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

APPROVED BY
Academic Council of Igor Sikorsky Kyiv Polytechnic Institute
(Prot. № 3 from 15.03.2021)
Head of the Academic Council

_____ Mykhailo ILCHENKO

ACOUSTIC ELECTRONIC SYSTEMS AND ACOUSTIC INFORMATION PROCESSING TECHNOLOGY

EDUCATIONAL PROFESSIONAL PROGRAM

of the first (bachelor) level of higher education

specialty	**171 «Electronics»**
field of knowledge	**17 «Electronics and telecommunications»**
qualification	**bachelor of electronics**

Entered into force from
2021/2022 academic year
by order of the rector
Igor Sikorsky Kyiv Polytechnic Institute
from 19.04.2021, № НОН/89/2021

Kyiv – 2021

PREFACE

DEVELOPED by the project team:

Project team leader:
Naida Serhii Anatoliyovych, Doctor of Technical Sciences, Professor, Professor of the Department of Acoustic and Multimedia Electronic Systems
Members of the project team:
Drozdenko Oleksandr Ivanovych, Candidate of Technical Sciences, Associate Professor, Associate Professor of the Department of Acoustic and Multimedia Electronic Systems
Zhelyaskova Tetyana Mykolayivna, Candidate of Technical Sciences, Assistant of the Department of Acoustic and Multimedia Electronic Systems
Parenyuk Dmytro Volodymyrovych, graduate student of the Department of Acoustic and Multimedia Electronic Systems

The Department of Acoustic and Multimedia Electronic Systems is responsible for the training of higher education students in the educational program.

Scientific and Methodological Commission of the University, specialty 171 Electronics

Head of the SMCU 171 _____ Yulia YAMNENKO

(Prot. № 4 from 02.02. 2021)

Methodical Council of Igor Sikorsky KPI.

Head of the Methodical Council
_____ Yurii YAKYMENKO

(Prot. № 6 from 25.02. 2021)

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

Recommendations on updating educational programs and peculiarities of developing curricula for bachelors (taking into account the order of Igor Sikorsky KPI from 30.11.2020 № НОН/35 /2020 "On improving educational programs of the first (bachelor) level of higher education") and accordingly changed the list compulsory and elective educational components.

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

The educational program was considered at the meeting of the Department of Acoustic and Multimedia Electronic Systems., Protocol № 8 of January 20, 2021.

CONTENT

1. Profile of the educational program in the specialty 171 Electronics

1 – General information	
Full name of institution of higher education and institute / faculty	National Technical University of Ukraine "Kyiv Polytechnic Institute named after Igor Sikorsky", Faculty of Electronics
Degree of higher education and title of qualification in the original language	Degree - Бакалавр Qualification – Бакалавр з електроніки
The official name of the educational program	Acoustic electronic systems and acoustic information processing technology
Type of diploma and scope of educational program	Bachelor's degree, single, 240 credits, term of study 3 years 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	- on the basis of complete general secondary education – 240 ECTS credits; - on the basis of the degree of "junior bachelor" (educational qualification level "junior specialist") it is possible to recalculate ECTS credits received within the previous educational program of junior bachelor (junior specialist): in specialties 17 "Electronics and Telecommunications" not more than 120 ECTS credits; in other specialties not more than 60 ECTS credits.
Language (s) of instruction	Ukrainian / English
Term of the educational program	Until next viewing
Internet address of the permanent placement of the educational program	https://osvita.kpi.ua/171_OPPB_AESTOAI
2 – The purpose of the educational program	
The purpose of training is to form a specialist in electronics theoretical and practical knowledge and skills, ways of thinking, views, values and other personal qualities sufficient to solve complex specialized theoretical and practical problems of development, design, production, installation, operation, maintenance, repair and modernization of electronic acoustic systems aimed at productive and efficient work in the conditions of sustainable innovative scientific and technical development of society and formation of high adaptability of higher education seekers in the conditions of labor market transformation through interaction with employers and other stakeholders. 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	*Objects of study and activity*: hardware and software of electronics, microprocessor and microcontroller devices, devices and systems of power electronics and conversion equipment, electroacoustic energy conversion, primary and secondary information conversion systems, analog and digital components, processes and systems of collection, storage, protection, processing, transmission of acoustic information and integration of these systems for automation of engineering tasks with the use of modern computer equipment and software. *The purpose of training*: acquisition of theoretical and practical knowledge and skills, abilities, ways of thinking, views, values and other personal qualities sufficient to solve complex specialized theoretical and practical problems of development, design, production, installation, operation, maintenance, repair and modernization of acoustic electronic systems. *Theoretical content of the subject area*: concepts and principles of electrical engineering, physical foundations of electronics, information theory, signal processing, computer-integrated technologies, principles and concepts of construction, modeling, design and improvement of modern acoustic electronic systems. *The graduate learns* to apply and use computer and microprocessor technology, measuring equipment, devices and systems of electronic and electroacoustic conversion equipment, acoustoelectronics and power electronics, industrial controllers, other technical means of acoustic electronic devices and systems.
Orientation of the educational program	Educational and professional
The main focus of the educational program	General higher education in the field of electronics, in particular, its physical foundations, materials and technologies, acoustic electronic systems and acoustic information processing technologies, analog and digital circuitry, converter and microprocessor technology, mastering additional fundamental and vocational disciplines, which together provides the acquisition necessary competencies for further professional activity. Aimed at forming the applicant's ability to identify and solve complex problems in the field of knowledge 17 Electronics and telecommunications within the specialty 171 Electronics. The program gives students the opportunity to freely choose disciplines according to the profile of the department. **Keywords**: Acoustic electronic systems; Acoustic information processing technologies; Electroacoustic devices and systems; Acoustic non-destructive testing; Acoustoelectronics; Medical acoustics; Hydroacoustics; Electroacoustics; Architectural acoustics.

Features of the program	The internship must be at least 4 ECTS credits. The program is based on the requirements of the European Qualifications Framework for Lifelong Learning (EQF-LLL). Possibility of obtaining higher education in dual form. Participation of students in certificate programs. Students receive special knowledge of modern technologies for processing and protection of acoustic information, electroacoustic devices and systems that belong to the field of electronic acoustic systems and can work at Ukrainian enterprises in the relevant profile. The implementation of the program involves the involvement of specialists and experts in the field of 171 Electronics, as well as representatives of stakeholders.
4 – Suitability of graduates for employment and further study	
Suitability for employment	Recommended professional titles of works according to the current edition of the National Classifier of Ukraine: Classifier of professions (SC 003: 2010): 3114 Technicians in the field of electronics and telecommunications: - telecommunication technician, - radar technician, - alarm technician, - design technician (electronics), - technician-technologist (electronics); 3119 Other technical specialists in the field of physical sciences and technology; - navigation information collection manager - laboratory assistant (electronics) - technician for preparation of technical documentation (electronics) - specialist in technical expertise (electronics) 3123 Controllers and regulators of industrial robots: - debugging and testing technician - robot controller 3132 Radio and telecommunication equipment operators: - radio electronic 3133 Medical equipment operators: - medical equipment operator; 3139 Other operators of optical and electronic equipment: – diagnostic equipment technician; – technician-operator of electronic equipment – technician-technologist for the production of optical and optoelectronic devices 3111 Laboratory technicians and technicians related to chemical and physical research: – technician-technologist (electronics) 3439 Other technicians in management: – specialist in the organization of consumer services.
Further training	The right to continue education at the second (master's) level of higher education. Acquisition of additional qualifications in the system of postgraduate education.

5 – Teaching and assessment	
Teaching and learning	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. - 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; - independent work with the use of methodological and scientific information sources; - participation in research project development groups; - consultations with scientific and pedagogical workers. The training ends with the writing and public defense of the thesis (project).
Evaluation	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 qualifying work. Assessment of students' knowledge is carried out in accordance with the Regulations on the system of assessment of learning outcomes in Igor Sikorsky KPI for all types of classroom and extracurricular work (current, calendar, semester control); oral and written exams, tests.
6 – Program competencies	
Integral competence	Ability to solve complex specialized problems and practical problems, characterized by complexity and uncertainty of conditions, during professional activities in the field of electronics, or in the learning process, which involves the application of theories and methods of electronics.
General competencies (GC)	
GC1. Ability to apply knowledge in practical situations.	
GC2. Knowledge and understanding of the subject area and understanding of professional activity.	
GC3. Ability to communicate in the state language both orally and in writing	
GC4. Ability to communicate in a foreign language.	
GC5. Skills in the use of information and communication technologies.	
GC6. Ability to learn and master modern knowledge.	
GC7. Ability to search, process and analyze information from various sources.	
GC8. Interpersonal skills.	
GC9. Ability to work in a team.	
GC10. Implementation of safe activities.	
GC11. Ability to evaluate and ensure the quality of work performed.	
GC12. Definiteness and perseverance in terms of tasks and responsibilities.	

GC13. The 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.
GC14. 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 leading a healthy lifestyle.
Special (professional, subject) competencies (SC)
SC1. Ability to use knowledge and understanding of scientific facts, concepts, theories, principles and methods for the design and application of devices, devices and systems of electronics.
SC2. Ability to perform analysis of the subject area and regulatory documentation required for the design and application of devices, devices and electronics systems.
SC3. Ability to integrate knowledge of fundamental sections of physics and chemistry to understand the processes of solid-state, functional and power electronics, electrical engineering.
SC4. 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.
SC5. 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.
SC6. Ability to identify, classify, evaluate and describe processes in electronics devices, devices and systems using analytical methods, modeling tools, prototypes and experimental results.
SK7. Ability to apply creative and innovative potential in the synthesis of engineering solutions and in the design of devices and electronics systems.
SC8. 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 and systems.
SC9. 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.
SC10. Ability to apply in practice industry standards and quality standards of functioning of devices and systems of electronics.
SC11. Ability to monitor and diagnose the condition of 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.
SC12. Ability to apply knowledge of modern technologies of processing and protection of acoustic information, information technologies in the field of acoustic electronic systems.
SC13. Ability to develop technical and design documentation for electroacoustic devices and systems designed to work in gases, liquids, and solids, in accordance with industry regulations; to carry out their testing, certification and examination.
SC14. Ability to apply modern methods for the development of new electroacoustic technologies, devices and systems designed for acoustic non-destructive testing, acoustoelectronics, medical acoustics, hydroacoustics, electroacoustics, architectural acoustics, acoustic ecology

7 – Program learning outcomes	
O1	Describe the principle of operation using scientific concepts, theories and methods and verify the results in the design and application of devices, devices and electronics systems.
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 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, electromagnetism, statistical physics, solid state physics.
O4	Evaluate the characteristics and parameters of electronic materials, understand the basics of solid-state 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 procedures for conducting experiments) to test hypotheses and study the phenomena of electronics, be able to use standard equipment, plan, draw diagrams, analyze, model and critically evaluate the results.
O7	Analyze complex digital and analog information and measurement systems with advanced architecture of computer and telecommunication networks, taking into account the specification of selected technical means of electronics and relevant technical documentation. Identify and identify mathematical models of technological objects in the development of new complex electronic systems in the computer environment and the choice of the optimal solution.
O8	Define and identify mathematical models of technological objects in the development of new complex electronic systems in the computer environment and the choice of 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 professionals, conduct literary searches and read texts on technical and professional topics.
O13	Be able to learn 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, to control the reliability of the obtained results; to 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	Apply knowledge of modern technologies for processing and protection of acoustic information, information technology in the field of acoustic electronic systems.
O20	Develop technical and design documentation for electroacoustic devices and systems designed to work in gases, liquids, and solids, in accordance with industry regulations; to carry out their testing, certification and examination.
O21	Apply modern methods for the development of new electroacoustic technologies, devices and systems designed for acoustic non-destructive testing, acoustoelectronics, medical acoustics, hydroacoustics, electroacoustics, architectural acoustics, acoustic ecology

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 from 30.12.2015 № 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine №347 from 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 from 30.12.2015 № 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine № 347 from 10.05.2018. Use of equipment for lectures in the format of presentations, network technologies, in particular on the Sikorsky distance learning platform, demonstration industry equipment during laboratory workshops.
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 License Conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine from 30.12.2015 № 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine № 347 from 10.05.2018 Use of the Scientific and Technical Library of Igor Sikorsky KPI.

9 – Academic mobility	
National credit mobility	Possible subject to the conclusion of relevant agreements on national mobility and double diplomacy
International credit mobility	Possible subject to the conclusion of relevant agreements
Training of foreign applicants for higher education	Studying in general groups of Ukrainian students or in separate groups with teaching disciplines in English with the study of Ukrainian as a foreign language.

2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Course code	Components of the educational program (academic disciplines, practices, qualification work)	Number of credits	Form of final control
Mandatory (regulatory) educational components			
General training cycle			
GE 1	Ukrainian language for professional purposes	2	test
GE 2	History of science and technology	2	test
GE 3	Basics of a healthy lifestyle	3	test
GE 4	Foreign Language	6	test
GE 5	Foreign language for professional purposes	6	examination
GE 6	Environmental safety of engineering activities	2	test
GE 7	Introduction to philosophy	2	test
GE 8	Business law	2	test
GE 9	Economics and organization of production	4	test
GE 10	Labor protection and civil protection	4	test
GE 11	Mathematical analysis	17.5	examination
GE 12	Analytical geometry	4.5	examination
GE 13	Physics	12	examination
GE 14	Engineering and computer graphics	6	examination
GE 15	Informatics	8	test
Cycle of professional training			
PE 1	Measurement technique	3.5	test
PE 2	Fundamentals of analytical mechanics and theory of oscillations	4	test
PE 3	Physical basics of electronics	4	examination
PE 4	Theory of electric circuits	4	test
PE 5	Probabilistic bases of data processing	5	examination
PE 6	Circuitry	6.5	examination
PE 7	Applied mechanics	4	examination
PE 8	Acoustic information processing software	3	test
PE 9	Computational mathematics	4	test
PE 10	Special sections of the theory of electric circuits	4.5	examination
PE 11	Course work on special sections of the theory of electric circuits	1	test
PE 12	Theoretical foundations of acoustics	4	test
PE 13	Theory of processes and systems	3.5	test
PE 14	Physical acoustics	8.5	examination
PE 15	Methods of acoustic signal processing	4	examination
PE 16	Fundamentals of design in electronics	4	examination
PE 17	Electroacoustic transducers	5	examination
PE 18	Course project on electroacoustic transducers	1.5	test
PE 19	Acoustic devices and systems	4.5	examination
PE 20	Electroacoustics	4	examination
PE 21	Fundamentals of microprocessor technology	4.5	examination
PE 22	Pre-diploma practice	6	test
PE 23	Diploma design	6	defense

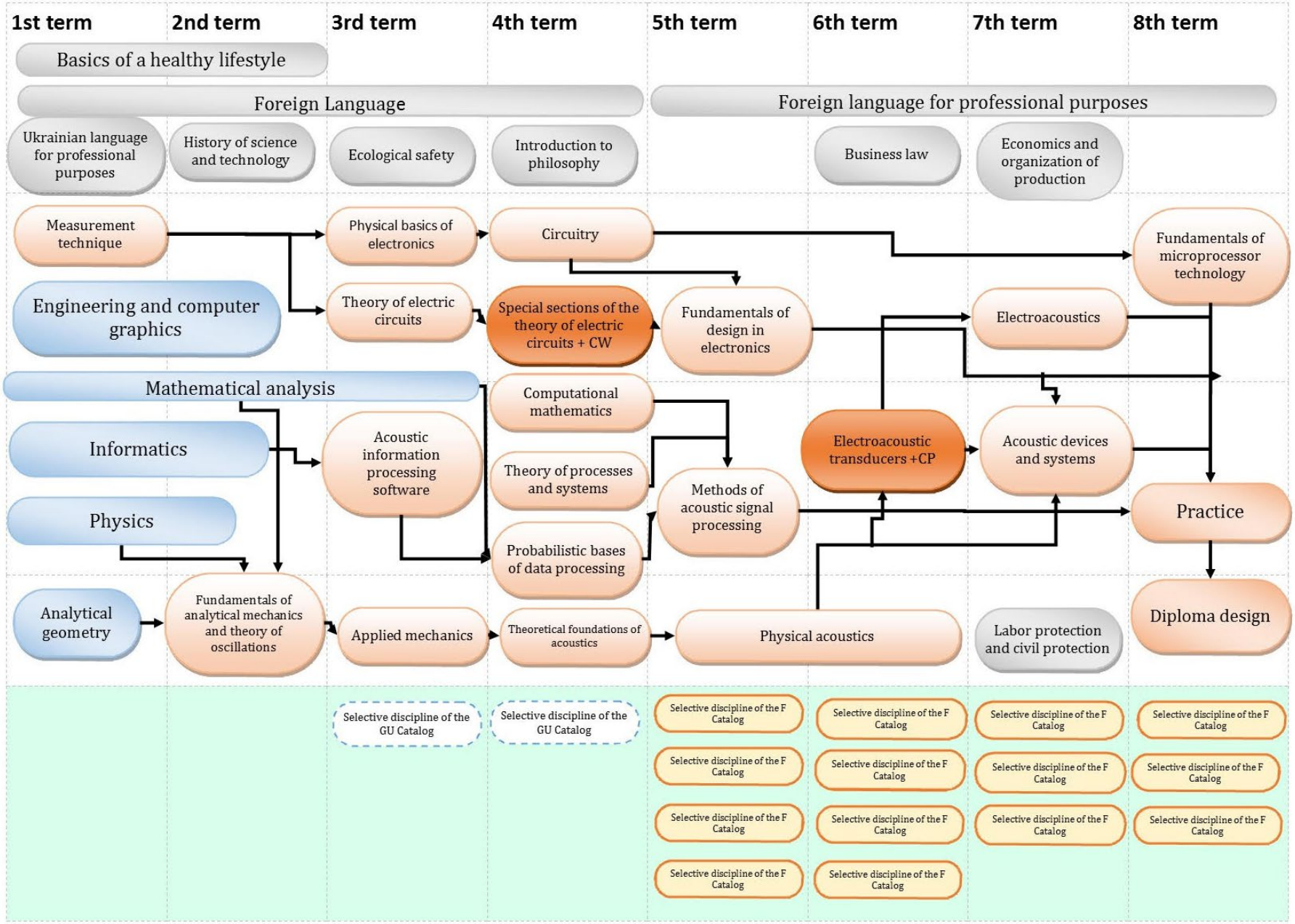
Selective educational components			
General training cycle			
GS 1	Educational component 1 of GU Catalog	2	test
GS 2	Educational component 2 of GU Catalog	2	test
Cycle of professional training			
PS 1	Educational component 1 of F Catalog	4	test
PS 2	Educational component 2 of F Catalog	4	test
PS 3	Educational component 3 of F Catalog	4	test
PS 4	Educational component 4 of F Catalog	4	test
PS 5	Educational component 5 of F Catalog	4	test
PS 6	Educational component 6 of F Catalog	4	test
PS 7	Educational component 7 of F Catalog	4	test
PS 8	Educational component 8 of F Catalog	4	test
PS 9	Educational component 9 of F Catalog	4	test
PS 10	Educational component 10 of F Catalog	4	test
PS 11	Educational component 11 of F Catalog	4	test
PS 12	Educational component 11 of F Catalog	4	test
PS 13	Educational component 11 of F Catalog	4	test
PS 14	Educational component 11 of F Catalog	4	test
The total amount of **normative educational components**:		**180**	
The total amount of **selective educational 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. Form of final certification of higher education applicants

Certification is carried out in the form of public defense (demonstration) of qualifying work.

Requirements for the qualification work: The qualification work must contain a 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 university, its department or in the university depository. Publication of qualification works containing information with limited access is carried out in accordance with the requirements of current legislation.

4. Structural and logical scheme of the educational program



5. Matrix of correspondence of program competences to components of the educational program

	GE 1	GE 2	GE 3	GE 4	GE 5	GE 6	GE 7	GE 8	GE 9	GE 10	GE 11	GE 12	GE 13	GE 14	GE 15	PE 1	PE 2	PE 3	PE 4	PE 5	PE 6	PE 7	PE 8	PE 9	PE 10	PE 11	PE 12	PE 13	PE 14	PE 15	PE 16	PE 17	PE 18	PE 19	PE 20	PE 21	PE 22	PE 23
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GC2																		+			+	+	+		+	+										+		
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SC14											+																								+	+	+	+

6. Matrix for providing program learning outcomes with relevant components of the educational program

	GE 1	GE 2	GE 3	GE 4	GE 5	GE 6	GE 7	GE 8	GE 9	GE 10	GE 11	GE 12	GE 13	GE 14	GE 15	PE 1	PE 2	PE 3	PE 4	PE 5	PE 6	PE 7	PE 8	PE 9	PE 10	PE 11	PE 12	PE 13	PE 14	PE 15	PE 16	PE 17	PE 18	PE 19	PE 20	PE 21	PE 22	PE 23
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