APPROVED

by the Academic Council
of Igor Sikorsky Kyiv Polytechnic Institute
(protocol № 3 from 15.03.2021)

Chairman of the Academic Council

Mykhailo ILCHENKO

COMPUTER SYSTEMS AND NETWORKS

КОМП'ЮТЕРНІ СИСТЕМИ ТА МЕРЕЖІ

EDUCATIONAL PROFESSIONAL PROGRAM first
(bachelor's) level of higher education

Specialty	**123 Computer Engineering**
Field of Study	**12 Information Technologies**
Qualification	**Bachelor in Computer Engineering**

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

Kyiv – 2021

TAKEN INTO ACCOUNT:
1. The standard of higher education in specialty 123 «Computer Engineering» https://mon.gov.ua/storage/app/media/vyshcha/standarty/123.pdf
2. Remarks and suggestions of stakeholders based on the results of public discussion: - by Scientific and Pedagogical staff of Computing Technics Department;
   by graduates and higher education applicants who study in the educational professional program «Computer Engineering»;
   by specialists of the educational and methodical department of Igor Sikorsky Kyiv Polytechnic Institute;
   by experts in the field of information systems and technologies.
3. Professional expertise was carried out:
   Employers representatives:
   Victor Kondratjuk - Institute of Computer Technologies
   Victoria Taraniuk - QA manager of GLOBAL LOGIC Company
   Representatives of student organizations:
   Demchik Valerii, 1st year graduate student in specialty 123 «Computer Engineering»
   Osievska Valentina, 5th year undergraduate student in specialty 123«Computer Engineering»
   Balaban Vladislav, 4th year undergraduate student in specialty 123 «Computer Engineering»
   The following stakeholder suggestions are taken into account:
   Increase the diversity of professionally-oriented disciplines while maintaining the fundamental component of training (employers);
   To supplement the educational program with modern relevant disciplines, which provide the knowledge necessary to ensure the life cycle of computer systems and networks, for example, "Information Protection", (employers, students);
   Transfer a number of basic disciplines to earlier semesters (students).
   Education Program (EP) has been updated. the following changes have been made to it:
   Made mandatory disciplines that provide for the formation of competencies provided for by the Standard of Higher Education in the specialty 123 «Computer Engineering» (among them is Law, Life safety and civil protection, Introduction to Philosophy, Environmental Strategy, sections Computer modeling as part of the disciplines Computer Systems and Computer Networks;
   part of the natural and fundamental disciplines was transferred to selective disciplines, modernizing their content in accordance with the profile of the specialty 123 «Computer Engineering»; included in the list of selected disciplines in the Faculty Catalog.

The educational program was discussed after receiving all the wishes and suggestions and approved at an extended meeting of the Department of Computing Technics (protocol №8, January 21, 2021)

CONTENTS

1. PROFILE OF THE EDUCATIONAL PROGRAM
Speciality 123 Computer Engineering

1 – General information	
Full name of the University and Institute/Faculty	National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Faculty of Informatics and Computer Science
Higher education degree and title of qualification in the original language	Degree - Bachelor Qualification – Bachelor in Computer Engineering
The level of the National Qualifications Framework (NQF)	NQF of Ukraine – 6 level, QF-EHEA – 1st cycle, EQF-LLL –6 level
The official title of the educational program	Computer Systems and Networks
Diploma type and scope of educational program	Bachelor diploma, single, 240 credits, term of study 3 years, 10 months
Availability of accreditation	Accreditation certificate of the specialty НД 1192547. Certificate is valid until 01.07.2023 р.
Prerequisites	Availability of complete general secondary education
Language(s) of Instruction	Ukrainian / English
The validity of educational program	Until the next accreditation
Internet address of the permanent placement of the educational program	http://osvita.kpi.ua section "Educational programs" http://fiot.kpi.ua section "Educational programs" http://comsys.kpi.ua section "Educational programs"
2 – The goal of the educational program	

The goal of the educational program is fundamentally and complex train of specialists in the area of Computer Engineering as Computer Systems and Networks. They will be able to solve difficult professional problems and carry out professional activities in design, manufacture and operation of Hardware and Software Computer Systems and Networks. Create conditions for comprehensive professional, intellectual, social and creative development of the individual at the highest levels of excellence in the educational and scientific environment in accordance with mission and strategy of Igor Sikorsky KPI.

The goal of the educational and professional program corresponds to the strategy of development of Igor Sikorsky KPI for 2020-2025. The vision is to promote the formation of the society of the future on the basis of the concept of sustainable development.

3 – Education program characteristics	
Subject area	*Objects of professional activity are*: - Software and Hardware (Programming, Reconfigured, System and Application Software) of Computers and Computer Systems of Universal and Specialized, including Stationary, Mobile, Embedded, Distributed too, Local, Global Computer Internet Networks, Cyber-Physical Systems, the Internet of Things, IT-Infrastructures, Interfaces and Protocols of Interaction of their Components; - Information Processes, Technologies, Methods, Technique and Systems of Automated and Automatic Design; Debugging, Production and Operation, Project Documentation, Standards, Procedures and Means of Supporting the Life Cycle Management of these Software and Hardware; - Methods of Information Processing, Mathematical Models of Computational Processes, Technologies for Performing Calculations, including High-Productivity, Parallel, Distributed, Mobile, Web-based and Cloud, Green (energy-efficient), Safe, Autonomous, Adaptive, Intelligent, Smart too, Architecture and Organization of Functioning of the Relevant Software and Hardware. *Goal of leaning:* training of specialists who are able to independently apply and implement computer engineering technologies. *The theoretical content of the subject area*: Terms, Concepts, Principles, Methods, Software, Hardware and Technologies for the Development, use and maintenance of Computer Systems and Networks, Embedded and Distributed Calculations. *Methods, techniques, and technologies* (which must be acquired by the Applicant for Higher Education for Application in Practice): Methods of Computer-Aided Design of Software and Hardware of Computer Systems and their Components, Methods of Mathematical and Computer Modeling, Information Technologies, Technologies of Development of Specialized Software, Technologies for Network, Mobile and Cloud Calculations. *Tools and equipment* (objects/items, Devices and Equipment that the applicant learns to apply and use): Computer Equipment, Measuring Devices, Software and Hardware Automation and Design Automation Systems.
Orientation of the Educational Program	Educational and professional

The main focus of the educational program	The educational program is aimed at the formation of applicants' competencies that make possible their comprehensive Professional and Social Development in the field of Computer Engineering. The program provides the acquisition of educational qualifications for the performance of professional activities related to the Design, Development, Quality Assurance and Maintenance of Computer Systems and Networks, as well as professional competencies that allow Higher Education Applicants to create and implement innovative Computer Systems and Networks, using the best world practices in this area. This is due to the introduction of the Methodology of Project and End-to-End approaches in the learning process, which allows simulating the design processes of Hardware and Software in real conditions and creating Start-Up Projects of innovative Computer Systems. The main focus of the EP is to combine the classical Educational University Training Program with Dynamic Professional Programs, which allows Graduates to have Professional Competencies requested by the IT Market. Higher Education Applicants have the opportunity to obtain knowledge from other branches of Science necessary in different spheres of Human Activity, due to the possibility of forming a Flexible Individual Learning Trajectory. *Keywords:* Computer Engineering, Computer Systems, Computer Networks, Hardware and Software, High Performance Computer Systems.
Features of the program	Higher Education Applicants develop their own startup projects for the design of systems that have a commercial focus and provide an opportunity to attract investment to create their own business. Projects use the Methods and Technologies provided by The International Professional Standards. This allows us to form the Competencies of Computer Engineers, which provide a possibility for them to work in international IT Projects. Education Program provides for Computer Workshops that take place in Specialized Laboratories that are equipped with Powerful Computer Equipment and Modern Software. In addition, it is envisaged that Higher Education Applicants will undergo practice in the profile and master modern methods of developing Computer Systems. The Educational Process involves Professional Practitioners, who work in leading IT Companies, and other Stakeholders. Participants of the Educational Process have the opportunity to join the programs of International Academic Mobility. Higher Education Applicants have the opportunity to exercise training in the Relevant Certification Programs.
4 – Suitability of graduates for employment and further training	
Suitability for employment	Bachelors in Computer Engineering can work as specialists in the Development and Maintenance of Hardware, as well as Application and System Software in the field of Information Technology. According to the classifier of professions ДК003: 2010 graduates can perform the following types of professional work: 312 Technical specialists of Computing Technics 3121 Information Technology Specialist
Further training	Continuation of education at the second (master's) level of higher education.

5 – Teaching and assessment	
Teaching and learning	Lectures, Practical and Seminar classes, computer Workshops and Laboratory Works; Course Projects and Works; technology of Mixed Learning, Practice and Excursions; Execution of Diploma Project (Work)
Assessment	Assessment of students' knowledge is carried out in accordance with the Regulations on the rating system for assessing the learning outcomes of students of the Igor Sikorsky Kyiv Polytechnic Institute KPI for all types of classroom and extracurricular work (incoming, current, calendar, final control); verbal and written exams, final tests etc.
6 – Program competences	
Integral competence	Ability to solve complex specialized and practical problems during professional activities in the Computer field or in the learning process, which involves theories and methods Computer Engineering and is characterized by complexity and uncertainty of conditions.

General competences (GC)	
GC1	Ability to abstract thinking, analysis and synthesis.
GC2	Ability to learn and master modern knowledge
GC3	Ability to apply knowledge in practical situations
GC4	Ability to communicate in the state language both verbally and in writing
GC5	Ability to communicate in a foreign language
GC6	Interpersonal skills
GK7	Ability to identify, pose and solve problems.
GC8	Ability to work in a team
GC9	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.
GC10	Ability to preserve and increase 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, different types and forms of physical activity to rest and lead a healthy lifestyle.

Professional competencies (PC)	
PC1	Ability to apply legislative and regulatory frameworks, as well as national and international requirements, practices and standards, to implementation of professional activities in Computer Engineering field.
PC2	Ability to use Modern Methods and Programming Languages to development of Algorithms and Software.
PC3	Ability to create System and Applied Software of Computer Systems and Networks.
PC4	Ability to protect information that is processed in Computer and Cyber-Physical systems and Networks in order to implement an established security Information policy.
PC5	Ability to use automation design tools and systems for the development of components of Computer Systems and Networks, Internet applications, Cyber-Physical Systems also.
PC6	Ability to design, implement and maintain Computer Systems and Networks of various types and purposes.
PC7	Ability to use and implement new technologies, including Smart, Mobile, Green and Secure Computing Technologies, to take part in the modernization and reconstruction of Computer Systems and Networks, a variety of Embedded and Distributed applications, in particular with the aim of increasing their efficiency.

PC8	Readiness to take part in the implementation of Computer Systems and Networks, their commissioning at facilities for various purposes.
PC9	Ability to systematically administer, use and operate existing information Technologies and Systems.
PC10	Ability to organize Workplaces, their Technical Equipment, Placement of Equipment, the use of organizational, technical, algorithmic and other methods and means of Information Protection.
PC11	Ability to illustrate the obtained working results in the form of a Presentation, Scientific and Technical Reports.
PC12	Ability to identify, classify, evaluate and describe the operation of Software and Hardware, Computer and Cyber-Physical Systems, Networks and their Components through the use of modeling Methods and Techniques.
PC13	Ability to solve problems in the field of Computer and Information Technology, to determine the limitations of these Technologies.
PC14	Ability to Design Systems and their Components taking into account all aspects of their life cycle and task, including creation, configuration, operation, maintaining and disposal.
PC15	Ability to argue the choice of Methods for Solving specialized problems, critically evaluate the results obtained, justify and defend the decisions taken.
PC16	Ability to design, implement and administer High Performance parallel and distributed computer systems and their components using FPGA modules and Systems of Automated Design.
PC17	Ability to design, implement, administer and maintain Global and Local Intelligent Software-Defined Computer Networks.
PC18	Ability to develop, adapt, use Software to improve the efficiency of using High Performance Computer Systems.
PC19	Ability to organize computing processes in High Performance Computer systems with different structural organization based on the use of the latest techniques in the planning and dispatching.
7 – Program learning outcomes (PLO)	
PLO1	To know and understand the scientific foundations of operation of Computer Tools, Systems and Networks
PLO2	To have the skills to experiment, collect data and model in Computer Systems
PLO3	To know modern technologies in Computer Engineering area
PLO4	Know and understand the impact of Technical Solutions in a social, economic, social and environmental context.
PLO5	Have knowledge of the basics of Economics and Project Management.
PLO6	Be able to apply knowledge to identification, formulation and solve technical problems of the specialty, using methods that are most suitable for achieving the goals.
PLO7	Be able to solve the problems of analysis and synthesis of means typical for the specialty.
PLO8	Be able to think systematically and use creative abilities to form new ideas.
PLO9	Be able to apply knowledge of Technical Characteristics, Design Features, Purpose and Rules of Operation Software and Hardware of Computer Systems and Networks to solve Technical Problems of the Specialty.
PLO10	Be able to develop Software for Embedded and Distributed Applications, Mobile and Hybrid Systems; calculate, operate typical equipment for the specialty.
PLO11	Be able search for information in different sources to solve problems of Computer Engineering.
PLO12	Be able to work effectively both individually and as part of a team.

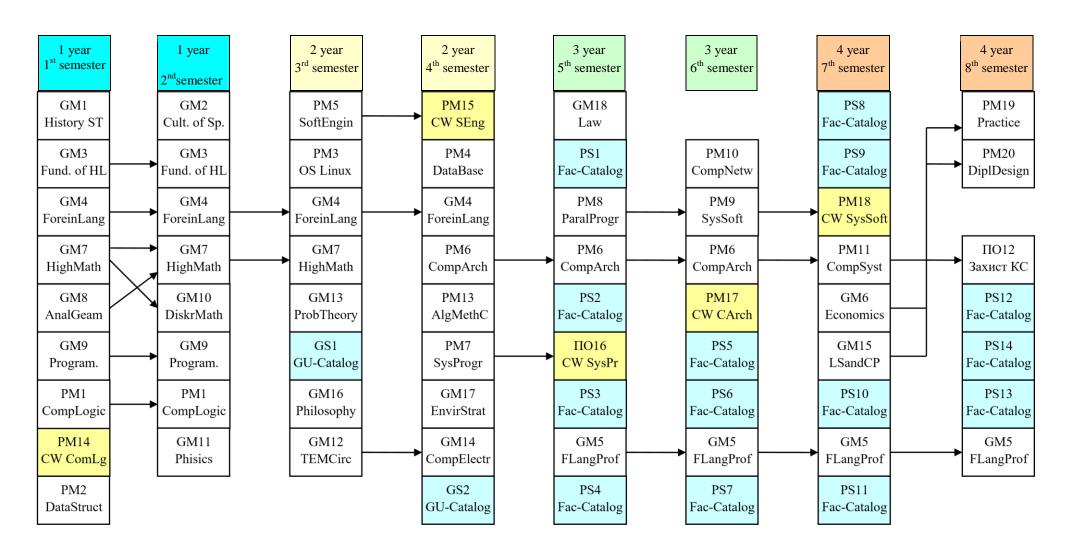| PLO13	Be able to identify, classify and describe the operation of Computer Systems and their components.
PLO14	Be able to combine Theory and Practice, as well as make decisions and develop a Strategy of actions to solve Problems of the Specialty taking into account Universal Values, Social, National and Production Interests.
PLO15	Be able to perform experimental research on professional topics.
PLO16	Be able to evaluate the results obtained and defend the decisions made reasonably.
PLO17	Communicate verbally and in writing on professional matters in Ukrainian and at least one of the official EU languages (English, Germany, Italian, French, Spanish etc.)
PLO18	Use Information technology for effective communication at the professional and social levels.
PLO19	Ability to adapt to new situations, to justify, make and implement decisions within the competence.
PLO20	To realize the need for lifelong learning in order to deepen the acquired and obtain new professional knowledge, improve creative thinking.
PLO21	Qualitatively perform work and achieve the goal in compliance with the requirements of professional ethics.
PLO22	Perform calculations of parameters of separate blocks of Computers, Computer Systems, Computer Networks.
PLO23	Be able to create and maintain Databases.
PLO24	Build, configure, and use Linux-type operating systems
8 – Resource support for program implementation	
Staffing	In accordance with the personnel requirements to ensure the implementation of educational activities for the relevant level of HE (Annex 2 to the License Conditions), approved by the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (as amended by the Cabinet of Ministers of Ukraine dated 10 May 2018 № 347) Invitation for teaching scientists and specialists of leading IT companies
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 by the Cabinet of Ministers of Ukraine dated 10 May 2018 № 347). Holding of laboratory classes, implementation of coursework, diploma and scientific projects is carried out in seven educational and scientific laboratories of the department, in the educational and scientific center "Hewlett-Packard", which are equipped with modern Hardware and Software,
Information, educational and methodical support	In accordance with the technological requirements for information, educational and methodical 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 by the Cabinet of Ministers of Ukraine dated 10 May 2018 № 347). Use of the Scientific and Technical Library of the Igor Sikorsky Kyiv Polytechnic Institute.
9 – Academic mobility	
National credit mobility	Possibility to conclude agreements on academic mobility, double graduation, etc.

International credit mobility	Agreements on international academic mobility (Eramus + K1) concluded with universities in France (Le Mans), Germany (Merseburg), China (м. Guangzhou).
Training of foreign applicants for higher education	It is possible the training students in general groups of Ukrainian students or for English-speaking students in separate academic groups, at this Ukrainian language is studied as a foreign language.

2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Code Discipline	Components of the educational program (academic disciplines, course projects/course works, practices, qualification work)	Number of credits ECTS	Final assessment form
1	2	3	4
1. Mandatory (regulatory) components of EP			
1.1. General Training Cycle			
GM 1	History of Science and Technology	2	Final Test
GM 2	Culture of Speech and Business Speech	2	Final Test
GM 3	Fundamentals of a Healthy Lifestyle	3	Final Test
GM 4	Foreign Language	6	Final Test
GM 5	Foreign language for Professional Purposes	6	Final Test, Exam
GM 6	Economics and Organization of Production	4	Final Test
GM 7	Higher mathematics	13,5	Exam
GM 8	Analytic Geometry	3	Exam
GM 9	Programming	11	Exam
GM 10	Discrete Mathematics	5	Final Test
GM 11	Physics	6	Exam
GM 12	The Theory of Electric and Magnetic Circuits	5	Exam
GM 13	Probability Theory and Mathematical Statistics	5	Exam
GM 14	Computer Electronics	5	Exam
GM 15	Life Safety and Civil Protection	2	Final Test
GM 16	Introduction to Philosophy	2	Final Test
GM 17	Environmental Strategy	2	Final Test
GM 18	Law	2	Final Test
1.2. Professional Training Cycle			
PM 1	Computer Logic	10	Final Test, Exam
PM 2	Data Structures and Algorithms	5	Final Test
PM 3	Introduction to Operating System Linux	5	Final Test
PM 4	Database Organization	4	Final Test
PM 5	Software Engineering	5	Exam
PM 6	Computer Architecture	15	Exam
PM 7	System Programming	5	Exam
PM 8	Parallel Programming	5	Final Test
PM 9	System software	5,5	Exam
PM 10	Computer Networks	5	Exam
PM 11	Computer Systems	5,5	Exam

PM 12	Protection of Information in Computer Systems and Networks	4,5	Exam
PM 13	Algorithms and methods of computation	4	Final Test
PM 14	Course work on Computer Logic	1	Final Test
PM 15	Course work on Software Engineering	1	Final Test
PM 16	Course work on System Programming	1	Final Test
PM 17	Course work on Computer Architecture	1	Final Test
PM 18	Course work on System software	1	Final Test
PM 19	Pre-diploma Practice	6	Final Test
PM 20	Diploma Design	6	Defense
2. Selective components EP			
2.1. General training cycle			
GS 1	Educational component 1 General University-Catalog	2	Final Test
GS 2	Educational component 2 General University-Catalog	2	Final Test
2.2. Professional training cycle			
PS 1	Educational component 1 Faculty-Catalog	4	Final Test
PS 2	Educational component 2 Faculty-Catalog	4	Final Test
PS 3	Educational component 3 Faculty-Catalog	4	Final Test
PS 4	Educational component 4 Faculty-Catalog	4	Final Test
PS 5	Educational component 5 Faculty-Catalog	4	Final Test
PS 6	Educational component 6 Faculty-Catalog	4	Final Test
PS 7	Educational component 7 Faculty-Catalog	4	Final Test
PS 8	Educational component 8 Faculty-Catalog	4	Final Test
PS 9	Educational component 9 Faculty -catalog	4	Final Test
PS 10	Educational component 10 Faculty-Catalog	4	Final Test
PS 11	Educational component 11 Faculty-Catalog	4	Final Test
PS 12	Educational component 12 Faculty-Catalog	4	Final Test
PS 13	Educational component 13 Faculty-Catalog	4	Final Test
PS 14	Educational component 14 Faculty-Catalog	4	Final Test
Total in **Mandatory Components:**		**180**	
Total in **Selective Components:**		**60**	
The Amount of Educational **Components that provide the Acquisition Competencies defined by the Higher Education Standard**		**120**	
TOTAL VOLUME OF THE EDUCATIONAL PROGRAM		**240**	

3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM

1 year 1st semester	1 year 2nd semester	2 year 3rd semester	2 year 4th semester	3 year 5th semester	3 year 6th semester	4 year 7th semester	4 year 8th semester
GM1 History ST	GM2 Cult. of Sp.	PM5 SoftEngin	PM15 CW SEng	GM18 Law		PS8 Fac-Catalog	PM19 Practice
GM3 Fund. of HL	GM3 Fund. of HL	PM3 OS Linux	PM4 DataBase	PS1 Fac-Catalog	PM10 CompNetw	PS9 Fac-Catalog	PM20 DiplDesign
GM4 ForeinLang	GM4 ForeinLang	GM4 ForeinLang	GM4 ForeinLang	PM8 ParalProgr	PM9 SysSoft	PM18 CW SysSoft	
GM7 HighMath	GM7 HighMath	GM7 HighMath	PM6 CompArch	PM6 CompArch	PM6 CompArch	PM11 CompSyst	ПО12 Захист КС
GM8 AnalGeam	GM10 DiskrMath	GM13 ProbTheory	PM13 AlgMethC	PS2 Fac-Catalog	PM17 CW CArch	GM6 Economics	PS12 Fac-Catalog
GM9 Program.	GM9 Program.	GS1 GU-Catalog	PM7 SysProgr	ПО16 CW SysPr	PS5 Fac-Catalog	GM15 LSandCP	PS14 Fac-Catalog
PM1 CompLogic	PM1 CompLogic	GM16 Philosophy	GM17 EnvirStrat	PS3 Fac-Catalog	PS6 Fac-Catalog	PS10 Fac-Catalog	PS13 Fac-Catalog
PM14 CW ComLg	GM11 Phisics	GM12 TEMCirc	GM14 CompElectr	GM5 FLangProf	GM5 FLangProf	GM5 FLangProf	GM5 FLangProf
PM2 DataStruct			GS2 GU-Catalog	PS4 Fac-Catalog	PS7 Fac-Catalog	PS11 Fac-Catalog	

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4. THE CERTIFICATION FORM OF HIGHER EDUCATION APPLICANTS

Graduation certification of applicants for higher education according to the educational-professional program "Computer Systems and Networks" is carried out in the form of defense of the qualification work and ends with the issuance of a standard document on the award of a degree "Bachelor" with the award of a qualification: Bachelor in Computer Engineering in the educational-professional program "Computer Systems and Networks".

The qualification work of the applicant is subject to mandatory verification for signs of academic plagiarism. After defense, the Qualification work is placed n the repository of scientific and technical library University for free access.

Graduation certification is open and public.

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

	GM 1	GM 2	GM 3	GM 4	GM 5	GM 6	GM 7	GM 8	GM 9	GM 10	GM 11	GM 12	GM 13	GM 14	GM15 LS	GM16 Phil	GM 17 ES	GM18 Law	PM 1	PM 2	PM 3	PM 4	PM 5	PM 6	PM 7	PM 8	PM 9	PM 10	PM 11	PM 12	PM 13	PM 14	PM 15	PM 16	PM 17	PM 18	PM 19	PM 20
GC1							+	+	+	+	+	+	+	+	+			+												+								
GC2															+						+	+	+	+	+		+	+	+	+								
GC3						+	+		+		+	+	+																			+	+	+	+	+	+	+
GC4		+																																			+	+
GC5				+	+																																	+
GC6				+	+										+																						+	
GC7						+	+	+	+			+				+						+										+	+	+	+	+	+	+
GC8									+													+								+								
GC9																	+																				+	+
GC10	+	+	+									+				+																						
PC 1				+	+							+				+	+								+			+	+						+			
PC 2									+												+		+		+	+	+				+			+	+	+		
PC 3									+														+				+	+	+			+						
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PC 19									+											+		+						+				+	+				+	+

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

	GM 1	GM 2	GM 3	GM 4	GM 5	GM 6	GM 7	GM 8	GM 9	GM 10	GM 11	GM 12	GM 13	GM 14	GM15 LS	GM16 Phil	GM 17 ES	GM18 Law	PM 1	PM 2	PM 3	PM 4	PM 5	PM 6	PM 7	PM 8	PM 9	PM 10	PM 11	PM 12	PM 13	PM 14	PM 15	PM 16	PM 17	PM 18	PM 19	PM 20
PLO1							+	+		+	+	+	+	+					+					+				+	+									
PLO2							+		+	+			+												+	+							+	+	+	+	+	+
PLO3	+											+		+					+		+			+		+		+	+	+							+	+
PLO4						+									+		+	+						+				+	+			+			+		+	+
PLO5						+			+														+	+													+	+
PLO6							+	+	+	+			+												+	+											+	+
PLO7							+	+	+	+									+	+				+				+	+			+	+	+	+	+	+	+
PLO8																+			+	+					+							+	+	+	+	+	+	+
PLO9									+										+			+			+	+	+	+	+	+	+				+		+	+
PLO10									+												+	+	+	+		+	+	+	+	+	+		+	+		+	+	+
PLO11				+	+												+	+	+					+				+	+			+	+	+	+	+	+	+
PLO12																																	+	+	+	+	+	+
PLO13																			+					+				+	+								+	+
PLO14						+									+		+							+								+	+	+	+	+	+	+
PLO15									+															+				+	+			+	+	+	+	+	+	+
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PLO20																		+		+										+							+	+
PLO21																	+	+		+																	+	+
PLO22							+	+	+	+									+					+				+	+			+			+			
PLO23									+													+	+												+			
PLO24									+												+			+	+	+					+							