

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

APPROVED

by Head of Academic Council
Igor Sikorsky Kyiv Polytechnic Institute

_____ Mykhaylo ILCHENKO

« 3 » _____ 15 _____ 2021 p.

ELECTRONIC DEVICES AND EQUIPMENT

EDUCATIONAL AND SCIENTIFIC PROGRAM

Level of higher education	second (master's) level
Speciality	171 Electronics
Qualification	Master in Electronics

APPROVED by Academic Council of university

protocol No HOH/89/2021
from «19» 04 2021

Kyiv – 2021

ПРЕАМБУЛА

PREFACE

DEVELOPED BY THE PROJECT GROUP:

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Project team members:

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APPROVED:

By Scientific and Methodological Commission of the University by specialty 171 Electronics

Chairman of the Scientific-Methodological Commission



Iulia YAMNENKO

(Protocol № 4 of 02.02.21.)

Methodical Council of KPI. Igor Sikorsky

Head of the Methodical Council _____

Yuriy

YAKYMENKO

(protocol No 6 from « 25 » 02 2021)

TAKING INTO ACCOUNT:

The program was updated in accordance with the standard of higher education, the results of meetings with students and employers, discussion at meetings of the Department of Electronic Devices and 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](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 stakeholders based on the results of public discussion:

- scientific and pedagogical staff of the Department of Electronic Devices and Systems;
- applicants for higher education who study in educational programs in the specialty 171 Electronics;
- specialists of the educational and methodical department of KPI named after Igor Sikorsky;
- Electronics and telecommunications specialists (feedback and letters of support are attached).

Coordinated with members of the scientific-methodical commission and the specialization group 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 Educational Program by the specialty 171 - Electronics

1 – Загальна інформація	
Full name of university and Institute/Faculty	National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Faculty of Electronics
Level of higher education and qualification	Level of higher education – Master Qualification – Master in Electronics
Level of HPK	HPK of Ukraine – Level 7 QF-EHEA – Second cycle EQF-LLL – Level 7
Official name of educational program	Electronic Devices and Systems
Type of diploma and volume of educational program	Master's diploma, single, 90 ECTS credits , terms of study – 1 year and 4 months
Presence of accreditation	Certificate of accreditation of the specialty НД 1192632, approved till July, 01, 2023
Pre-requisites	Existing Bachelor level Diploma
Languages of study	Ukrainian
Expiring date	Till next revision
Link to constant placement of educational program	http://eds.kpi.ua/?page_id=5040
2 – Мета освітньої програми	
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, components and systems of electronics, aimed at fruitful and efficient work in a sustainable innovative scientific and technological 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	

3 – Характеристика освітньої програми

Object of activity	<p><i>Object of activity:</i> Basic physical processes and phenomena on which the functioning of electronic devices and systems, circuit solutions, hardware and software of electronics, microprocessor and microcontroller devices, processes and systems of collection, storage, protection, processing, transformation and transmission of information, integration of these devices and systems to automate the solution of engineering problems based on modern computer hardware and software, control and modeling of electronic devices and systems</p> <p><i>Learning objectives:</i> 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 equipment based on the use of modern circuit solutions.</p> <p><i>Theoretical content of the subject area:</i> fundamental principles of construction of modern electronic systems, control and management systems, methods of modeling objects and processes and their optimization, modern computer and information technologies, tools of engineering and scientific research, theory of planning and conducting experiments.</p> <p><i>Methods, techniques and technologies:</i> research of processes in electronic devices, devices and systems; planning an experiment with processing the results; modern computer and information technologies; application of technologies of mathematical and physical-topological modeling, cloud computing in the design of electronic devices, devices, components and systems</p> <p><i>Tools and equipment:</i> electronic devices, devices, components and systems, control and measuring equipment, electronic systems for various purposes, including technological vacuum and plasma, microwave, functional, laser and optoelectronic, registration and display of information, technical vision, microcontroller control systems, software tools for analysis, calculation and modeling of processes in electronic devices, devices, components and systems</p>
Orientation of the educational program	Educational-scientific

<p>The main focus of the educational program</p>	<p>The main focus of the educational program is educational and professional. Special education in electronics, in particular, industrial and power electronics, analog and digital circuitry, converter and microprocessor technology, electronic devices, devices and systems with the acquisition of research skills for scientific and teaching careers</p> <p>Keywords: power electronics, industrial electronics, analog circuitry, digital circuitry, electronic systems, electronic process equipment</p>
<p>Particularities of the educational program</p>	<p>Features of the program Implementation of the program involves the involvement of specialists and experts in the field of electronics, as well as representatives of stakeholders</p> <p>The educational-professional program includes educational disciplines of the educational-professional program and additional disciplines which deepen knowledge from special sections of fundamental and professionally-oriented disciplines and provide design, designing and technological competences for the further engineering and research activity.</p> <p>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. Students have the opportunity to study double degree programs with the Technical University of Dresden (Germany) and the Korean Institute of Science and Technology (South Korea).</p>

4 – Suitability graduates for employment	
Suitability for employment	<p>Suitability for employment According to the State Classification of Occupations DK 003: 2010 graduates can work in the following positions:</p> <p>2143 Professionals in the field of electrical engineering</p> <ul style="list-style-type: none"> – Engineer of relay protection and electrical automation – Engineer of the transforming complex <p>2144 Professionals in electronics and telecommunications</p> <ul style="list-style-type: none"> – Engineer in the field of electronics and telecommunications; <ul style="list-style-type: none"> – Recording engineer – Electronics engineer – Electronics engineer of non-traditional and renewable energy production systems – Design engineer (electronics) <p>2149 Professionals in other fields of engineering</p> <ul style="list-style-type: none"> – Engineer – Engineer for control of gas metering systems – Debugging and testing engineer (electronics) – Standardization and quality engineer <ul style="list-style-type: none"> – Engineer for organization of operation and repair (electronics)
Further Education	The Master of Electronics has the right to master the programs of the Doctor of Philosophy

5 – Teaching and assessment	
Teaching and assessment	<p>The general style of learning is task-oriented. Teaching is carried out in the form of: lectures, seminars, practical classes, laboratory classes, independent work with the possibility of consultation with the teacher, individual classes, application of information and communication technologies (e-learning, online lectures, OCW, distance learning courses) 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; - providing of auditorium classes 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 employers. <p>The students carried out the course projects and works, have the practice training in Ukraine and abroad. The study is finished with the writing and public defense of a qualifying work - a master's thesis.</p>
Estimation	Estimation of students' knowledges is provided correspondently to Regulations on the system of assessment of learning outcomes in KPI. Igor Sikorsky for all types of classrooms and extracurricular work (current, calendar, semester control); oral and written exams, tests.
6 – General Competences	
Integral competence	Ability to solve complex specialized problems and practical problems characterized by complexity and uncertainty of conditions in the field of electronics during professional activities or in the learning process, which involves research and / or innovation in the application of theories and methods of electronics
General Competences (GC)	
GC 1	Ability to abstract thinking, analysis and synthesis
GC 2	Ability to use the knowledges at practice situations

GC 3	Ability to communicate in the state and foreign language both orally and in writing
GC 4	Ability to perform research at the appropriate level
GC 5	Ability to search, process and analyze information from various sources
GC 6	Ability to generate new ideas (creativity)
GC 7	Interpersonal skills
GC 8	Ability to communicate with representatives of other professional groups of different levels (with experts from other fields of knowledge / types of economic activity)
Vocational competencies (VC)	
VC 1	Ability to assess the level of existing technologies in the field of professional activity, the effectiveness of technical solutions
VC 2	Ability to plan and implement innovative projects in the field of electronics, protect intellectual property rights
VC 3	Ability to systematically solve problems of development, analysis, calculation, modeling of electronic power, information, control and multimedia systems
VC 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 systems
VC 5	Ability to ensure the efficiency and quality of measurements in electronic systems
VC 6	Ability to find the necessary information with the help of modern information resources, analyze and evaluate it
VC 7	Ability to solve problems of processing and displaying information in modern electronic systems
VC 8	Ability to assess problem situations in the field of development, design, tune-up, functioning and operation of electronic systems, to formulate proposals for solving problems
VC 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
VC 10	Ability to present the results investigation to expert and non-experts, providing the discussion and to argument the owner position
VC 11	The ability of planning and realizing of the investigations with applying the modern experimental methods and instruments, as well as methods of computer simulation, analyzing of investigations results, and substantiate the conclusions and recommendations
VC 12	The ability of formulation the novelty and actuality of scientific research work, providing the scientific discussion and to present the results of investigation by the specified topic in the field of elaboration and functionality of electronic devices, power and information systems
VC 13	The ability of applying the technical equipment and installations, intelligent systems, software and instruments to providing the scientific experiments for treatment the results of experimental investigations
VC 14	The ability of applying the base ideas on innovation activity and particularities of acquisition and using the rights to intellectual property.

7 – Програмні результати навчання	
R1	Implement projects for modernization of production and technologies in the field of electronics, introduction of the latest information and communication technologies, multimedia
R2	Modelling and experimentally study the phenomena and processes in electronic devices and systems, as well as in technologies of the electronic industry
R3	To cooperate with the customer in the formulation of the technical task and discussion of technical solutions and results of projects, to lead a reasoned professional and scientific discussion
R4	Develop low-waste, energy-saving and environmentally friendly technologies taking into account the requirements of human safety, rational use of raw materials, energy and other resources
R5	Ensure energy and economic efficiency of development, production and operation of electronic equipment
R6	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 systems
R7	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
R8	Carry out and coordinate the development, selection, use and modernization of the necessary equipment, tools and methods in the organization of the production process, taking into account technical and technological capabilities, modern science-intensive methods, tools and technical solutions
R9	Coordinate the work of teams of performers in the field of research, design, development, analysis, calculation, modeling, production and testing of electronic devices and systems taking into account the requirements of civil and moral values, human rights and freedoms, the rule of law
R10	Choose the best research methods, modify, adapt and develop new methods
R11	Analyze technical and economic indicators, reliability, ergonomics, patent purity, market requirements, investment climate and compliance of design solutions, research and development with certain goals and norms of the legislation of Ukraine
R12	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

R13	Organize and manage research, innovation and investment activities, business projects and production processes taking into account technical, technological and economic factors
R14	Apply mathematical, scientific and technical methods, automatic design tools and computer programs for the development of electronic devices, devices, components and systems
R15	Taking part in the elaboration and performance the projects of international projects of scientific collaboration and academic mobility
R16	Elaboration of electronic systems for obtaining the desirable technical and economical parameters of functionality, . Розробляти електронні системи для отримання бажаних технічних та економічних параметрів функціонування, proof of research decision to the level of competitive developments
R17	To solve the scientific and technical tasks with the means of computer and microprocessor technique, software and hardware means of information visualization
R18	Elaborate the improved electronic systems for transmission the information parameters with using the modern element base and technologies
8 – Resource support for program implementation	
Staffing	In accordance with the staffing requirements for ensuring the implementation of educational activities for the relevant level of High 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	In accordance with the technological requirements for logistics of educational activities of the relevant level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine № 347 dated 10.05.2018. Use of equipment for lectures in the format of presentations, network technologies, in particular on the Sikorsky distance learning platform, demonstration industry equipment during laboratory workshops.
Information and educational-methodical support	In accordance with the technological requirements for educational-methodical and informational support of educational activities of the relevant level of HE (Annex 5 to the License Terms), approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 as amended by the Resolution Cabinet of Ministers of Ukraine № 347 dated May 10, 2018 Use of the Scientific and Technical Library of KPI named after Igor Sikorsky

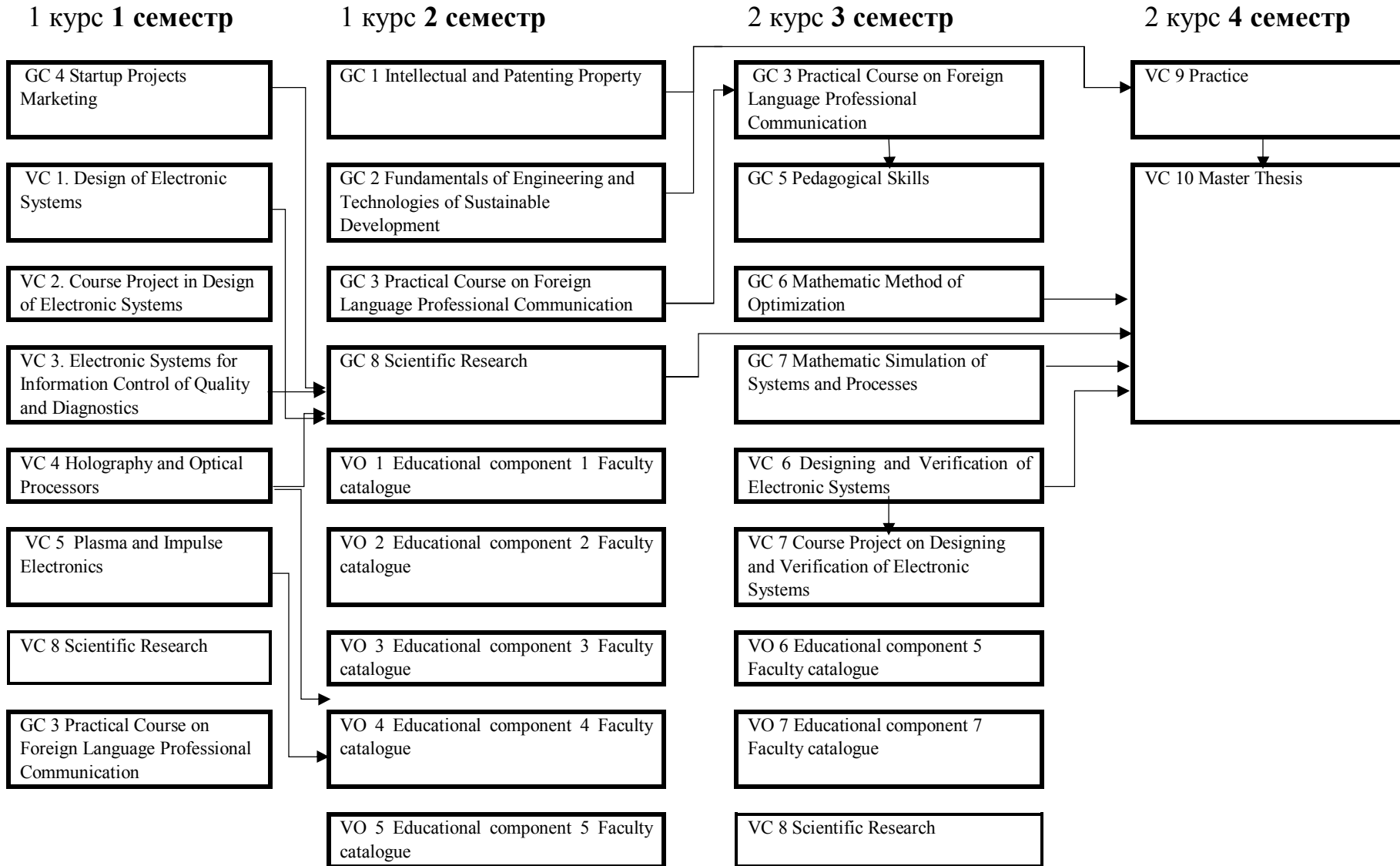
9 – Academic mobility	
National credit mobility	Possible, in the case of signing the specific agreement.
International Credit Mobility	Double Diploma Program with the Technical University of Dresden (Germany)
Training of foreign applicants for higher education	Possibility of teaching in Ukrainian in general training groups or in English with the provision of learning Ukrainian as a foreign language

2. List of components of the educational program

Code	Educational components (academic disciplines, course projects (works), practices, qualification work)	ECTS Credits	Final test forms
1	2	3	4
1. COMPULSORY educational components			
1.1. General training cycle			
GC 1	Intellectual and Patenting Property	3	Final tests
GC 2	Fundamentals of Engineering and Technologies of Sustainable Development	2	Final tests
GC 3	Practical Course on Foreign Language Professional Communication	4,5	Final tests
GC 4	Startup Projects Marketing	3	Final tests
GC 5	Pedagogical Skills	2	Final tests
GC 6	Mathematic Method of Optimization	4	Exam
GC 7	Mathematic Simulation of Systems and Processes	4	Exam
1.2. Vocational training cycle			
VC 1	Design of Electronic Systems	5	Exam
VC 2	Course Project in Design of Electronic Systems	1,5	Final tests
VC 3	Electronic Systems for Information Control of Quality and Diagnostics	5	Exam
VC 4	Holography and Optical Processors	5	Final tests
VC 5	Plasma and Impulse Electronics	6	Exam
VC 6	Designing and Verification of Electronic Systems	6	Exam
VC 7	Course Project on Designing and Verification of Electronic Systems	1,5	Final tests
Research (scientific) component			
VC 8	Scientific Research	10,5	Final tests
VC 9	Practice	10	Final tests
VC 10	Master Thesis	16	Defense

1	2	3	4
2. OPTIONAL educational components			
2.1. Vocational training cycle (Optional subjects from Faculty catalogue)			
VO 1	Educational component 1 Faculty catalogue	5	Exam
VO 2	Educational component 2 Faculty catalogue	4	Final tests
VO 3	Educational component 3 Faculty catalogue	5	Exam
VO 4	Educational component 4 Faculty catalogue	5	Exam
VO 5	Educational component 5 Faculty catalogue	4	Final tests
VO 6	Educational component 6 Faculty catalogue	4	Final tests
VO 7	Educational component 7 Faculty catalogue	4	Final tests
Total volume of required components :		89	
Total volume of optional components :		31	
The scope of educational components that ensure the acquisition of competencies defined by the HES		59	
TOTAL VOLUME OF THE EDUCATIONAL PROGRAM		120	

3. Structural and logical scheme of the educational program



4. FORM OF FINAL ATTESTATION OF STUDENTS

The final attestation of students in the educational program is conducted in the form of pu and finished with the issuance of a standard document on awarding a master's degree and qualif the educational program "Electronic Devices and Systems".

The aim of Qualification Work is defining of general scientific-technical, professional and control of his knowledge and skills, estimation of possibility independently analyzes the form task and conclusion, present the material of the work both oral and in the written form, pre defense.

The Qualification Work is published for defense at the official site of higher educational in as well as in the reposition of higher educational institution. Publishing of Qualification Works with the limited access, taking place corresponding to the requirement of current legislation.

Certification is carried out openly and publicly. The master's dissertation is checked fo placed in the repository of the university scientific-technical library for free access.

**5. MATRIX OF CONFORMITY OF PROGRAM COMPETENCES TO THE C
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
GC 1				+		+	+	+		+	+	+	+	+	+		+
GC 2	+				+	+	+						+		+		+
GC 3			+														
GC 4	+														+		
GC 5	+	+												+			+
GC 6	+	+		+											+		
GC 7				+	+											+	
GC 8			+													+	
VC 1	+			+				+			+	+			+	+	+
VC 2	+			+							+						
VC 3							+	+	+	+			+	+	+		
VC 4						+	+	+	+	+	+	+	+	+		+	
VC 5										+	+	+					
VC 6	+							+	+	+		+			+		+
VC 7								+	+			+					
VC 8										+	+			+			
VC 9								+			+				+	+	+
VC 10					+	+											
VC 11							+						+		+		
VC 12	+							+		+	+	+					
VC 13	+																
VC 14	+							+		+	+	+					

6. MATRIX OF PROVIDING PROGRAM LEARNING RESULTS BY RELEVANT 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
R 1		+	+					+			+	+	+			+	
R 2								+	+	+	+						+
R 3	+			+	+	+									+	+	+
R 4		+	+					+	+	+	+	+	+	+	+		
R 5				+				+		+	+	+					
R 6	+				+		+		+					+	+	+	
R 7	+														+		+
R 8											+				+		
R 9				+											+		
R 10	+					+		+		+					+		
R 11	+			+											+		
R 12				+				+		+	+						
R 13		+	+	+												+	
R 14						+	+					+	+			+	+
R 15					+											+	+
R 16	+							+		+	+	+					
R 17	+							+		+	+	+					
R 18	+							+		+	+	+					

