky Kyiv Polytechnic Institute", faculty of electric energy and automations
Higher education degree and title of qualification in the original language	Degree - Doctor of Philosophy Qualification - Doctor of Philosophy in Power Engineering, Electrical Engineering and Electromechanics
The official name of the EP	Electric power, electrical engineering and electromechanics
Type of diploma and scope of EP	Doctor of Philosophy diploma, single, 40 credits ECTS educational component, 200 credits scientific component, term of study 4 years The scientific component involves conducting your own research and design of its results in the form of a dissertation.
Availability of accreditation	Accredited for the first time
Cycle/level of HE	NQF of Ukraine – level 8; FQ-EHEA – third cycle, EQF-LLL – level 8
Prerequisites	The presence of a master's degree, specialist
Language(s) of instruction	Ukrainian, English
Validity of the EP	Until the next accreditation
Internet address of the permanent placement of the educational program	https://fea.kpi.ua/temp/onp_PhD_141_29_10_2020.pdf osvita.kpi.ua
2 - The purpose of the educational program	
Training of highly qualified, competitive, integrated into the European and world scientific and educational space professionals capable of independent research, scientific and organizational, pedagogical and organizational and practical activities in the field of electricity, electrical engineering and electromechanics, teaching in higher education. The purpose of the educational program corresponds to the development strategy of Igor Sikorsky KPI 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	
Subject area	Field of knowledge: 14 - "Electrical Engineering" Specialty: 141 - "Electric power, electrical engineering and electromechanics" *Objects of study and activity:* 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; means of information and measuring equipment; methods of measurement, control, testing and diagnosis; regulatory documentation related to the processes of production, transmission, distribution and consumption of electricity; information technologies of experimental researches. *The purpose of training:* training of specialists in the field of electrical engineering, which involves the formation and development of general and professional competencies in power engineering, electrical engineering and electromechanics, which provide the ability to solve complex problems in professional and / or research and innovation, involving deep rethinking of existing and new holistic knowledge and / or professional practice. *Theoretical content of the subject area:* concepts and principles and concepts of 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; optimal ways to automate experimental research in order to obtain reliable information about the objects of study; principles of professional activity aimed at improving the reliability and energy efficiency of systems and complexes. *Methods, techniques and technologies:* methods and means of conducting research of processes in electric power and electromechanical systems and complexes; automated design, engineering and production control; teaching and training; team management in solving problems in power engineering, electrical engineering and electromechanics; creation and research of information technologies, software of measuring instruments and software for processing of measurement results. *Tools and equipment:* software and hardware, devices, systems, technologies of design, control, monitoring, modeling, creation, research and operation of electric power, electrotechnical and electromechanical equipment.
Orientation of EP	Educational and scientific
The main focus of the EP	Special education in the field of power engineering, electrical engineering and electromechanics. The program is based on well-known scientific principles, taking into account the current state of development of the country's energy. Keywords: electricity, electric power, electrical engineering, electromechanics, energy saving, energy

	management, automation
Features of EP	The implementation of the program involves mandatory pedagogical practice. A semester of academic mobility is possible within the framework of research on the topic of dissertations. The high level of the research part of the training is provided by scientific schools of the specialty, the availability of research centers and laboratories, cooperation agreements with leading industrial and scientific institutions. Implemented in English for foreign graduate students.
4 - Suitability of graduates for employment and further study	
Suitability for employment	Graduates are able to hold positions whose qualification requirements include a doctorate: - research and teaching work in higher education institutions; - research work in research institutions. Graduates can be employed in positions (according to the current Classifier of Professions of Ukraine SC 003:2010): **2143.1 Researchers (electrical engineering):** 2143.1 Research Engineer in Agricultural Energy 2143.1 Junior researcher (electrical engineering) 2143.1 Researcher (electrical engineering) 2143.1 Researcher-consultant (electrical engineering) **2310.1 Professors and associate professors:** 2310.1 Doctoral student 2310.1 Associate Professor 2310.1 Professor of the Department **2310.2 Other teachers of universities and higher educational establishments:** 2310.2 Assistant 2310.2 Teacher of a higher educational institution
Further training	Continuing education in doctoral studies and / or participation in postdoctoral programs
5 - Teaching and assessment	
Teaching and learning	Lectures, practical and seminar classes, computer workshops and laboratory works; technology of blended learning, practice; execution of the dissertation
Evaluation	Rating system, assessment, oral and written exams, testing
6 - Program competencies	
Integral competence	Ability to solve complex problems during professional and / or research and innovation activities in the field of power engineering, electrical engineering and electromechanics, which involves a deep rethinking of existing and the creation of new holistic knowledge and /

	or professional practice.
General Competences (GC)	GC01. Ability to abstract thinking, analysis and synthesis. GC02. Ability to search, process and analyze information from various sources. GC03. Ability to work in an international context.
Professional competencies (PC)	PC01. Ability to perform original research, achieve scientific results that create new knowledge in electrical engineering and related interdisciplinary areas and can be published in leading scientific journals in electrical engineering and related fields. PC02. Ability to orally and in writing present and discuss the results of research and / or innovative developments in Ukrainian and English, a deep understanding of English scientific texts in the field of research. PC03. Ability to solve problems of increasing the reliability and efficiency of electric, electrical and electromechanical facilities and systems due to the need to ensure sustainable development. PC04. Ability to use modern information technologies, databases and other electronic resources, specialized software in scientific and educational activities. PC05. Ability to identify, pose and solve research problems in the field of electrical engineering, evaluate and ensure the quality of research. PC06. Ability to initiate, develop and implement comprehensive innovative projects in the field of electrical engineering and related interdisciplinary projects, leadership in their implementation. PC07. Ability to adhere to the ethics of research, as well as the rules of academic integrity in research and scientific and pedagogical activities.

7 - Program learning outcomes

LO01. Have advanced conceptual and methodological knowledge in electrical engineering and at the subject line, as well as research skills sufficient to conduct scientific and applied research at the level of the latest world achievements in the field, gain new knowledge and / or innovate.
LO02. Freely present and discuss with specialists and non-specialists the results of research, scientific and applied problems of electrical engineering in state and foreign languages, qualified to reflect the results of research in scientific publications in leading international scientific journals.
LO03. Develop and research conceptual, mathematical and computer models of processes and systems, effectively use them to gain new knowledge and / or create innovative products in electrical engineering and related interdisciplinary areas.
LO04. Plan and perform experimental and / or theoretical research in electrical engineering and related interdisciplinary areas using modern tools, critically analyze the results of their own research and the results of other researchers in the context of the whole set of modern knowledge about the problem.
LO05. Deeply understand the general principles and methods of technical sciences, as well as the methodology of scientific research, apply them in their own research in the field of electrical engineering and teaching practice.

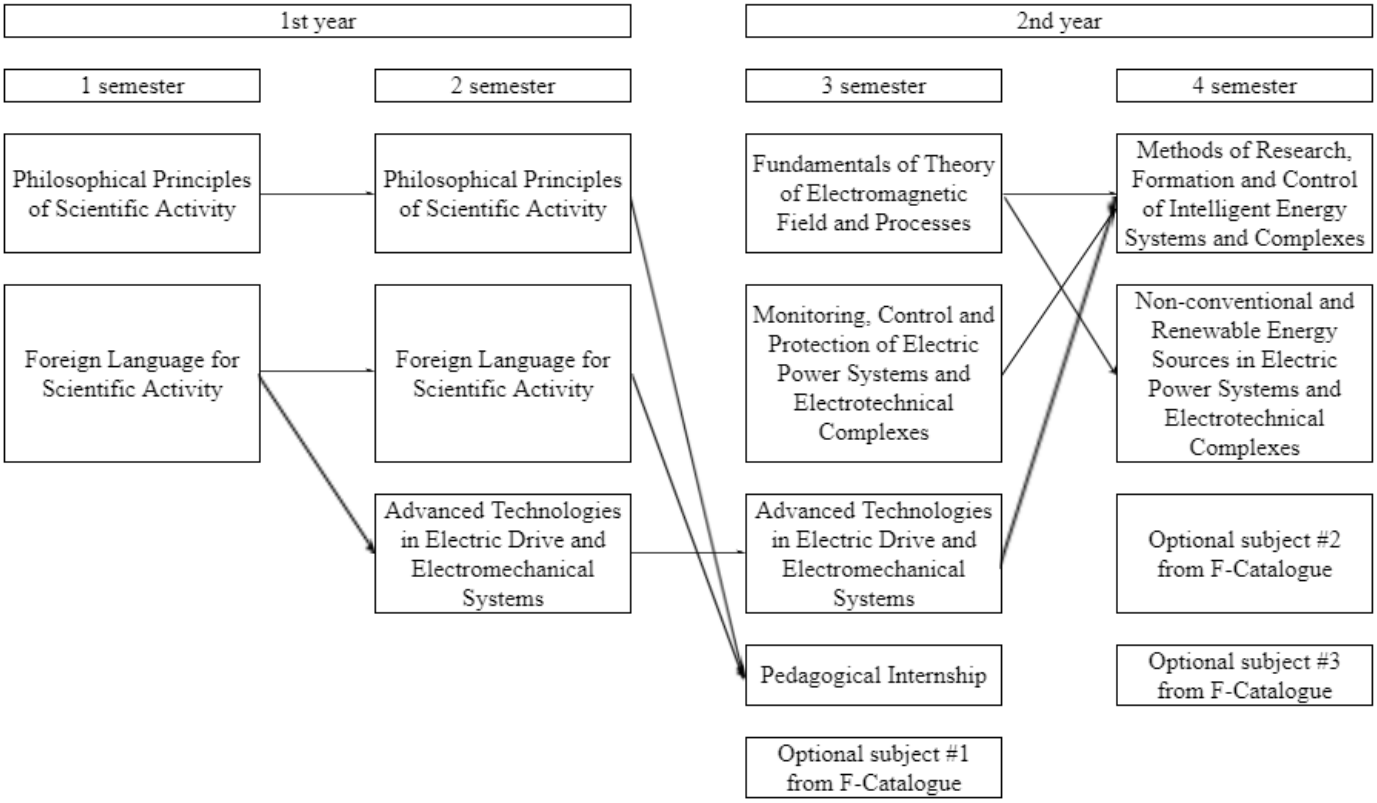
LO06. Be able to organize joint work with specialists from different fields in the framework of research projects in power engineering, electrical engineering and electromechanics. LO07. Be able to formulate the basic psychological and pedagogical principles and teach professionally-oriented disciplines in electrical engineering, electrical engineering and electromechanics. LO08. Be able to develop a feasibility study of projects in electricity, electrical engineering and electromechanics and assess the economic efficiency of their implementation.	
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 (current) in the wording dated 23.05.2018 №347.
Logistics	In accordance with the technological requirements for material and technical support of educational activities of the appropriate 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
Information and educational and methodical support	In accordance with the technological requirements for educational and methodological and informational support of educational activities of the appropriate 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
9 - Academic mobility	
National credit mobility	Possibility of concluding agreements on academic mobility, double graduation, etc.
International credit mobility	Possibility to conclude agreements on international academic mobility, on double graduation, on long-term international projects that include inclusive student education, etc. International projects: **Project Erasmus+ (KD1)** with West Pomeranian University of Technology, Szczecin, Poland (West Pomeranian University of Technology in Szczecin) **Project DAAD** with the Higher Technical School of Hesse - University of Applied Sciences, Hesse, Germany (Technische Hochschule Mittelhessen - University of Applied Sciences) **Project Erasmus+ (KD1)** with the University of Lorraine, Min Nancy High School, Nancy, France (Universite de Lorraine Ecole Nationale Superieur des Mines Nancy, ville Nancy, France) **Project Erasmus+ (KD1)** with Le Mans University, Le Mans, France (Université du Maine, ville Le Mans, France) **Project Erasmus+ (KD1)** with the University of Applied

	Sciences in Giessen, Germany (Technische Hochschule Mittelhessen)
Training of foreign applicants HE	Teaching in English

2. LIST OF COMPONENTS OF THE EDUCATIONAL AND SCIENTIFIC PROGRAM

Code	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
NORMATIVE components of the EP			
ZO 1	Philosophical Principles of Scientific Activity	6	Exam
ZO 2	Foreign Language for Scientific Activity	6	Exam
ZO 3	Methods of Research, Formation and Control of Intelligent Energy Systems and Complexes	3	Exam
ZO 4	Fundamentals of Theory of Electromagnetic Field and Processes	3	Credit
ZO 5	Non-conventional and Renewable Energy Sources in Electric Power Systems and Electrotechnical Complexes	3	Credit
ZO 6	Monitoring, Control and Protection of Electric Power Systems and Electrotechnical Complexes	3	Exam
PO 1	Advanced Technologies in Electric Drive and Electromechanical Systems	4	Exam
PO 2	Pedagogical Internship	2	Credit
ELECTIVE educational components			
V 1	Optional subject #1 from F-Catalogue	3	Credit
V 2	Optional subject #2 from F-Catalogue	3	Credit
V 3	Optional subject #3 from F-Catalogue	4	Exam
TOTAL of NORMATIVE educational components		30 credits	
TOTAL of ELECTIVE educational components		10 credits	
TOTAL		**40 credits**	

3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



4. SCIENTIFIC COMPONENT

YEAR	The content of the graduate student's scientific work	Forms of control (Reporting)
1st year	Choice and substantiation of the topic of own scientific research, determination of the content, terms of performance and volume of scientific works; selection and substantiation of the methodology of conducting own research, review and analysis of existing views and approaches that have developed in modern science in the chosen field. Preparation and publication of at least 1 article (usually a review) in scientific professional publications (domestic or foreign) on the research topic; participation in scientific and practical conferences (seminars) with the publication of abstracts.	Approval of the individual plan of the postgraduate student's work at the academic council of the institute / faculty, reporting on the progress of the individual postgraduate student's plan twice a year
2nd year	Conducting own research under the guidance of the supervisor, which involves solving research problems through the use of a set of theoretical and empirical methods. Preparation and publication of at least 1 article in scientific professional publications (domestic or foreign) on the research topic; participation in scientific and practical conferences (seminars) with the publication of abstracts.	Reporting on the progress of the individual postgraduate student's plan twice a year
3rd year	Analysis and generalization of the obtained results of own scientific research; substantiation of scientific novelty of the obtained results, their theoretical and / or practical significance. Preparation and publication of at least the 1st article in scientific professional publications on the research topic; participation in scientific and practical conferences (seminars) with the publication of abstracts.	Reporting on the progress of the individual postgraduate student's plan twice a year
4th year	Registration of scientific achievements of the post-graduate student in the form of the dissertation, summing up concerning completeness of coverage of results of the dissertation in scientific articles according to the current requirements. Implementation of the obtained results and receipt of supporting documents. Submission of documents for preliminary examination of the dissertation. Preparation of a scientific report for final certification (defense of the dissertation).	Reporting on the progress of the individual postgraduate student's plan twice a year. Providing an opinion on the scientific novelty, theoretical and practical significance of the dissertation results.

5. FORM OF GRADUATE CERTIFICATION OF HIGHER EDUCATION APPLICANTS

Graduation certification of applicants for higher education 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 qualification work and ends with the issuance of a standard document. electrical engineering and electromechanics.

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 STL of the University for free access. Graduation certification is carried out openly and publicly.

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

	ZO 1	ZO 2	ZO 3	ZO 4	ZO 5	ZO 6	PO 1	PO 2	Scientific component
ZK 01	+							+	+
ZK 02	+							+	+
ZK 03		+						+	
ZK 01				+	+		+		
ZK 02		+					+		+
SK 03				+	+	+			
SK 04		+					+		
SK 05			+				+		+
SK 06			+		+	+			
SK 07	+							+	+

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

	ZO 1	ZO 2	ZO 3	ZO 4	ZO 5	ZO 6	PO 1	PO 2	Scientific component
RC 01			+	+	+	+	+		+
RC 02		+						+	+
RC 03					+				
RC 04			+				+		+
RC 05	+		+	+			+		+
RC 06	+	+							
RC 07	+							+	
RC 08			+			+			+