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

ELECTRONIC SYSTEMS OF MULTIMEDIA AND INTERNET OF THINGS TECHNOLOGY

EDUCATIONAL AND SCIENTIFIC PROGRAM

second (master's) level of higher education

in specialty	**171 "Electronics"**
field of knowledge	**17 "Electronics and telecommunications"**
qualification	**Master's degree in 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

PREAMBLE

DEVELOPED by the project group:
Project team leader:
Popovych Pavlo Vasylovych, Ph.D., Docent, Associate Professor of the Department of Acoustic and Multimedia Electronic Systems
Project team members:
Pilinskyi Volodymyr Volodymyrovych, Ph.D., Professor, Professor of the Department of Acoustic and Multimedia Electronic Systems
Onykienko Yurii Oleksiiovych, Ph.D., Docent, Associate Professor of the Department of Acoustic and Multimedia Electronic Systems
Baran Vadym Serhiiovych, graduate student of the Department of Acoustic and Multimedia Electronic Systems
The Department of Acoustic and Multimedia Electronic Systems *is responsible for the preparation of higher education applicants under this educational program*
AGREED:
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)
Proposals of interested persons are taken into account:
The program was updated in accordance with the standard of higher education, the results of meetings with students and employers, discussions at meetings of the Department of Acoustic and Multimedia Electronic Systems.
1. Methodical recommendations of the higher education sector of the Scientific and Methodological Council of the Ministry of Education and Science of Ukraine https://mon.gov.ua/ua/osvita/visha-osvita/naukovo-metodichna-rada-ministerstva-osviti-i-nauki-ukrayini/ metodichni-rekomendaciyi-vo
2. Standard of higher education in the specialty 171 Electronics of the second (master's) level https://mon.gov.ua/storage/app/media/vyshcha/standarty/ 2020/05/2020-zatverd-standart-171-m.pdf
3. Comments and suggestions of employers and other stakeholders on the results of public discussion:
- scientific and pedagogical staff of the Department of Acoustic and Multimedia Electronic Systems;
- applicants for higher education who study in educational programs specialty 171 Electronics;
- specialists of the educational and methodical department of Igor Sikorsky KPI;
- specialists in the field of Electronics and Telecommunications (reviews and letters of support added).
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 the higher education institution and institute / faculty	National Technical University of Ukraine " Igor Sikorsky Kyiv Polytechnic Institute", Faculty of Electronics
Degree of higher education and title of qualification qualification in English	Degree - Master Qualification - Master of Electronics
Cycle / level of higher education	National Qualifications Framework of Ukraine - 7 level QF-EHEA – the second cycle EQF-LLL - 7 level
The official title of the educational program	Electronic systems of multimedia and Internet of Things technology
Type of diploma and scope of educational program	Master's degree, single, 120 credits, term of study 1 year 9 months
Availability of accreditation	Certificate of accreditation of the specialty НД 1192632, valid until 01.07.2023
Prerequisites	Having a bachelor's degree
Language (s) of instruction	Ukrainian
Term of the educational program	Until the next review
Internet address of the permanent placement of the educational program	https://osvita.kpi.ua/171_ONPM_ESMZIR
2 - The purpose of the educational program	
Training of an electronics specialist capable of solving complex specialized tasks and practical problems of design, production, operation, maintenance, repair and modernization of acoustic electronic systems, able to carry out professional activities, aimed at fruitful and efficient work in the conditions of sustainable innovative scientific and technical development of society and formation of high adaptability education in the context of labor market transformation through interaction with employers and other stakeholders.	

3 - Characteristics of the educational program	
Subject area	*Object of activity:* basic physical processes and phenomena on which the functioning of electronic equipment, devices and systems is based, primary and secondary information conversion systems, analog and digital components, processes and systems of collection, storage, protection, processing, transmission of audio-visual information and integration of these systems to automate the process of solving engineering problems using modern microprocessor and computer hardware and software. *Learning objectives:* acquisition of theoretical and practical knowledge and skills, abilities and other competencies for successful professional activity: use of technologies, materials and devices of electronic equipment; design, manufacture, testing, installation and installation, operation, restoration and modernization of electronic multimedia systems and Internet of Things. *Theoretical content of the subject area:* fundamental principles of construction of modern electronic multimedia systems and means of the Internet of Things, control and management systems, methods of modeling objects and processes and their optimization, modern computer and information technologies of audio-visual information processing, engineering and scientific tools research, theory of planning and conducting experiments. *Methods, techniques and technologies:* research of processes in electronic systems of creation, processing and transfer of audio-visual information, and also processes and technologies of functioning and interaction of electronic means of the Internet of Things, methods of planning of experiment with processing of results; application of modern technologies for designing electronic systems, devices and devices of multimedia and means of the Internet of Things, Tools and equipment: electronic equipment, devices, components and systems, control and measuring equipment, multimedia electronic systems for various purposes, including equipment for video recording, recording and display of audiovisual information, microcontroller control systems and processing of audiovisual information, analysis software, calculation and modeling of processes in electronic multimedia devices and systems, in systems of interaction of electronic means and technologies of the Internet of Things.
Orientation of the educational program	Educational and scientific
The main focus of the educational program	Special education in the field of electronic and information systems and technologies of television, cinematography, audiovisual systems, systems of creation and distribution of audiovisual content and networking of electronic devices with the acquisition of research skills for scientific and teaching careers **Key words:** audiovisual content, electronic information systems, digital cinematography, multiservice network, television, video surveillance, technical vision systems, Internet of Things.

Features of the program	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. The educational-scientific program contains educational disciplines of the educational-professional program and additional disciplines on specialization which deepen knowledge from special sections of fundamental and professionally-oriented disciplines and provide research competences for the further educational-scientific activity. Students receive highly qualified scientists in the field of electronics and can work in higher education institutions, research institutions and enterprises of Ukraine in the relevant profile. The program will be implemented with the involvement of specialists and experts in the specialty 171 Electronics, as well as representatives of stakeholders.
4 - Suitability of graduates for employment and further study	
Suitability for employment	2144 Professionals in electronics and telecommunications - Engineer in the field of electronics and telecommunications; - Sound engineer - Electronic engineer - Design engineer (electronics) - Researcher (electronics, telecommunications) - Junior researcher (electronics, telecommunications) - Researcher-consultant (electronics, telecommunications) 2149 Professionals in other fields of engineering - Research engineer - Debugging and testing engineer (electronics) - Standardization and quality engineer - Engineer - Engineer for organization of operation and repair (electronics)
Further study	The Master of Electronics has the right to study in the program of Doctor of Philosophy
5 - Teaching and assessment	
Teaching and studying	General learning style - task-oriented. Teaching is provided in the form of: lectures, seminars, practical classes, laboratory classes, independent work with the possibility of consultation with the teacher, individual classes, classes with the use of information and communication technologies (e-learning, online lectures, OCW, distance learning courses) educational components. The program provides: - 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 groups for the development of research projects; - consultations with scientific and pedagogical workers. The study ends with the writing and public defense of the qualification work - a master's thesis.

Assessment	Assessment of students' knowledge is provided in accordance with the Regulations on the system of assessment of learning outcomes in KPI. Igor Sikorsky for all types of classroom and extracurricular work (current, calendar, semester control); with the use of 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 research and / or innovation in the application of theories and methods of electronics.
Common Competences (GC)	
CC 1	Ability to abstract thinking, analysis and synthesis
CC 2	Ability to communicate in the state language both orally and in writing.
CC 3	Ability to communicate in foreign languages both orally and in writing
CC 4	Ability to conduct research at the appropriate level
CC 5	Ability to search, process and analyze information from various sources
CC 6	Ability to generate new ideas (creativity)
CC 7	Ability to interpersonal interaction
CC 8	Ability to communicate with representatives of other professional groups of different levels (with experts from other fields of knowledge / types of economic activity)
Professional competencies of the specialty (PC)	
PC 1	Ability to assess the level of existing technologies of the electronic industry in the field of professional activity, the effectiveness of technical solutions
PC 2	Ability to plan and implement innovative projects in the field of electronics, protect intellectual property rights
PC 3	Ability to systematically solve problems of development, analysis, calculation, modeling of electronic devices, components, devices and systems for various purposes
PC 4	Ability to use information, computer and multimedia technologies, methods of modeling, intellectualization, artificial intelligence, experimental methods for research and analysis of processes in electronic devices, components, devices and systems
PC 5	Ability to ensure the efficiency and quality of measurements in electronic devices, components, devices and systems
PC 6	Ability to find the necessary information with the help of modern information resources, analyze and evaluate it
PC 7	Ability to solve problems of processing and displaying information in modern electronic devices, devices and systems
PC 8	Ability to assess problem situations and shortcomings in the development, design, commissioning, operation and operation of electronic devices, devices and systems, to formulate proposals for solving problems
PC 9	Ability to take into account in design and technological, engineering and scientific and technical solutions requirements for safety of life, protection of intellectual property, energy efficiency and environmental friendliness
PC 10	Ability to analyze, synthesize and optimize modern electronic multimedia systems and Internet of Things, control and management systems, as well as to process information flows and signals of these systems.
PC 11	Ability to develop design and technological documentation for the manufacture of electronic devices, devices and systems of multimedia and systems using Internet of Things technologies, in accordance with industry regulations; carry out testing, certification and examination of electronic equipment and systems.

PC 12	Ability to apply modern methods for the development of advanced technologies, devices and systems for the needs of multimedia systems and the Internet of Things.
PC 13	Ability to plan and conduct research using modern experimental methods and tools and methods of computer modeling, analyze research results, substantiate conclusions and recommendations
PC 14	Ability to formulate the novelty and relevance of research work, lead a scientific discussion and present the results of research on a given topic in the field of development and operation of electronic devices, devices, multimedia systems and the Internet of Things
7 - Program learning outcomes	
O 1	Implement projects to modernize production and technology in the field of electronics, implement the latest information and communication technologies, multimedia
O 2	Model and experimentally study phenomena and processes in electronic devices, devices and systems, in technologies of the electronic industry
O 3	Collaborate with the customer during the formulation of the terms of reference and discussion of technical solutions and results of projects, to lead a reasoned professional and scientific discussion
O 4	Develop low-waste, energy-saving and environmentally friendly technologies, taking into account the requirements of safety of human life, rational use of raw materials, energy and other resources
O 5	Ensure energy and economic efficiency of development, production and operation of electronic equipment
O 6	Ensure professional development of team members taking into account the world level of scientific and engineering achievements in the field of development and operation of electronic devices, devices and systems
O 7	Carry out information and scientific research using scientific, technical and reference literature, databases and knowledge, other sources of information; critically comprehend and interpret existing knowledge and data, form directions of research and development taking into account domestic and foreign experience
O 8	Carry out and coordinate the development, selection, use and modernization of the necessary equipment, tools and methods during the organization of the production process, taking into account technical and technological capabilities, modern science-intensive methods, tools and technical solutions.
O 9	Coordinate the work of teams of researchers in the field of research, design, development, analysis, calculation, modeling, production and testing of electronic components, devices and systems, taking into account the requirements of civil and moral values, human rights and freedoms, the rule of law
O 10	Choose the best research methods, modify, adapt and develop new methods
O 11	Analyze technical and economic indicators, reliability, ergonomics, patent purity, market needs, investment climate and compliance of design solutions, research and development with certain goals and norms of the legislation of Ukraine
O 12	To generalize modern scientific knowledge in the field of electronics and apply them to solve complex scientific and technical problems, bringing the obtained solutions to the level of competitive developments, implementation of results in business projects
O 13	Organize and manage research, innovation and investment activities, business projects and production processes taking into account technical, technological and economic factors
O 14	Analyze, synthesize and optimize modern electronic systems of multimedia and Internet of Things, control and management systems, as well as process signals, images and phonograms of electronic systems of multimedia and Internet of Things

O 15	Develop design and technological documentation for the manufacture of electronic systems for equipment of multimedia systems and the Internet of Things in accordance with industry regulations; carry out their testing, certification and examination
O 16	Apply modern methods for the development of advanced technologies, devices and systems for the needs of multimedia systems and the Internet of Things
O 17	Solve scientific and technical problems by means of computer and microprocessor technology, software and hardware means of information visualization
O 18	Develop advanced electronic systems for converting information parameters using a modern element base and modern technologies
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 distance learning platform Sikorsky, 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 dated 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
International credit mobility	A framework agreement on cooperation between the University of LeMans (France) and NTUU "KPI" dated June 23, 2015 on international cooperation and a double master's degree in acoustoelectronics
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.

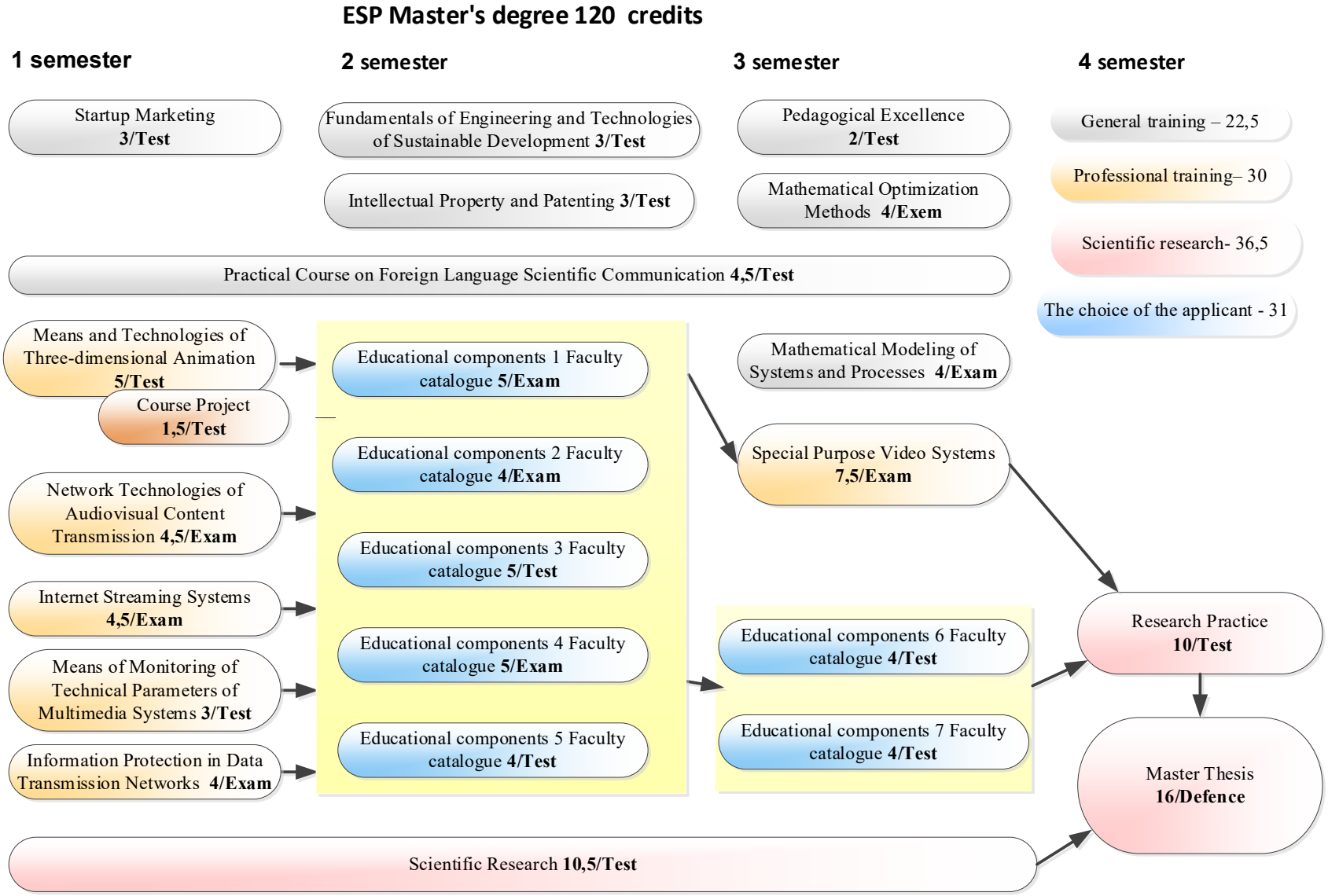
2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Code n / a	Components of the educational program (academic disciplines, practices, qualification work)	Number of credits	Form of final control
1	2	3	4
1. REGULATORY educational components			
1.1. General training cycle			
GC1	Intellectual Property and Patenting	3	Final tests
GC2	Fundamentals of Engineering and Technologies of Sustainable Development	2	Final tests
GC3	Practical Course on Foreign Language Scientific Communication	3	Final tests
GC4	Startup Marketing	3	Final tests
GC5	Pedagogical Excellence	2	Final tests
GC6	Mathematical Optimization Methods	4	Exam
GC7	Mathematical Modeling of Systems and Processes	4	Exam
1.2. Cycle of professional training			
VC1	Means and Technologies of Three-dimensional Animation	5	Final tests
VC2	Course Project on Means and Technologies of Three-dimensional Animation	1,5	Final tests
VC3	Network Technologies of Audiovisual Content Transmission	4,5	Exam
VC4	Internet Streaming Systems	4,5	Exam
VC5	Means of Monitoring of Technical Parameters of Multimedia Systems	3	Final tests
VC6	Information Protection in Data Transmission Networks	4	Exam
VC7	Special Purpose Video Systems	7,5	Exam
Research (scientific) component			
VC7	Scientific Research	10,5	Final tests
VC8	Research practice	10	Final tests
VC9	Master Thesis	16	Defense
2. Selective educational components			
2.1. Cycle of professional training (Selective educational components from faculty / departmental Catalogs)			
VO1	Educational components 1 Faculty catalogue*	5	Exam
VO2	Educational components 2 Faculty catalogue*	4	Exam
VO3	Educational components 3 Faculty catalogue*	5	Final tests
VO4	Educational components 4 Faculty catalogue*	5	Exam
VO5	Educational components 5 Faculty catalogue*	4	Final tests
VO6	Educational components 6 Faculty catalogue*	4	Final tests
VO7	Educational components 7 Faculty catalogue*	4	Final tests
The total amount of normative educational components:		**89**	
The total amount of selective educational components:		**31**	
The scope of educational components that ensure the acquisition of competencies defined by the SVO:		**59**	
TOTAL VOLUME OF THE EDUCATIONAL PROGRAM		**120**	

Designations and abbreviations given in the table:
GC is a normative discipline of the general training cycle
VC - normative discipline of the training cycle
VO - a selective discipline of the training cycle
F-catalog - a professional catalog of selective disciplines of the training cycle

3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM

4.



4. FORM OF FINAL CERTIFICATION OF HIGHER EDUCATION APPLICANTS

Graduation certification of applicants for higher education under the educational and scientific program of specialty 171 "Electronics" is provided in the form of defense of qualifying work. Based on the results of successful defense, the applicant is issued a document of the appropriate sample on the award of the qualification "Master of Electronics" in the educational and scientific program "Electronic multimedia systems and the Internet of Things."

Graduation certification is planned to be carried out openly and publicly. Qualification work should be checked for borrowings (plagiarism) and after protection it is placed in the repository of the NTB of the university for free access.

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

	GC 1	GC 2	GC 3	GC 4	GC 5	GC 6	GC 7	VC 1	VC 2	VC 3	VC 4	VC 5	VC 6	VC 7	VC 8	VC 9	VC 10
CC 1				+				+	+	+	+	+	+	+			+
CC 2	+	+		+	+				+				+			+	
CC 3			+							+	+		+				+
CC 4	+		+	+					+			+			+	+	+
CC 5	+	+	+						+	+	+						+
CC 6	+	+		+	+	+	+		+					+		+	+
CC 7			+	+	+				+						+	+	+
CC 8			+	+												+	
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	+					+	+							+		+	+

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

	GC 1	GC 2	GC 3	GC 4	GC 5	GC 6	GC 7	VC 1	VC 2	VC 3	VC 4	VC 5	VC 6	VC 7	VC 8	VC 9	VC 10
O 1		+	+	+				+	+	+	+	+	+		+	+	+
O 2						+	+	+	+					+	+	+	+
O 3	+			+	+			+	+						+	+	+
O 4		+		+											+		+
O 5		+		+								+			+		+
O 6	+	+		+	+			+	+	+	+	+	+		+	+	+
O 7	+		+						+			+	+		+		+
O 8		+		+		+				+	+	+			+		+
O 9		+		+				+	+			+			+	+	
O 10	+		+	+	+							+			+		+
O 11	+	+	+	+								+			+		+
O 12		+	+			+					+				+		+
O 13				+				+	+	+	+					+	+
O 14				+				+	+	+	+	+	+		+		+
O 15									+			+			+		+
O 16										+	+	+			+	+	+
O 17						+	+	+	+					+	+	+	+
O 18						+	+							+	+	+	+