

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL TECHNICAL UNIVERSITY OF UKRAINE
«IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE»**

Approved by Scientific Council
of Igor Sikorsky Kyiv Polytechnic Institute
(protocol № 3 from 15.03.2021)

Head of Scientific Council

Mykhailo Ilchenko

ELECTRONIC COMPONENTS AND SYSTEMS

EDUCATIONAL PROGRAM

for first (Bachelor) level of higher education

Specialty	171 Electronics
Field of knowledge	17 Electronics and telecommunications
Qualification	Bachelor on Electronics

Came into force from 2021/2022
academic year
Order of Rector of Igor Sikorsky
Kyiv Polytechnic Institute
from 19.04.2021
№HOH/89/2021

Kyiv – 2021

PREAMBLE

DEVELOPED by the project team:

Project team leader:

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Members of the project team:

Tereshchenko Tetyana Oleksandrivna, Professor of the Department of Electronic Devices and Systems, Doctor of Technical Sciences, Prof.

Yamnenko Yuliya Serhiivna, acting Head of the Department of Electronic Devices and Systems, Doctor of Technical Sciences, Prof.

Verbytskyi Yevhen Volodymyrovych, Associate Professor of the Department of Electronic Devices and Systems, Ph.D., Assoc. Prof.

The Department of Electronic Devices and Systems is responsible for the training of applicants for higher education according to the educational program.

AGREED:

Scientific and Methodological Commission of the University, specialty 171 Electronics

The Head of the SMCU 171

Julia YAMNENKO

(protocol № 4 from 02.02.2021)

Methodological Council of Igor Sikorsky KPI

The Head of the Methodological Council

Yuriy YAKYMENKO

(protocol № 6 from 25.02.2021)

Stakeholder suggestions taken into account:

- increase the diversity of professionally-oriented disciplines (students) while maintaining a rich fundamental component (employers).

The following changes were made to the educational program:

- to transfer a part of disciplines to selective blocks, to modernize their filling according to a profile 171 Electronics, the list of disciplines to the cathedral F-Catalog is offered.

- recommendations on updating educational programs and features of developing curricula for bachelors (KPI named after Igor Sikorsky from 30.11.2020 № NON / 35/2020 "On improving educational programs of the first (bachelor's) level of higher education") and changed the list accordingly compulsory and elective educational components.

Agreed with members of the scientific-methodical commission and the support group of the specialty 171 Electronics KPI them. Igor Sikorsky.

The educational program was considered at the meeting of the Department of Electronic Devices and Systems, Minutes № 14 of January 21, 2021.

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1. PROFILE OF THE EDUCATIONAL PROGRAM

1 – General characteristics	
Full name of institution of higher education and institute / faculty	National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”, Faculty of Electronics
Higher education degree and title of qualification in the original language	Degree – bachelor Educational qualification – bachelor of electronics
The official name of the educational program	Electronic components and systems
Type of diploma and scope of the educational program	Bachelor's degree, single, 240 credits, term of study 3 years and 10 months
Availability of accreditation	Certificate of accreditation of the specialty ND 1192560, valid until 01.07.2023
Cycle / level of higher education	NFC of Ukraine – level 6 QF-EHEA – the first cycle EQF-LLL – 6 level
Prerequisites	Availability of complete general secondary education The presence of a degree of junior specialist
Teaching languages	English
Validity of the educational program	Until the next accreditation
Internet address of the permanent placement of the educational program	https://osvita.kpi.ua/op http://eds.kpi.ua/?page_id=5040
2 – The aim of the educational program	
Training of an electronics specialist capable of solving complex specialized problems and practical problems of design, production, operation, maintenance, repair and modernization of devices, devices and systems of electronics, aimed at fruitful and efficient work in a sustainable innovative scientific and technological development of society and high adaptability of higher education seekers in the context of labor market transformation through interaction with employers and other stakeholders. The aim 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	<p><i>Object of activity:</i> physical processes and phenomena, hardware and software of electronics, microprocessor and microcontroller devices, devices and systems of power electronics and converters, analog and digital components, circuit and system solutions, which are the basis of electronic components and systems.</p> <p><i>Learning objectives:</i> training of professionals capable of successful professional and research and innovation activities in the field of development, design, production, installation, operation, maintenance, repair and modernization of electronic components and systems based on acquired theoretical and practical knowledge and skills, methods thinking, views, values and other personal qualities sufficient to solve complex specialized theoretical and practical problems.</p> <p><i>Theoretical content of the subject area:</i> concepts and principles of electrical engineering, physical foundations of electronics, information theory, signal processing, computer-integrated technologies, fundamental principles, concepts of construction, modeling, design and optimization of modern electronic components and systems.</p> <p><i>Methods, techniques and technologies:</i> research of processes in electronic components and systems; planning an experiment with processing the results, development and substantiation of circuit and system solutions, modern computer and information technologies, application of machine learning methods, artificial intelligence and cloud computing in electronic components and systems.</p> <p><i>Tools and equipment:</i> electronic components and systems, control and measuring equipment, control and regulation systems, power supply of electronic equipment, information display and registration, electronic systems for various purposes, in particular, distributed power generation systems, computer and microprocessor technology, software for analysis, calculation and modeling of processes, design of devices, components and systems of electronics.</p>
Orientation of the educational program	Educational and professional
Main focus of the educational program	<p>General higher education in the field of electronics, in particular, its physical foundations, materials and technologies, industrial and power electronics, analog and digital circuitry, converter and microprocessor technology, electronic components and systems, mastering additional fundamental and vocational disciplines, which together provides acquisition of the necessary competencies for further professional activity.</p> <p>Aimed at developing the applicant's ability to identify and solve complex problems in the field of knowledge 17 Electronics and Telecommunications, in the specialty 171 Electronics. The program gives applicants the opportunity to freely choose disciplines in accordance with the profile of the department.</p> <p>Keywords: Electronic components and systems; Power electronics; Industrial electronics; Analog circuitry; Digital circuitry; Electronic technological equipment.</p>

Features of the educational program	<p>The program is based on the requirements of the European Qualifications Framework for Lifelong Learning (EQF-LLL).</p> <p>Possibility of obtaining higher education in dual form.</p> <p>The implementation of the program involves the involvement of specialists and experts in the field of 171 Electronics, as well as representatives of stakeholders.</p> <p>Students have the opportunity to study double degree programs with the Technical University of Dresden (Germany), the Korean Institute of Science and Technology (South Korea) and other foreign universities with which there are agreements.</p>
4 – Suitability of graduates for employment and further study	
Suitability for employment	<p>In accordance with the professional requirements and the State Classification of Occupations SC 003: 2010 graduates can work in the following positions:</p> <p>3114 Technicians in the field of electronics and telecommunications</p> <ul style="list-style-type: none"> - alarm technician - design technician (electronics) - technician-technologist (electronics) <p>3119 Other technical specialists in the field of physical sciences and technology</p> <ul style="list-style-type: none"> - navigation information collection manager - laboratory assistant (electronics) - technician for preparation of technical documentation (electronics) - specialist in technical expertise (electronics) <p>3123 Controllers and regulators of industrial robots</p> <ul style="list-style-type: none"> - debugging and testing technician - robot controller <p>3132 Operators of radio and telecommunication equipment</p> <ul style="list-style-type: none"> - radio electronics <p>3139 Other operators of optical and electronic equipment</p> <ul style="list-style-type: none"> - technicians for diagnostic equipment - technician-operator of electronic equipment - technician-technologist for the production of optical and optoelectronic devices <p>3111 Laboratory assistants and technicians related to chemical and physical research</p> <ul style="list-style-type: none"> - technician-technologist (electronics) <p>3439 Other technical experts in the field of management</p> <ul style="list-style-type: none"> - specialist in the organization of consumer services
Further training	<p>The bachelor of electronics has the right to study master's programs in electronics and interdisciplinary programs close to electronics (automation, instrumentation, telecommunications, radio engineering and others).</p>

5 – Teaching and assessment		
Teaching and learning	<p>General learning style – task-oriented. Training is conducted in the form of lectures, seminars, practical classes, laboratory classes, individual lessons. Independent work of students involves the possibility of consultation with the teacher. During teaching, information and communication technologies (e-learning, online lectures, OCW, distance learning courses) are used for individual educational components.</p> <ul style="list-style-type: none"> -lectures, practical and seminar classes, computer workshops, laboratory and calculation works, practices, interactive workshops - in classroom, distance, mixed format; -conducting classrooms with the involvement of professionals-practitioners in the field, including in the territories of partner companies; -participation in scientific, scientific and technical international and interdisciplinary conferences, seminars, projects, trainings; -individual work with the use of methodical and scientific information sources; -participation in research project development groups; -consultations with scientific and pedagogical workers. <p>The study ends with the writing and public defense of the diploma project.</p>	
Evaluation	<p>Current control in the form of laboratory reports, presentations, written modular tests. Semester control in the form of written and oral examinations and defense of qualification work. Current and semester tests are assessed in accordance with the criteria of the Regulations on the system of assessment of learning outcomes in Igor Sikorsky KPI.</p>	
6 – Program competencies		
Integral competence	<p>Ability to solve complex specialized problems and practical problems, characterized by complexity and uncertainty of conditions, during professional activities in the field of electronics, or in the learning process, which involves the application of theories and methods of electronics.</p>	
General competencies (GC)	GC 1	Ability to apply knowledge in practical situations
	GC 2	Knowledge and understanding of the subject area and understanding of professional activity
	GC 3	Ability to communicate in the state language both orally and in writing
	GC 4	Ability to communicate in a foreign language
	GC 5	Skills in the use of information and communication technologies
	GC 6	Ability to learn and master modern knowledge
	GC 7	Ability to search, process and analyze information from various sources
	GC 8	Interpersonal skills
	GC 9	Ability to work in a team
	GC 10	Safe activities skills
	GC 11	Ability to evaluate and ensure the quality of work performed

	GC 12	Definiteness and perseverance in terms of tasks and responsibilities
	GC 13	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
	GC 14	Ability to preserve and multiply 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)	PC 1	Ability to use knowledge and understanding of scientific facts, concepts, theories, principles and methods for the design and application of devices, devices, components and systems of electronics
	PC 2	Ability to perform analysis of the subject area and regulatory documentation required for the design and application of devices, devices, components and electronics systems
	PC 3	Ability to integrate knowledge of fundamental sections of physics and chemistry to understand the processes of solid-state, functional, quantum and energy electronics, electrical engineering, field theory
	PC 4	Ability to take into account social, environmental, ethical, economic and commercial considerations that affect the efficiency and results of engineering activities in the field of electronics
	PC 5	Ability to apply appropriate mathematical, scientific and technical methods, modern information technology and computer software, skills in working with computer networks, databases and Internet resources to solve engineering problems in the field of electronics
	PC 6	Ability to identify, classify, evaluate and describe processes in electronics devices, devices, components and systems using analytical methods, modeling tools, prototypes and experimental results
	PC 7	Ability to apply creative and innovative potential in the synthesis of engineering solutions and in the design of devices and electronics systems
	PC 8	Ability to solve engineering problems in the field of electronics taking into account all aspects of development, design, production, operation and modernization of electronic devices, devices, components and systems
	PC 9	Ability to determine and evaluate the characteristics and parameters of materials of electronic equipment, analog and digital electronic devices for the design of microprocessor and electronic systems
	PC 10	Ability to apply in practice industry standards and quality standards of operation of devices, devices and systems of electronics

	PC 11	Ability to monitor and diagnose equipment, use modern electronic components and hardware, perform maintenance, repair and maintenance of electronic devices and systems, install, configure and repair analog, digital and optical modules, develop and manufacture printed circuit boards, develop software for microcontrollers
	PC 12	Ability to develop working technical documentation, design work with verification of compliance with standards, specifications and other regulations
	PC 13	Ability to apply modern methods of production quality control, to conduct testing, certification and examination of production equipment, parts, assemblies and finished electronic products and devices
	PC 14	Ability to apply modern methods for the development of low-waste, energy-saving and environmentally friendly technologies that ensure the safety of human life and their protection from possible consequences of accidents, catastrophes and natural disasters, apply methods of rational use of raw materials, energy and other resources

7 – Program learning outcomes

O1	Describe the principle of operation using scientific concepts, theories and methods and test the results in the design and application of devices, devices and systems of electronics
O2	Apply knowledge and understanding of differential and integral calculus, algebra, functional analysis of real and complex variables, vectors and matrices, vector calculus, differential equations in ordinary and partial derivatives, Fourier series, statistical analysis, information theory, numerical methods, basics of automatic theory regulation to solve theoretical and applied problems of electronics
O3	Find solutions to practical problems of electronics by applying appropriate models and theories of electrodynamics, analytical mechanics, electro-magnetism, statistical physics, solid state physics
O4	Evaluate the characteristics and parameters of electronic materials, understand the basics of solid-state, functional, quantum and power electronics, electrical engineering, analog and digital circuitry, converter and microprocessor technology
O5	Use information and communication technologies, applied and specialized software products to solve problems of design and debugging of electronic systems, demonstrate skills of programming, analysis and display of measurement and control results
O6	Apply experimental skills (knowledge of experimental methods and the order of experiments) to test hypotheses and study the phenomena of electronics, be able to use standard equipment, plan, make diagrams; analyze, model and critically evaluate the results
O7	Analyze complex digital and analog information-measuring systems with advanced architecture of computer and telecommunication networks taking into account the specification of selected technical means of electronics and relevant technical documentation
O8	Define and identify mathematical models of technological objects in the development of new complex electronic systems in a computer environment and choosing the optimal solution

O9	Design complex real-time systems and means of collecting and processing information, consistent with the specified information and software by using software for embedded systems based on microcontrollers
O10	Develop technical means for the construction and diagnosis of technical condition of electronic devices and systems, organize and conduct scheduled and unscheduled repairs, adjustment and reconfiguration of electronic equipment in accordance with current production requirements
O11	Argue the legal framework for the implementation of electronic devices and systems; evaluate the benefits of engineering developments, their environmental friendliness and safety; to defend their own worldviews and beliefs in production or social activities
O12	Use documentation related to professional activities, using modern technologies and office equipment; use English, including special terminology, to communicate with experts, conduct literary searches and read texts on technical and professional topics
O13	Be able to acquire new knowledge, advanced technologies and innovations, find new non-standard solutions and means of their implementation; meet the requirements of flexibility in overcoming obstacles and achieving goals, rational use and regulation of time, discipline, responsibility for their decisions and activities
O14	Adhere to the norms of modern Ukrainian business and professional language
O15	Demonstrate skills of independent and collective work, leadership qualities, organize work in a limited time with an emphasis on professional integrity
O16	Apply understanding of the theory of stochastic processes, methods of statistical processing and data analysis in solving professional problems
O17	Demonstrate skills in conducting experimental research related to professional activities; to improve measurement methods; control the reliability of the obtained results; systematize and analyze the data obtained experimentally
O18	Apply methods of mathematical modeling and optimization of electronic systems for the development of automated and robotic production systems
O19	Develop working technical documentation, design work with verification of compliance with standards, specifications and other regulations
O20	Apply modern methods of production quality control, conduct testing, certification and examination of production equipment, parts, assemblies and finished electronic and acoustic products and devices
O21	Apply modern methods for the development of low-waste, energy-saving and environmentally friendly technologies that ensure the safety of human life and their protection from the possible consequences of accidents, catastrophes and natural disasters, apply methods of rational use of raw materials, energy and other resources
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 higher education, 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.

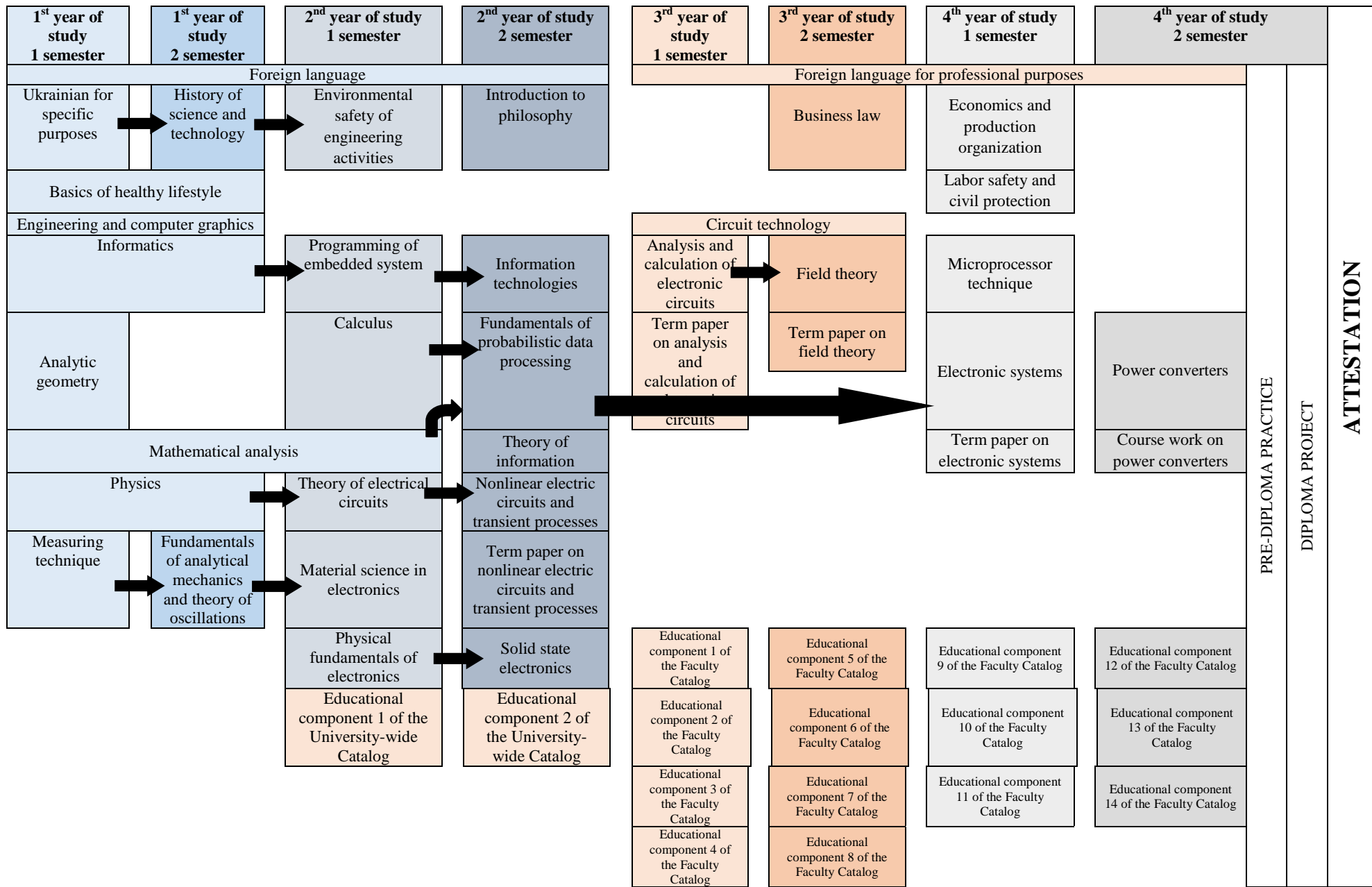
Logistics	<p>In accordance with the technological requirements for material and technical support of educational activities of the relevant level of higher education, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine № 347 dated 10.05.2018.</p> <p>Use of equipment for lectures in the format of presentations, network technologies, in particular on the distance learning platform Sikorsky, demonstration industry equipment during laboratory workshops.</p>
Information, educational and methodical support	<p>In accordance with the technological requirements for educational and methodological and informational support of educational activities of the relevant level of higher education (Annex 5 to the License Conditions), 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 10.05.2018.</p> <p>Use of the Scientific and Technical Library of KPI named after Igor Sikorsky.</p>
9 – Academic mobility	
National credit mobility	It is possible, subject to the conclusion of relevant agreements between Igor Sikorsky KPI and higher education institutions of Ukraine
International credit mobility	<p>Implemented on the basis of agreements on international academic mobility (Erasmus + K2).</p> <p>Double degree program with the Technical University of Dresden (Germany), the Korean Institute of Science and Technology (South Korea).</p>
Study of foreign applicants for higher education	Teaching a foreign language (English) in the case of the formation of separate foreign groups (in this case, the Ukrainian language is studied as a foreign language). Teaching in Ukrainian in case of forming of mixed Ukrainian-foreign groups.

2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Code	Components of the educational program (academic disciplines, course projects / works, practices, qualification work)	Number of ECTS credits	Form of final control
1	2	3	4
Mandatory (regulatory) components of the educational program			
General training			
GM 1	Ukrainian for specific purposes	2	Credit
GM 2	History of science and technology	2	Credit
GM 3	Basics of healthy lifestyle	3	Credit
GM 4	Foreign language	6	Credit
GM 5	Foreign language for professional purposes	6	Credit Exam
GM 6	Environmental safety of engineering activities	2	Credit
GM 7	Introduction to philosophy	2	Credit
GM 8	Business law	2	Credit
GM 9	Economics and production organization	4	Credit
GM 10	Labor safety and civil protection	4	Credit
GM 11	Mathematical analysis	17,5	Exam
GM 12	Analytic geometry	4,5	Exam
GM 13	Physics	12	Exam
GM 14	Engineering and computer graphics	6	Exam
GM 15	Informatics	8	Credit
Vocational training			
VM 1	Measuring technique	3,5	Credit
VM 2	Fundamentals of analytical mechanics and theory of oscillations	4	Credit
VM 3	Material science in electronics	4	Exam
VM 4	Physical fundamentals of electronics	4	Exam
VM 5	Calculus	4	Credit
VM 6	Programming of embedded system	3	Credit
VM 7	Theory of electrical circuits	4	Credit
VM 8	Nonlinear electric circuits and transient processes	6	Exam
VM 9	Term paper on nonlinear electric circuits and transient processes	1	Credit
VM 10	Fundamentals of probabilistic data processing	5	Exam
VM 11	Circuit technology	6,5	Exam
VM 12	Solid state electronics	4,5	Exam
VM 13	Theory of information	4	Credit
VM 14	Information technologies	4	Credit
VM 15	Field theory	5,5	Exam
VM 16	Term paper on field theory	1	Credit

1	2	3	4
VM 17	Analysis and calculation of electronic circuits	5	Exam
VM 18	Term paper on analysis and calculation of electronic circuits	1	Credit
VM 19	Electronic systems	3,5	Exam
VM 20	Term paper on electronic systems	1	Credit
VM 21	Microprocessor technique	4	Exam
VM 22	Power converters	7,5	Exam
VM 23	Term paper on power converters	1	Credit
VM 24	Pre-diploma practice	6	Credit
VM 25	Diploma project	6	Defence
Optional components of the educational program			
General training			
GO 1	Educational component 1 of the University-wide Catalog	2	Credit
GO 2	Educational component 2 of the University-wide Catalog	2	Credit
Vocational training			
VO 1	Educational component 1 of the Faculty Catalog	4	Credit
VO 2	Educational component 2 of the Faculty Catalog	4	Credit
VO 3	Educational component 3 of the Faculty Catalog	4	Credit
VO 4	Educational component 4 of the Faculty Catalog	4	Credit
VO 5	Educational component 5 of the Faculty Catalog	4	Credit
VO 6	Educational component 6 of the Faculty Catalog	4	Credit
VO 7	Educational component 7 of the Faculty Catalog	4	Credit
VO 8	Educational component 8 of the Faculty Catalog	4	Credit
VO 9	Educational component 9 of the Faculty Catalog	4	Credit
VO 10	Educational component 10 of the Faculty Catalog	4	Credit
VO 11	Educational component 11 of the Faculty Catalog	4	Credit
VO 12	Educational component 12 of the Faculty Catalog	4	Credit
VO 13	Educational component 13 of the Faculty Catalog	4	Credit
VO 14	Educational component 14 of the Faculty Catalog	4	Credit
The total amount of mandatory components:		180	
The total amount of optional components:		60	
The amount of educational components that ensure the acquisition of competencies defined by the standard of higher education:		120	
TOTAL VOLUME OF THE EDUCATIONAL PROGRAM		240	

3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



4. FORM OF ATTESTATION OF APPLICANTS FOR HIGHER EDUCATION

Attestation of applicants for higher education in the educational program is carried out in the form of public defense of the qualification work in the form of a diploma project or thesis and ends with the issuance of a standard document on awarding a bachelor's degree with a bachelor's degree in electronics under the educational program "Electronic Components and Systems".

Attestation is carried out openly and publicly. Thesis project or thesis is tested for plagiarism.

Qualification work should include the solution of a complex specialized problem or practical problem in the field of electronics, which is characterized by complexity and uncertainty of conditions and involves the application of theories and methods of electronics. There can be no academic plagiarism, falsification or writing off in the qualification work. Qualification work must be published for defense on the official website of the higher education institution or its subdivision, or in the repository of the higher education institution. Publication of qualification works containing information with limited access is carried out in accordance with the requirements of current legislation.

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

	GM 1	GM 2	GM 3	GM 4	GM 5	GM 6	GM 7	GM 8	GM 9	GM 10	GM 11	GM 12	GM 13	GM 14	GM 15	VM 1	VM 2	VM 3	VM 4	VM 5	VM 6	VM 7	VM 8	VM 9	VM 10	VM 11	VM 12	VM 13	VM 14	VM 15	VM 16	VM 17	VM 18	VM 19	VM 20	VM 21	VM 22	VM 23	VM 24	VM 25					
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6. MATRIX OF PROVIDING PROGRAM LEARNING OUTCOMES WITH RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM

	GM 1	GM 2	GM 3	GM 4	GM 5	GM 6	GM 7	GM 8	GM 9	GM 10	GM 11	GM 12	GM 13	GM 14	GM 15	VM 1	VM 2	VM 3	VM 4	VM 5	VM 6	VM 7	VM 8	VM 9	VM 10	VM 11	VM 12	VM 13	VM 14	VM 15	VM 16	VM 17	VM 18	VM 19	VM 20	VM 21	VM 22	VM 23	VM 24	VM 25									
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