## MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE NATIONAL TECHNICAL UNIVERSITY OF UKRAINE «Igor Sikorsky KYIV POLYTECHNICAL INSTITUTE»

#### APPROVED

Academic Council of the Igor Sikorsky KPI (Doc.  $N_{\underline{0}}$  10 from <u>13.12.2021</u>) Head of the Academic Council

Mykhailo ILCHENKO

## AUTOMATED AND ROBOTIC MECHANICAL SYSTEMS

## EDUCATIONAL AND PROFESSIONAL PROGRAM

## first (bachelor's) level of higher education

specialty

131 Applied Mechanics

field of knowledge

13 Mechanical engineering

qualification

**Bachelor of Applied Mechanics** 

Entered into force in 2022/2023 by order of the rector Igor Sikorsky KPI from <u>15.02. 2022</u> № <u>HOH/75/2022</u>

#### PREAMBLE

#### **Developed by the project group:**

#### Project team leader:

Oleksandr HUBAREV, Professor of Applied Fluid mechanics and Mechanotronics department, Doctor of Technical Sciences, Professor

Members of the project team:

Oleg LEVCHENKO, of Applied Fluid mechanics and Mechanotronics department, Ph.D., Associate Professor

Oksana GANPANTSUROVA, Associate Professor of of Applied Fluid mechanics and Mechanotronics department, Ph.D., Associate Professor

Oleksandr UZUNOV, professor of of Applied Fluid mechanics and Mechanotronics department, Doctor of Technical Sciences, Professor

Kostiantyn BIELIKOV, senior teacher of Applied Fluid mechanics and Mechanotronics department, Ph.D.

Alyona MURASHCHENKO, senior teacher of of Applied Fluid mechanics and Mechanotronics department, Ph.D.

Stakeholder representatives:

Georgy HRABOVSKY, Deputy Director of the Kyiv Institute of Automation

Sofiia KOSMINA, master, graduate of 2019 (graduate student in 2021)

Yegor MOROZ, candidate of VO (3rd year)

The head of the department of Applied Hydroaeromechanics and Mechanotronics is responsible for the training of higher education students in the educational program.

#### **APPROVED:**

Scientific and Methodological Commission of the University in the specialty 131 Applied Mechanics

Head of the SMCU 131

Mykola BOBYR

(Doc. № <u>4</u> of <u>08.12.2021</u>)

Methodical Council of Igor Sikorsky KPI

Deputy Head of the Methodical Council

Anatolii MELNYCHENKO

(Doc. № <u>2</u> of <u>09.12.2021</u>)

#### **CONSIDERED:**

Feedback, reviews, proposals and recommendations of stakeholders: SE "Antonov", SC "FESTO", Institute of Hydromechanics of NAS of Ukraine, Concern "Nicmas", SPC "Kiev Institute of Automation", "Hydrosila Group Ltd".

Recommendations of the working group of the chair of AHM and SE "ANTONOV" on the dual form of education.

Recommendations of the working group of the chair of AFMM and SPC "Kyiv Institute of Automation" on the subject of course projects and the volume of laboratory work.

Results of the discussion of the educational process with 4th year students.

The results of self-analysis of the educational process of the chair of AHM for 2021.

Recommendations for organizing and detailing multi-credit educational components by semesters.

The update of the educational program has been agreed with the stakeholders, and the positive feedback provided on the program remains relevant.

The educational program was discussed after receiving all the wishes and suggestions, approved at an extended meeting of the Department of chair of AHM (Doc. №6 of 06 December 2021).

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## **1. CURRICULUM PROFILE**

1 – General information       Full name of the higher     National Technical University of Ukraine "Igor Sikorsky Kyiy													
Full name of the higher	National Technical University of Ukraine "Igor Sikorsky Kyiv												
education institution and	Polytechnic Institute"												
institute / facultyEducational and Scientific Institute of Mechanical EngineerDegree of higher													
Degree of higher													
education and title of	Degree – bachelor												
qualification in the	Qualification - Bachelor of Applied Mechanics												
original language													
Official name of the Automated and robotic mechanical systems													
educational program Automated and robotic mechanical systems													
Type of diploma and													
scope of educational	Bachelor's degree, single, 240 ECTS credits,												
program	term of study 3 years 10 months												
Availability of	Certificate of accreditation of the specialty ND 1192553, valid until												
accreditation	01.07.2023, issued by the Ministry of Education and Science of Ukraine												
	NRC of Ukraine - level 6												
Cycle / level of higher	OF-EHEA - the first cycle												
education QF-EHEA - the first cycle EOF-LLL - 6 level													
Prerequisites	Availability of complete general secondary education												
recequisites Availability of complete general secondary education   Teaching language(s) Ukrainian													
Duration of the	UNIAIIIIAII												
educational program	Until the next accreditation												
Internet address of the	https://osvita.kpi.ua/op												
permanent placement of	https://mmi.kpi.ua/												
the educational program	http://pGC 0 kpi ua/uk/												
Training of highly qualifie	2 – Purpose of the educational program												
in the field of menty quanties	ed specialists capable of solving basic scientific and technical problems												
in the field of mechanical	engineering in creating automated and robotic mechanical systems in												
the conditions of sustain	able innovative scientific and technical development of society and												
formation of high adaptab	lifty of higher education seekers in labor market transformation through												
interaction with employ	ers and other stakeholders. Create conditions for comprehensive												
professional, intellectual,	social and creative development of the individual at the highest levels of												
excellence in the education	onal and scientific environment in accordance with the development												
strategy of Igor Sikorsky H	KPI for 2020-205 [https://kpi.ua/2020-2025-strategy].												
3	– Characteristics of the educational program												
Subject area	<b>Object of activity:</b> structures, machines, equipment, mechanical and												
	biomechanical automated systems and complexes, processes of their design manufacture research and exerction:												
	Learning objectives: professional engineering activities in the field of												
	design and automation of production. operation of automated												
	mechanical systems, machines and equipment, robotic means and												
	complexes, automation of technologies of machine-building												
	productions;												
	Theoretical content of the subject area: general laws of theoretical												
	mechanics and their applied applications, theoretical principles of												

	machine design, control and automation of mechanical systems,
	machine-building technologies, fluid and gas mechanics, machine parts
	and structures, forecasting the performance of technical systems;
	Methods, techniques and technologies: physical and mathematical
	methods for calculating statics, dynamics and stability of elements and
	structures; analytical, numerical and algorithmic methods of automated
	control of mechanical systems, modelling of kinematics and dynamics
	of machines, analysis of stress-strain state of structural elements;
	methods of design, control, research, development of technologies for
	the manufacture and assembly of elements of machines and structures;
	information technology in engineering research, design and
	production; methods and means of numerical software control of
	technological equipment; technologies of automated machine-building productions:
	<b>Tools and equipment:</b> executive control controlling and power
	supply devices of automated mechanical systems machines tools
	technological and control devices sensors and controllers control and
	measuring devices numerical software control systems drives of
	machine and robotic systems.
Orientation of the	
educational program	Educational and professional
	Special education in the field of applied mechanics - automated and
	robotic mechanical systems.
Main focus of the	Keywords: mechatronics, automation in mechanical engineering,
educational program	hydraulic and pneumatic automation, logistic systems, robots and
	manipulators, hydraulic and pneumatic machines, hoisting and
	transport machines, design, engineering, modelling, control.
	The object of professional orientation is an automated physically
Features of the	heterogeneous system with algorithms of operation and control, due to
advantional and around	the fundamental laws of mechanics, hydraulics, hydromechanics
educational program	Ability to build an individual trajectory by choosing a certificate
	Ability to build an individual trajectory by choosing a certificate
4 – Suita	bility of graduates for employment and further study
Suitability for	According to the State Classification of Occupations DK 003: 2010
	graduates can work in the positions of professionals in mechanics and
employment	other positions in the field of physical sciences and technology in
	particular.
	3115 – Mechanic technician
	3119 - Other technical specialists in the field of physical sciences and
	technology
	3121 - Programmer technician
	2145 - Professionals in the field of mechanical engineering
	2145.2 - Engineer for mechanization and automation of production
	processes
	2149 – Professionals in other fields of engineering
	2131.2 – Engineer of automated production control systems
	2143.2 - Dispatching and technological control equipment engineer
	Opportunity to study at the second (master's) level of higher education
Further study	and / or to acquire additional qualifications in the system of
	postgraduate education.

	5 - Teaching and assessment
	Lectures, practical and seminar classes, computer workshops and
Tasshing and lasming	individual and group laboratory and project works; course projects and
reaching and rearning	works; technology of blended learning, practice and excursions;
	performance of attestation work
	Oral and written examinations, testing, defence of course projects,
Assassment	certification work, is carried out in accordance with the Regulations on
Assessment	the system of evaluation of learning outcomes in Igor Sikorsky KPI for
	all types of classroom and extracurricular work
	6 - Program competencies
Integral competence	Ability to solve complex specialized problems and practical problems
	in applied mechanics or in the learning process, which involves the
	application of certain theories and methods of mechanical engineering
	and is characterized by complexity and uncertainty of conditions.
General competencies	GC1. Ability to abstract thinking, analysis and synthesis
(GC)	GC2. Knowledge and understanding of the subject area and
	understanding of professional activity
	GC3. Ability to identify, pose and solve problems
	GC4. Ability to apply knowledge in practical situations
	GC5. Ability to work in a team
	GC6. Definiteness and persistence in terms of tasks and responsibilities
	GC7. Ability to learn and master modern knowledge
	GC8. Ability to communicate in a foreign language
	GC9. Skills in the use of information and communication technologies
	GC10. Skills for safe activities
	GC11. Ability to act socially responsibly and consciously
	GC12. Ability to search, process and analyse information from various
	sources
	GC13. Ability to assess and ensure the quality of performed work
	GC14. 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
	GC15. 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, use different types and forms
	physical activity for active recreation and a healthy lifestyle
Professional	PC1. Ability to analyse materials, structures and processes based on
competencies (PC)	laws, theories and methods of mathematics, natural sciences and
-	applied mechanics
	PC2. Ability to evaluate the performance parameters of materials,
	structures and machines in operating conditions and find appropriate
	solutions to ensure a given level of reliability of structures and
	processes, including in the presence of some uncertainty

PC3. Ability to conduct technological and technical and economic
assessment of the effectiveness of new technologies and technical
means
PC4. Ability to make the optimal choice of technological equipment,
complete set of technical complexes, to have basic ideas about the rules
of their operation
PC5. Ability to use analytical and numerical mathematical methods to
solve problems of applied mechanics, in particular to calculate the
strength, endurance, stability, durability, rigidity in the process of static
and dynamic loading to assess the reliability of parts and structures of
machines
PC6. Ability to perform technical measurements, obtain, analyse and
critically evaluate measurement results
PC7. Ability to use computerized systems of design (CAD), production
(CAM), engineering research (CAE) and specialized application
software to solve engineering problems in applied mechanics
PC8. Ability to spatial thinking and reproduction of spatial objects,
structures and mechanisms in the form of projection drawin GS 0 and
three-dimensional geometric models
PC9. Ability to present the results of its engineering activities in
compliance with generally accepted norms and standards
PC10. Ability to describe and classify a wide range of technical objects
and processes, based on a deep knowledge and understanding of basic
mechanical theories and practices, as well as basic knowledge of related
sciences
PC11. Ability to choose rational approaches and technical means to
creation, testing and operation of control systems of technical objects
and systems, machines and mechanisms with means of mechanics,
hydropneumatic automation, electromechanics, mechatronics and
 robotics
PC12. Ability to use modern approaches and tools of computer-aided
design to create automated mechanical systems, machines, systems of
hydropneumatic automation, electromechanics, mechatronics and
robotics and their components with the implementation of specified
functions, performance characteristics and efficiency indicators
PC13. Ability to use design tools justify and develop rational design
solutions for automated mechanical systems, machines.
hydropneumatic systems, electromechanics, mechatronics and robotics
and their elements and units, in accordance with the specified
operational, functional, economic, ergonomic and other practical tasks
PC14. Ability to use modern approaches and tools of computer-aided
design to create automated mechanical systems, machines, systems of
hydropneumatic automation, electromechanics, mechatronics and
robotics and their components with the implementation of specified
functions, performance characteristics and efficiency indicators

PC15. Ability to use modern tools to develop mathematical and
simulation models of automated mechanical systems, machines,
hydropneumatic systems, electromechanics, mechatronics and robotics
and their components to determine the rational design and operating
parameters, modes and conditions of operation, evaluation of
functionality and efficiency computer simulation

#### 7 - Program learning outcomes

LO1. Choose and apply for solving problems of applied mechanics suitable mathematical methods LO2. To use knowledge of theoretical bases of mechanics of liquids and gases, heat engineering and electrical engineering for the decision of professional problems

LO3. Perform calculations for strength, endurance, stability, durability, rigidity of machine parts

LO4. Evaluate the reliability of parts and structures of machines in the process of static and dynamic loading

LO3. Perform calculations for strength, endurance, stability, durability, rigidity of machine parts

LO6. To create and theoretically substantiate the design of machines, mechanisms and their elements on the basis of methods of applied mechanics, general principles of design, the theory of interchangeability, standard methods of calculating machine parts

LO7. Apply regulatory and reference data to monitor compliance of technical documentation, products and technologies with standards, specifications and other regulatory documents

LO8. Know and understand the basics of information technology, programming, practical use of application software to perform engineering calculations, information processing and experimental results research

LO9. Know and understand related fields (fluid and gas mechanics, heat engineering, electrical engineering, electronics) and be able to identify interdisciplinary links in applied mechanics at the level required to meet other requirements of the educational program

LO10. Know the design, methods of selection and calculation, basics of maintenance and operation of drives of machine tools and robotic equipment

LO11. Understand the principles of automated control systems of technological equipment, including microprocessors, choose and use the optimal means of automation

LO12. Have skills in the practical use of computer-aided design (CAD), production preparation (CAM) and engineering research (CAE)

LO13. Evaluate the technical and economic efficiency of production

LO14. Carry out the optimal choice of equipment and equipment of technical complexes

LO15. Take into account by making decisions the main factors of man-made impact on the environment and the main methods of environmental protection, labor protection and life safety

LO16. Communicate freely on professional issues orally and in writing in the state and foreign languages, including knowledge of special terminology and interpersonal skills

LO17. Take into account and choose rational technologies for the manufacture of structural elements and assembly of units and devices in the development of new and modernization of known design solutions

LO18. To develop rational constructive decisions of the automated mechanical systems, machines, systems of hydropneumatic automation, electromechanics, mechatronics and robotics and their elements and units, according to the set characteristics by the solving of practical problems

LO19. Design automated mechanical systems, machines, systems of hydropneumatic automation, electromechanics, mechatronics and robotics and their components with the use of computer tools,

and provide functions, performance characteristics and performance indicators of design objects

LO20. To determine rational design and operational parameters, efficiency, modes and conditions of operation of automated mechanical systems, machines, systems of hydropneumatic automation, electromechanics, mechatronics and robotics and their components, by computer and imitation modelling

LO21. To build rational technical solutions for automation of the set functions by means of hydroautomatics and electromechanics with providing of certain parameters, modes and conditions of operation as a part of the automated mechanical systems and machines

LO22. To develop rational technical solutions of control systems of technical objects and systems, machines and mechanisms with means of mechanics, hydropneumatic automation, electromechanics, mechatronics and robotics with provision of certain parameters, modes and conditions of operation of automated mechanical systems and machine

8 - R	lesource providing for program implementation									
Human resources	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 in the current version. Teachers of professional disciplines 21, with a scientific degree 21, a doctor degree 6, professors 6.									
Material and technical providing	In accordance with the technological requirements for material and technical providing of educational activities of the appropriate level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 in the current version. Use of equipment for lectures in the format of presentations, network technologies, in particular on the Sikorsky distance-learning platform.									
Informational, educational and methodical providing	In accordance with the technological requirements for educational, methodological and informational providing 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 in the current version. Use of the Scientific and Technical Library of Igor Sikorsky KPI.									
	9 - Academic mobility									
National credit mobility	Based on bilateral agreements between the National Technical University of Ukraine " Igor Sikorsky Kyiv Polytechnic Institute" and technical universities of Ukraine									
International credit mobility	On the basis of bilateral agreements between the National Technical University of Ukraine " Igor Sikorsky Kyiv Polytechnic Institute" and educational institutions of partner countries, agreements on international academic mobility									
Training of foreign applicants for higher education	Teaching in English for individual groups with the provision of learning Ukrainian as a foreign language or after studying by foreign students of the Ukrainian language course in joint groups with Ukrainian students									

## 2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

	Components of the educational program	Number of	Form of final
Code	(academic disciplines, course projects/works, practices,	FCTS credits	control
	qualification work)	Letib credits	control
1	2	3	4
1	Mandatory (normative) components of H	τ <u>ρ</u>	
	General training cycle	21	
GC 01	Ukrainian language for Professional Purposes	2	Test
~~ ~ ~	Ukraine in the Context of the Historical Development of		
GC 02	Europe	2	Test
GC 03	Basics of a Healthy Lifestyle	3	Test
GC 04.1	Foreign Language. Part 1	3	Test
GC 04.2	Foreign Language. Part 2	3	Test
GC 05	Introduction to Philosophy	2	Test
GC 06	Business Law	2	Test
GC 07	Economics and Production Organization	4	Test
GC 08	Labor Safety and Civil Defence	2	Test
GC 00 1	Earoign Language for Professional Purposes, Part 1	2	Test
CC 09.1	Foreign Language for Professional Purposes, Part 7	3	Exem
GC 09.2	Foreign Language for Professional Purposes. Part 2	5	Exam
DC 01	Construction Materials Engineering	15	Exom
PC 01	Chamistry	4,5	Teat
PC 02	Lincon Alashra and Analytic Coometry	25	Test
PC 03	Linear Algebra and Analytic Geometry	3,5	Test
PC 04.1	Calculus of one-variable functions	4,5	Exam
PC 04.2	Further Mathematics. Part 2. Differential and Integral Calculus of multi-variable functions. Differtial equations	8,5	Exam
PC 04.3	Further Mathematics. Part 3. Rows. Theory of complex function variable	4	Exam
PC 05	Engineering and Computer Graphics	4	Test
PC 06.1	General Physics. Part 1. Mechanics. Basics of	5,5	Exam
PC 06.2	General Physics. Part 2. Electricity and Magnetism. Optics.	4,5	Test
PC 07	Atomic Physics Materials Science	15	Exam
PC 08	Flectrical Engineering and Electronics	3	Test
PC 00 1	Theoretical Mechanics, Part 1, Statics	15	Exam
PC 09.1	Theoretical Mechanics, Part 2, Kinematics	4,5	Exam
DC 00 2	Theoretical Machanias, Part 2, Kinematics	25	Test
PC 09.5	Information	3,3	Test
PC 10	The section of heat on singering	4	Test
PUII	Theoretical foundations of heat engineering	3	Test
PC 12.1	Load	6,5	Exam
PC 12.2	Mechanics of Materials and Constructions. Part 2. Complex Load, rigidity and dynamics	6,5	Exam
PC 13	Mechanics of Materials and Structures. Coursework	1	Test
PC 14	Metrology, standardization and certification	4,5	Exam
PC 15	Fluid and Gas Mechanics	3,5	Test
PC 16	Theory of Mechanisms and Machines	3,5	Test
PC 17	Theory of Mechanisms and Machines. Coursework	1	Test

1	2	3	4							
PC 18	Machine Parts and Design Fundamentals	6	Exam							
PC 19	Machine Parts and Design Fundamentals. Course project	1,5	Test							
PC 20	Fundamentals of design and engineering	6	Exam							
PC 21	Fundamentals of mathematical modeling of physically heterogeneous systems	5,5	Exam							
PC 22	Discrete control systems for actuators	6	Exam							
PC 23	Fundamentals of industrial electric drive	5	Exam							
PC 24	Fundamentals of hydraulic automation	3	Exam							
PC 25	Design of units of automated mechanical systems	4	Exam							
PC 26	Design of units of automated mechanical systems. Coursework	1,5	Test							
PC 27	Mechanical engineering technology	3.5	Exam							
PC 28	Mechanical engineering technology Coursework	1	Test							
PC 29	Diploma Practice	6	Test							
PC 30	Diploma Project Preparation	6	Defense							
1000	Selective components of EP		2010100							
	General training cycle									
GS 01	Educational component 1 GU-Catalog	2	Test							
GS 02	Educational component 2 GU-Catalog	2	Test							
	Professional training cycle									
PS1	Educational component 1 F-Catalog	4	Test							
PS2	Educational component 2 F-Catalog	4	Test							
PS3	Educational component 3 F-Catalog	4	Test							
PS4	Educational component 4 F-Catalog	4	Test							
PS5	Educational component 5 F-Catalog	4	Test							
PS6	Educational component 6 F-Catalog	4	Test							
PS7	Educational component 7 F-Catalog	4	Test							
PS8	Educational component 8 F-Catalog	4	Test							
PS9	Educational component 9 F-Catalog	4	Test							
PS10	Educational component 10 F-Catalog	4	Test							
PS11	Educational component 11 F-Catalog	4	Test							
PS12	Educational component 12 F-Catalog	4	Test							
PS13	Educational component 13 F-Catalog	4	Test							
PS14	Educational component 14 F-Catalog	4	Test							
	Or									
	Certificate program "Mechatronic and robotic systems in mechanical engineering"	56	Tests: 14							
	Or									
	Certificate program "Hydraulic and pneumatic automation of smart systems"	56	Tests: 14							
	Or Contificante macaname "Il contration front and Francisco III.	E C	$T_{a} = 4 = 1.4$							
	Certificate program "Logistic Systems Engineering"	<u> </u>	1 ests: 14							
Total amount of mandatory components:180Total amount of selective components:60										
Amoun	t of educational components that ansure the acquisition	0	U							
Amoun	of competencies of certain SVF.	14	4,5							
ТОТА	L AMOUNT OF THE EDUCATIONAL PROGRAM	24	40							



## 4. CERTIFICATION FORM FOR APPLICANTS OF HIGHER EDUCATION

Certification of applicants for higher education under the educational program "Automated and robotic mechanical systems" is carried out in the form of defense of the qualification work and ends with the issuance of a standard document on awarding him a bachelor's degree with a qualification: Bachelor of Applied Mechanics in 131 Applied Mechanics. "Automated and robotic mechanical systems". Qualification work is published before defense on the official website of the institution of higher education or graduation department, as well as in the repository of the institution of higher education. Publication of qualification works containing information with limited access is carried out in accordance with the requirements of current legislation. Graduation certification is open and public. Qualification work should not contain academic plagiarism, falsification and writing off. The graduating department provides verification of qualification work for plagiarism.

# 5. CONFORMITY MATRIX OF PROGRAM COMPETENCIES TO THE COMPONENTS OF THE EDUCATIONAL PROGRAM

	GC 01	GC 02	GC 03	GC 04	GC 05	GC 06	GC 07	GC 08	GC 09	PC 01	PC 02	PC 03	PC 04	PC 05	PC 06	PC 07	PC 08	PC 09	PC 10	PC 11	PC 12	PC 13	PC 14	PC 15	PC 16	PC 17	PC 18	PC 19	PC 20	PC 21	PC 22	PC 23	PC 24	PC 25	PC 26	PC 27	PC 28	PC 29	PC 30
GC 1					+							+	+						+						+				+	+	+	+	+	+			1		
GC 2																+	+			+				+					+					+				+	+
GC 3																										+		+	+		+				+			+	+
GC 4																						+									+							+	+
GC 5			+			+																																+	+
GC 6																				+											+		+		+		+	+	+
GC 7		+			+												+													+			+					+	
GC 8				+					+																														
GC 9	+								+					+					+																				+
GC 10								+																														+	
GC 11					+																																	+	
GC 12																										+		+		+				+					+
GC 13							+																+																
GC 14						+																																+	
GC 15		+	+	+	+				+																													+	
PC 01											+	+	+			+	+	+		+				+	+	+												+	+
PC 02																+					+	+			+		+												+
PC 03							+																													+	+		+
PC 04							+			+																								+			+		+
PC 05																		+			+	+				+	+	+											+
PC 06															+								+															+	+
PC 07														+													+	+	+	+				+	+				+
PC 08														+															+									+	+
PC 09																							+																+
PC 010										+	+					+	+			+				+			+			+				+					+
PC 11																															+		+					+	
PC 12																														+	+	+	+	+				+	
PC 13	1	1	1		1			1		1	1							1						1	1	1		1	+			+			+		1	+	
PC 14																																+		+	+			+	
PC 15																														+									

## 6. PROVIDING MATRIX OF PROGRAM LEARNING RESULTS BY RELEVANT COMPONENTS OF THE EDUCATIONAL PROGRAM

	GC 01	GC 02	GC 03	GC 04	GC 05	GC 06	GC 07	GC 08	GC 09	PC 01	PC 02	PC 03	PC 04	PC 05	PC 06	PC 07	PC 08	PC 09	PC 10	PC 11	PC 12	PC 13	PC 14	PC 15	PC 16	PC 17	PC 18	PC 19	PC 20	PC 21	PC 22	PC 23	PC 24	PC 25	PC 26	PC 27	PC 28	PC 29	PC 30
LO 1												+	+					+	+			+				+		+		+									+
LO 2																	+			+				+								+							
LO 3																					+	+							+										
LO 4																					+	+					+	+											+
LO 5												+		+				+					+			+		+	+										+
LO 6																		+					+		+	+	+	+											+
LO 7																							+						+						+		+	+	
LO 8																			+										+	+				+					+
LO 9											+				+	+	+			+				+								+							
LO 10																									+		+	+	+					+	+				
LO 11																	+		+												+	+	+	+					
LO 12														+												+		+	+				+	+					+
LO 13							+																																+
LO 14							+			+																					+					+	+	+	+
LO 15			+					+																														+	
LO 16	+	+		+	+	+			+																														+
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LO 18																																	+	+	+				
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LO 21																															+		+						
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