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

APPROVED:
Academic Council
of Igor Sikorsky Kyiv Polytechnic Institute
(Protocol № 10 dated December 13, 2021)

Chairman of the Academic Council

Mykhailo ILCHENKO

CONTROL SYSTEMS OF FLIGHT VEHICLES AND COMPLEXES ENGINEERING

PROFESSIONAL EDUCATIONAL PROGRAMME

The first (bachelor's) level of higher education

speciality	**173 Avionics**
field of knowledge	**17 Electronics and telecommunications**
qualification	**bachelor in Avionics**

Put into effect since 2022/2023 academic year by order of the rector
of Igor Sikorsky Kyiv Polytechnic Institute
from 15.02.2022 № НОН/75/2022

Kyiv - 2021

PREAMBLE

DEVELOPED by the project team:

The project team chairman
Vitalii Burnashev, Ph.D., Associate Professor, Associate Professor
of the Department of Aircraft Control Systems

The project team members:
Sergiy Ponomarenko, Ph.D., Senior Researcher, Associate Professor
of the Department of Aircraft Control Systems

Mykola Chernjak, Ph.D., Associate Professor, Associate Professor
of the Department of Aircraft Control Systems

Oleksandr Zbrutskyi, Doctor of Technical Sciences, Professor,
Head of the Department of Aircraft Control Systems

Ponomarenko Kostiantyn, Head of Sector
of the State Kyiv Design Bureau “Luch”

Osipov Roman, graduated student of the
department of aircraft control systems, phd student

AGREED:

Scientific and methodical commission of Igor Sikorsky Kyiv Polytechnic Institute on specialty 173 "Avionics":

Head SMC 173 Oleksandr ZBRUTSKYI
(protocol № 4 from 08.12.2021)

Vice-chairman of the Methodical Council Anatolii MELNYCHENKO
(protocol № 2 from 09.12.2021)

TAKEN INTO ACCOUNT:

The results of the self-analysis of the 2021 educational program.
Remarks and suggestions of stakeholders based on the results of the public discussion.
Professional expertise was conducted by:
Director - Chief Designer SE SDB "Arsenal" M.I. Likholit
The update of the educational program has been agreed with the stakeholders, the feedback on the program is positive and remain relevant.
The educational and professional program was discussed after receiving all wishes and proposals from students and graduates and approved at a meeting of the Department of Aircraft Control Systems (protocol No.5 dated 08.12.2021).

CONTENTS

1. EDUCATIONAL PROGRAMME PROFILE

1 – General information	
Full name of Higher education institution and faculty	NATIONAL TECHNICAL UNIVERSITY OF UKRAINE «Igor Sikorsky Kyiv Polytechnic Institute», Educational and Scientific Institute of Aerospace Technology
Higher education degree and qualification title in the original language	Degree of HE – bachelor Educational qualification – bachelor in Avionics
Educational programme official title	Control systems of flight vehicles and complexes engineering
Diploma type and educational programme scope	Bachelor Diploma Normative training period, 3 years and 10 months Educational component 240 ECTS credits
Prior accreditation	Certificate of accreditation of the specialty series ND № 1192565 issued by the Ministry of Education and Science of Ukraine on 30.04.13, valid until 01.07.2023.
Education cycle, level of higher education	NQF of Ukraine – level 6 (QF-EHEA – the 1st cycle, EQF-LLL – Level 6)
Prerequisites	Complete secondary education
Language (s) of instruction	Ukrainian
Validity	Until the next accreditation
Permanent link to the programme online	https://skla.kpi.ua/study, https://osvita.kpi.ua/op
2 – Educational programme purpose	
Training of specialists who are able to solve complex specialized tasks and practical problems of use and implementation of avionics systems and devices. Specialists must acquire fundamental knowledge of natural sciences, as well as applied competencies in the field of avionics systems, which should allow to understand the trends of the industry and society, to adequately respond to the challenges of the labor market. The purpose of the educational program corresponds to the development strategy of Igor Sikorsky KPI for 2020-2025 regarding the formation of the society of the future based on the concept of sustainable development	
3 – Educational programme characteristics	
Subject area	Objects of study and / or activity: automated and automatic control systems for aeronautical, rocket and space objects and systems, their information support. Theoretical content of the subject area: notions, concepts, principles in the field of flight dynamics, of flying vehicles control systems, of electronic and microprocessor technology of avionics and navigation systems. Methods, techniques and technologies: methods, techniques, technologies of design, research and testing of avionics systems. Tools and equipment: stands and simulation software for modelling avionics systems; information and measuring systems and devices; automatic control systems, computers, microprocessor control systems for onboard and ground equipment.

Orientation EP	Educational-professional
The main focus of the EP	Special education in the field of development, design, production and certification of devices and control systems for aerospace technics and robotics. Key words: devices and control systems, robotics, avionics.
Features of EP	In-depth study of methods of synthesis and analysis of flying vehicles control systems, their sensitive elements, automatic control theory.
4 – Eligibility of graduates for employment and further study	
Suitability for employment	The graduate can hold the positions of professionals and specialists in accordance with the current version of the National Classification of Ukraine (DK 003: 2010): specialist in control and maintenance of systems, applied programmer, designer, technical specialist.
Further training	Opportunity to continue education in the educational-professional or educational-scientific program of the master's degree. Acquisition of additional qualifications in the system of postgraduate education.
5 – Teaching and assessment	
Teaching and learning	Lectures, practical and seminar classes, computer practices and laboratory works; course projects and works; technology of blended learning, practices and excursions; the execution of diploma project and thesis
Evaluation	In accordance with the rating system, oral and written exams, assessments, tests, etc. are evaluated in accordance with the Regulation on the system of learning results evaluation at Igor Sikorsky KPI for all types of classroom and extracurricular work (current, calendar, semester control).
6 – Programme competencies	
Integral competence	Ability to solve complex specialized tasks and practical problems of avionics and control systems during professional activities and in the learning process, which involves the application of theories and methods of engineering and is characterized by complexity and uncertainty of conditions
General Competences (GC)	
GC 1	Ability to apply knowledge in practical situations
GC 2	Ability to search, process and analyse information
GC 3	Ability to identify, pose and solve problems
GC 4	Knowledge and understanding of the subject area and understanding of professional activity
GC 5	Ability to communicate in the state language both orally and in writing
GC 6	Ability to communicate in a foreign language
GC 7	Ability to exercise own 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
GC8	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, technology and technology, and use different types and forms of motor activities for active recreation and a healthy lifestyle
GC9	Ability to understand theory and use methods of mathematical analysis, analytical geometry, linear algebra, operational calculus, probability theory and mathematical

	statistics
GC 10	Ability to synthesise and analyse automatic control systems
GC 11	Ability to understand and use the laws of physics and chemistry
GC 12	The ability to study the motion of solid bodies, study structures for strength and elasticity, spatial figures using the methods of descriptive geometry, create drawings
Professional competencies (PC)	
PC 1	Ability to carry out professional activities in the field of avionics autonomously and responsibly, adhering to the legislative and regulatory framework, as well as state and international requirements
PC 2	Ability to use the basics of electronics, circuitry in solving practical problems of avionics
PC 3	Ability to develop and program microprocessor control systems
PC 4	Ability to analyze and synthesize control systems of flying vehicles
PC 5	Ability to develop avionics and aircraft ground systems using information technology
PC 6	Ability to mathematically describe and model physical processes in aircraft control systems
PC 7	Ability to design avionics devices and systems using automated systems
PC 8	Ability to describe and use modern technologies for the manufacture of avionics systems
PC 9	Ability to evaluate the technical and economic characteristics of avionics systems and devices
PC 10	Ability to justify decisions, work effectively autonomously and as part of a team
PC 11	Ability to design avionics devices
PC 12	Ability to develop mathematical models of aircraft motion using aerodynamics and flight theory
PC 13	Ability to plan testing and test technical systems
PC 14	Ability to develop elements of avionics, design and defend the results of development
7 – Programme learning outcomes (LO)	
LO 1	Adapt to changes in professional technologies, predict their impact on the end result
LO 2	Autonomously acquire new knowledge in their subject and related areas from various sources to effectively solve specialized professional problems
LO 3	Responsibly and competently set and solve problems related to the creation of avionics devices and systems
LO 4	Understand the state and prospects of the subject area
LO 5	Organize their own professional activity, to choose optimum methods and ways of solving difficult specialized tasks and practical problems in professional activity
LO 6	Critically comprehend the basic theories, principles, methods and concepts in professional activities
LO 7	Communicate freely in state and foreign languages orally and in writing on professional issues
LO 8	Understand the principles of law and legal basics of professional activity in the field of avionics
LO 9	Understanding of modern philosophical theories and main achievements of world and national culture, their creative comprehension and skills of application in professional activity, in particular, at communicating with colleagues
LO 10	Effectively plan and organize their working hours, maintain their own health and ability to work through active recreation and a healthy lifestyle

LO 11	Develop technical requirements for avionics systems and devices; carry out the design of avionics systems and devices taking into account the requirements of the customer and regulatory and technical documentation
LO 12	Analyze, calculate and design electrical and electronic avionics systems
LO 13	Develop and program microprocessor control systems
LO 14	Apply modern information technologies to ensure the functioning of flying vehicles and ground complexes
LO 15	Develop mathematical models of flying vehicles as control objects
LO 16	Be able to describe information processes related to avionics, analyze their noise immunity
LO 17	Be able to create radioelectronic equipment and devices of flying vehicles and ground complexes using computer-aided design systems
LO 18	Provide manufacturability of avionics systems by modern design, automated and experimental means
LO 19	Evaluate the technical and economic characteristics of the decisions to ensure the efficiency and high quality of development
LO 20	Know the methods of mathematical analysis and analytical geometry, the laws of physics and chemistry, descriptive geometry, social sciences
LO 21	Know the automatic control theory, analog and digital models of dynamic systems, methods of synthesis and analysis of automatic control systems
LO 22	Be able to use methods for estimating and ensuring the accuracy of measurements, design methods, testing methods and technologies for the production of avionics systems
LO 23	Be able to use methods of mathematical description and modeling of physical processes in flying vehicles control systems
LO 24	Know labor and civil protection regulations
LO 25	Know the basics of aviation and astronautics, the structure of flying vehicles and their systems
LO 26	Know the laws of motion of solids, resistance of materials, the theory of oscillations in technical systems
LO 27	Be able to calculate mechanical structures for strength and elasticity, determine the solids motion parameters
LO 28	Be able to develop, analyze and use aircraft control systems, navigation systems and their sensing elements
LO 29	Be able to study dynamic systems for stability, determine the quality of control and synthesize corrective devices
LO 30	Use programming languages, create algorithms

8 – Resource provision for programme implementation	
Staffing	In accordance with the personnel requirements for ensuring the implementation of educational activities for the 1st level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 in the current edition
Material and technical provision	In accordance with the technological requirements for material and technical support of educational activities of the 1st level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 in the current edition

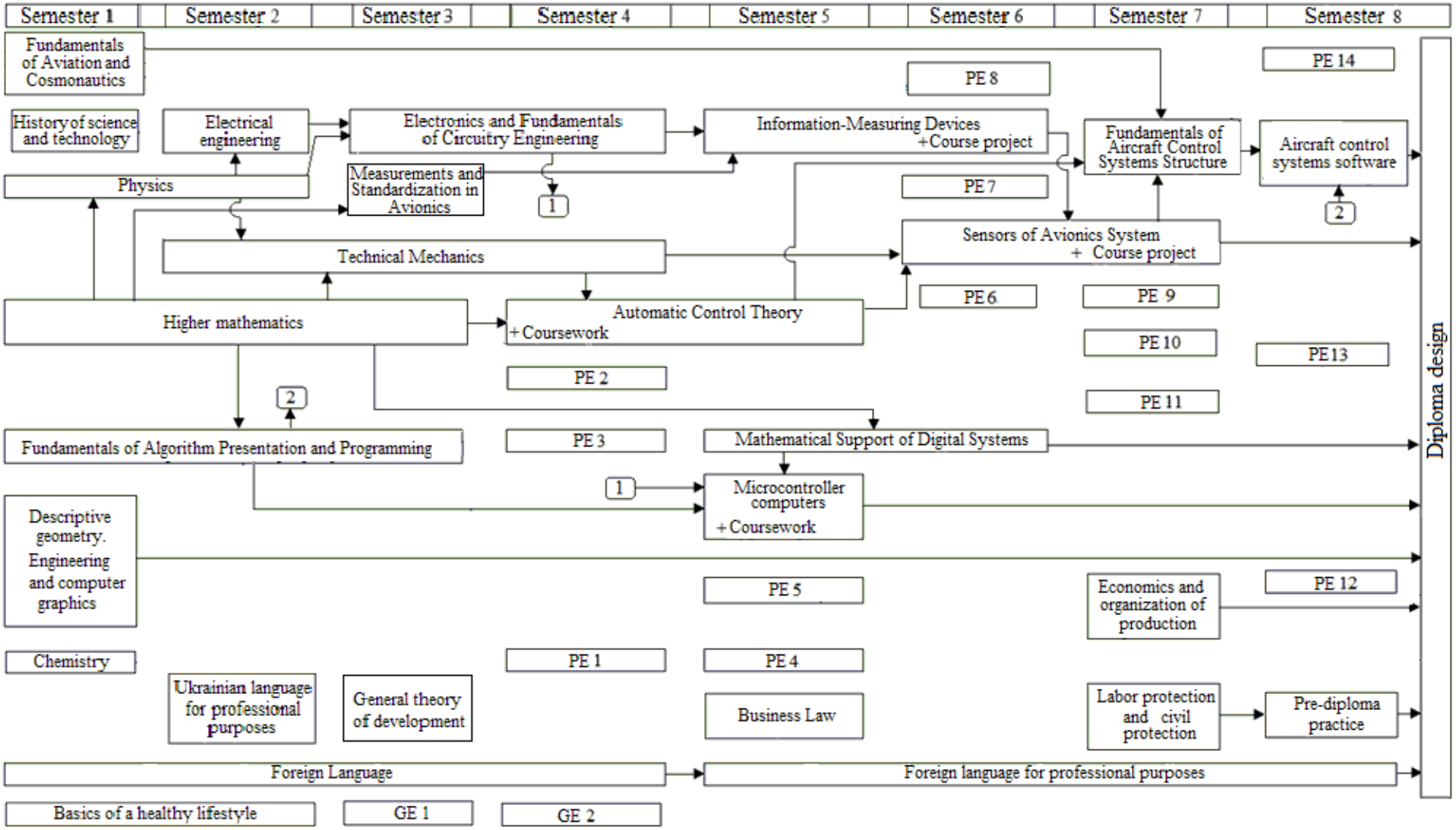
Information and educational and methodical support	In accordance with the technological requirements for educational and methodological and informational support of educational activities of the 1st level of HE, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 in the current edition in the current edition in the current edition
9 – Academic mobility	
National credit mobility	Exchange programs between partner universities, harmonization of the content of disciplines with the related disciplines of profile educational institutions.
International credit mobility	Opportunities for exchange between partner universities of other countries, implementation of a double degree program with EU universities. Participation in international educational programs. To determine knowledge and skills that students should acquire in the learning process, European standards of higher education for related specialties are taken into account.
Training of foreign applicants HE	The possibility of teaching in the Ukrainian language in groups of general training or in English with the provision of learning Ukrainian as a foreign language

2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Code	Components of the educational program (academic disciplines, course projects /works, practices)	Number of ECTS credits	Form of final control
1	2	3	4
Obligatory (regulatory) components of the EP			
General training cycle			
GR 1	Ukrainian language for professional purposes	2	Test
GR 2	History of science and technology	2	Test
GR 3	Basics of a healthy lifestyle	3	Test
GR 4.1	Foreign Language. Part I	3	Test
GR 4.2	Foreign Language. Part II	3	Test
GR 5.1	Foreign language for professional purposes. Part I	3	Test
GR 5.2	Foreign language for professional purposes. Part II	3	Examination
GR 6	General theory of development	2	Test
GR 7	Business law	2	Test
GR 8	Economics and organization of production	4	Test
GR 9	Labor protection and civil protection	4	Test
GR 10.1	Higher mathematics. Part 1. Differential calculus. Analytical geometry. Linear algebra	7	Examination
GR 10.2	Higher mathematics. Part 2. Integral calculus	7	Examination
GR 10.3	Higher mathematics. Part 3. Differential equations. Analytical functions	4	Examination
GR 11.1	Physics. Part 1. Mechanics. Molecular physics	5	Examination
GR 11.2	Physics. Part 2. Electromagnetism. Optics. Atomics Physics	5	Examination
GR 12	Chemistry	3	Test
GR 13	Descriptive geometry. Engineering and computer graphics	5	Examination
GR 14.1	Fundamentals of Algorithm Presentation and Programming. Part 1. Fundamentals of Algorithm Presentation	3	Test
GR 14.2	Fundamentals of Algorithm Presentation and Programming. Part 2.Fundamentals of Programming	5	Examination
GR 14.3	Fundamentals of Algorithm Presentation and Programming. Part 3.Software of avionics systems	3.5	Test
GR 15	Fundamentals of Aviation and Cosmonautics	2	Test
GR 16	Electrical engineering	4	Test
GR 17.1	Technical Mechanics. Part 1. Statics. Kinematics	4	Test
GR 17.2	Technical Mechanics. Part 2. Dynamics of mechanisms and systems. Strength of Materials	7	Examination
GR 17.3	Technical Mechanics. Part 3. Oscillations in technical systems	3.5	Examination
GR 18.1	Electronics and Fundamentals of Circuitry Engineering. Part 1. Analog electronics	5	Test
GR 18.2	Electronics and Fundamentals of Circuitry Engineering. Part 2. Digital electronics	5	Examination
GR 19.1	Automatic Control Theory. Part 1. General course	5	Examination
GR 19.2	Automatic Control Theory. Part 2. Fundamentals of modern automatic control	4	Test
GR 20	Automatic Control Theory. Coursework	1	Test
GR 21.1	Mathematical Support of Digital Systems. Part 1. Digital signal processing	5	Examination
GR 21.2	Mathematical Support of Digital Systems. Part 2. Digital filtering	5	Examination

Cycle of professional training			
PR 1	Measurement and standardization in avionics	5	Examination
PR 2	Microcontroller computers	5,5	Examination
PR 3	Microcontroller computers. Course work	1	Test
PR 4.1	Information-Measuring Devices. Part 1. Theory and calculation methods	3	Examination
PR 4.2	Information-Measuring Devices. Part 2. Fundamentals of design	6	Examination
PR 5	Information-Measuring Devices. Course project	1,5	Test
PR 6.1	Sensors of Avionics System. Part 1. Gyroscopes	4	Examination
PR 6.2	Sensors of Avionics System. Part 2. Accelerometers	4	Examination
PR 7	Sensors of Avionics System. Course project	1,5	Test
PR 8	Fundamentals of Aircraft Control Systems Structure	3	Examination
PR 9	Aircraft control systems software	4,5	Examination
PR 10	Pre-diploma practice	6	Test
PR 11	Diploma design	6	Defense
Selective components of EP			
General training cycle			
GE 1	Educational component 1 of the U-Catalog	2	Test
GE 2	Educational component 2 of the U-Catalog	2	Test
Cycle of professional training			
PE 1	Educational component 1 F-Catalog	4	Test
PE 2	Educational component 2 F-Catalog	4	Test
PE 3	Educational component 3 F-Catalog	4	Test
PE 4	Educational component 4 F-Catalog	4	Test
PE 5	Educational component 5 F-Catalog	4	Test
PE 6	Educational component 6 F-Catalog	4	Test
PE 7	Educational component 7 F-Catalog	4	Test
PE 8	Educational component 8 F-Catalog	4	Test
PE 9	Educational component 9 F-Catalog	4	Test
PE 10	Educational component 10 F-Catalog	4	Test
PE 11	Educational component 11 F-Catalog	4	Test
PE 12	Educational component 12 F-Catalog	4	Test
PE 13	Educational component 13 F-Catalog	4	Test
PE 14	Educational component 14 F-Catalog	4	Test
Total **obligatory** components:		180	
The total of **selective** components:		60	
The amount of educational components that provide the acquisition competencies defined by the SHE		154	
TOTAL VOLUME OF THE EDUCATIONAL PROGRAM		**240**	

3. STRUCTURAL-AND-LOGICAL SCHEME OF THE EDUCATIONAL PROGRAMME



4. THE FORM OF ATTESTATION FOR DEGREE PURSUERS

Graduation certification is carried out in the form of a public defense of a qualification work (diploma thesis or diploma project).

The qualification work should involve the solution of a complex specialized task or a practical problem of avionics, which requires the application of theories and methods of engineering sciences and is characterized by complexity and uncertainty of conditions.

The qualifying work should not contain academic plagiarism, fabrication, or falsification.

According to the results of the certification, a document of the established model is issued on awarding a bachelor's degree with the qualification: "Bachelor in Avionics" under the educational and professional training program "Control Systems of Flight Vehicles and Complexes Engineering".

The qualification work must be published on the official website of the institution of higher education or its subdivision, or in the repository of the institution of higher education.

Publication of qualification works containing information with limited access shall be carried out in accordance with the requirements of current legislation.

5. COMPLIANCE MATRIX OF PROGRAMME COMPETENCIES WITH PROGRAMME COMPONENTS

	GR 1	GR 2	GR 3	GR 4	GR 5	GR 6	GR 7	GR 8	GR 9	GR 10	GR 11	GR 12	GR 13	GR 14	GR 15	GR 16	GR 17	GR 18	GR 19	GR 20	GR 21	PR 1	PR 2	PR 3	PR 4	PR 5	PR 6	PR 7	PR 8	PR 9	PR 10	PR 11
GC 1	+	+		+	+		+	+	+	+			+	+		+		+	+	+	+											+
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6. COMPLIANCE MATRIX OF PROGRAMME LEARNING OUTCOMES WITH PROGRAMME COMPONENTS

	GR 1	GR 2	GR 3	GR 4	GR 5	GR 6	GR 7	GR 8	GR 9	GR 10	GR 11	GR 12	GR 13	GR 14	GR 15	GR 16	GR 17	GR 18	GR 19	GR 20	GR 21	PR 1	PR 2	PR 3	PR 4	PR 5	PR 6	PR 7	PR 8	PR 9	PR 10	PR 11
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