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 № 3 from 15.03. 2021) Head of the Academic Council Mykhailo ILCHENKO

Aerospace and Rocket Systems Engineering

EDUCATIONAL AND PROFESSIONAL PROGRAM

the first (Bachelor) level of higher education

specialty	134 Aerospace and rocket-space technology
field of knowledge	13 Mechanical engineering
qualification	Bachelor in Aerospace and rocket-space technology

Put into effect from 2021/2022 e.y. by order of the Rector Igor Sikorsky Kyiv Polytechnic Institute from 19.04.2021 № HOH/89/2021

PREAMBLE

DEVELOPED by the project team:

The project team chairman

Oleksandr Arhipov, Doctor of Technical Sciences, Professor, Professor of the Department of Space Engineering. Guarantor of Bachelor program **«Aerospace and Rocket Systems Engineering»**

The project team members: Ivan Korobko Doctor of Technical Sciences, Director of the Institute of Aerospace Technologies

Vitaliy Suhov Doctor of Technical Sciences, Professor, Professor of the Department of Aircraft and Rocket Engineering

Oleksandr Marynoshenko PhD in Engineering sciences, Associate Professor, acting Head of the Department of Space Engineering,

Oleksandr Bondarenko, PhD in Engineering sciences, Associate Professor of the Department of Aircraft and Rocket Engineering

AGREED:

Scientific and methodical commission of Igor Sikorsky KPI on specialty 134 " Aerospace and rocket systems engineering":

Head SMC 134 (Protocol № 1 from 20.01.2021) Volodymyr KABANYACHYI

Methodical Council of Igor Sikorsky Kyiv Polytechnic Institute

Head of the Methodical Council (Protocol № 6 from 25.02.2021)

Yurii YAKYMENKO

INCLUDED:

Propositions of the enterprises in the field of aviation and space engineering of Ukraine and main development trends in specialty, labor market, branch and regional context, experience of Ukrainian (KAI, DNU) and foreign (European and American) educational programs in the same field. The educational program was discussed with the students.

Recommendations for educational program update and and features of the development of curricula for bachelors (order of Igor Sikorskyi KPI dated November 30, 2020 N HOH/35/2020 "On the improvement of educational programs of the first (bachelor) level of higher education") and the list of mandatory and optional educational programs has been changed accordingly components.

Update of the education program was coordinated with the stakeholders; obtained positive references are actual

The education program was discussed after receiving all the wishes and suggestions and approved at a meeting of the Department of space engineering (protocol <u>N</u>^o3/20 from 17.12.2020).

CONTENT

1.	Profile of the education program	5
2.	List of components of the education program	10
3.	Structural and logical scheme of the education program	12
4.	Form of certification of applicants for higher education	13
5.	Matrix of program competences correspondence to the components of the education program	13
6.	Matrix for providing program learning outcomes with relevant components of the education program	14

1. Profile of the educational program

from specialty 134 "Aviation and rocket and space technology"

	1 – General information
Full name of HEI and institute / faculty	National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute», Institute of Aerospace Technologies
Degree of higher education and title of qualification in the original language	Degree of HE – Bachelor Educational qualification –Bachelor in Aerospace and rocket-space technology
The official name of the EP	Aerospace and Rocket Systems Engineering
Type of diploma and scope of EP	Bachelor Diploma, single, 240 ECTS credits, training period 3 year and 10 months
Availability of accreditation	accreditation certificate of specialty UD 11010593, valid till 01.07.2029
Cycle/level of higher education	NQF of Ukraine – level 6 QF-EHEA – 1st cycle EQF-LLL – level 6
Prerequisites	The presence of senior secondary education
Language (s) of teaching	Ukrainian/ English
Validity of the EP	Until the next accreditation
Internet address of the permanent placement of the educational program	https://osvita.kpi.ua/op, http://iat.kpi.ua

2 – The purpose of the educational program

The purpose of the education program is to train specialists who able to solve difficult specialized and practical problems in the area of aerospace and rocket-space technology.

The purpose of the education program corresponds the development strategy of Igor Sikorsky Kyiv Polytechnic Institute for the period 2020-2025 based on the vision and mission.

Vision is to create conditions for training highly qualified specialists capable to formulate modern scientific knowledge and develop innovative technologies for the benefit of mankind and to ensure the proper position of Ukraine in the world community.

Mission is to make considerable contribution to the sustainable development of society by means of internationalization and integration of education, new scientific researches and innovative developments. It is necessary to create conditions for the comprehensive professional, intellectual, social and creative development of the person in the educational and scientific environment.

	3 – Characteristics of the education program
Subject area	Objects of study - phenomena and problems related to the stages of the life cycle of aerospace and rocket-space technology.
	Purpose of study - is to train specialists able to solve complex specialized and practical problems dealing with the development, manufacturing and certification of aerospace and rocket-space technology, its engines and power plants, structures and systems characterized by the uncertainty of conditions.
	Theoretical content of subject area are theoretical basics of
	development and manufacturing of aerospace and rocket-space objects and technologies.

		Methods, techniques and technologies - analytical, numerical and										
		experimental methods of research of problems of the subject area,										
		especially integrated computer technologies, techniques and technologies										
		dealing with the stages of the life cycle of aerospace and rocket-space										
		technology.										
		Tools and equipment - laboratory measuring equipment with measuring										
		facilities i.e. hydraulic stands, wind tunnels, equipment for investigation										
		of materials properties, stress-strain state of constructions; tools and										
		equipment for studying structure of airplanes, helicopters, rockets,										
		engines and power plants, onboard, navigation, electric equipment;										
		equipment for manufacturing, assembling and testing of aerospace and										
		rocket-space objects, computers with information and specialized										
		software for calculation and geometrical modelling, finite-element										
		analysis, integrated design and production of aerospace and rocket-space										
		technology.										
Orientation	n of the EP	Educational and professional										
		It is focused on rocket and space vehicles design and aerospace										
		engineering.										
The main f	focus of EP	The program is based on the common scientific statements including the										
		current state of aerospace branch development. The program focuses on										
		actual information and manufacturing technologies facilitating further										
		professional and scientific career.										
		Key words: rockets, space vehicles, airspace engineering										
Features of	f EP	Program realization implies the engaging of practitioners and experts										
		the professional field, employer representatives to teach students. Prac										
		and part-time employment starting from the 3 rd year of study are										
		conducted at profile enterprises. Some disciplines are taught in foreign										
		language.										
	4 – Suit	ability of graduates for employment and further study										
Suitability	for employment	SC 003:2010, Codes: 3115 Technical mechanic, 3121 Technician-										
		programmer										
Further tra	ining	Continuing study at the second (master) level of higher education and / or										
		obtaining additional qualifications in post graduate study.										
		5 – Teaching and assessment										
Teaching a	and learning	Lectures, seminars, practical classes, computer practicums, laboratory										
		work course projects and works practice and excursions diploma project										
		work, course projects and works, practice and excutsions, diptoma project										
		are the main forms of study.										
Assessmen	nt	are the main forms of study. For evaluation, a rating system, oral and written exams, testing, etc. are used										
Assessmen	nt	 are the main forms of study. For evaluation, a rating system, oral and written exams, testing, etc. are used in accordance with the Regulation on the system of evaluation of study 										
Assessmen	nt	 are the main forms of study. For evaluation, a rating system, oral and written exams, testing, etc. are used in accordance with the Regulation on the system of evaluation of study results at KPI named after Ihor Sikorsky for all types of classroom and 										
Assessmen	nt	 are the main forms of study. For evaluation, a rating system, oral and written exams, testing, etc. are used in accordance with the Regulation on the system of evaluation of study results at KPI named after Ihor Sikorsky for all types of classroom and extracurricular work. The final certification is carried out in the form of a dialogue project. 										
Assessmen	nt	 are the main forms of study. For evaluation, a rating system, oral and written exams, testing, etc. are used in accordance with the Regulation on the system of evaluation of study results at KPI named after Ihor Sikorsky for all types of classroom and extracurricular work. The final certification is carried out in the form of a diploma project. 										
Assessmen	nt	 are the main forms of study. For evaluation, a rating system, oral and written exams, testing, etc. are used in accordance with the Regulation on the system of evaluation of study results at KPI named after Ihor Sikorsky for all types of classroom and extracurricular work. The final certification is carried out in the form of a diploma project. 6 – Program competences 										
Assessmen Integral co	nt mpetence	 are the main forms of study. For evaluation, a rating system, oral and written exams, testing, etc. are used in accordance with the Regulation on the system of evaluation of study results at KPI named after Ihor Sikorsky for all types of classroom and extracurricular work. The final certification is carried out in the form of a diploma project. 6 – Program competences Ability to solve complex specialized and practical problems dealing with the development, manufacturing and certification of aerospace and rocket. 										
Assessmen Integral co	nt mpetence	are the main forms of study. For evaluation, a rating system, oral and written exams, testing, etc. are used in accordance with the Regulation on the system of evaluation of study results at KPI named after Ihor Sikorsky for all types of classroom and extracurricular work. The final certification is carried out in the form of a diploma project. 6 – Program competences Ability to solve complex specialized and practical problems dealing with the development, manufacturing and certification of aerospace and rocket-space technology, which implies the application of theories and methods										
Assessmen Integral co	nt mpetence	work, course projects and works, practice and excursions, diploind project are the main forms of study. For evaluation, a rating system, oral and written exams, testing, etc. are used in accordance with the Regulation on the system of evaluation of study results at KPI named after Ihor Sikorsky for all types of classroom and extracurricular work. The final certification is carried out in the form of a diploma project. 6 – Program competences Ability to solve complex specialized and practical problems dealing with the development, manufacturing and certification of aerospace and rocket- space technology, which implies the application of theories and methods of physics mathematics										
Assessmen Integral co	nt mpetence	work, course projects and works, practice and excursions, diploind project are the main forms of study. For evaluation, a rating system, oral and written exams, testing, etc. are used in accordance with the Regulation on the system of evaluation of study results at KPI named after Ihor Sikorsky for all types of classroom and extracurricular work. The final certification is carried out in the form of a diploma project. 6 - Program competences Ability to solve complex specialized and practical problems dealing with the development, manufacturing and certification of aerospace and rocket- space technology, which implies the application of theories and methods of physics, mathematics and engineering sciences and characterized by the complexity and uncertainty of conditions										
Assessmen Integral co	nt mpetence	work, course projects and works, practice and excursions, diploind project are the main forms of study. For evaluation, a rating system, oral and written exams, testing, etc. are used in accordance with the Regulation on the system of evaluation of study results at KPI named after Ihor Sikorsky for all types of classroom and extracurricular work. The final certification is carried out in the form of a diploma project. 6 – Program competences Ability to solve complex specialized and practical problems dealing with the development, manufacturing and certification of aerospace and rocket- space technology, which implies the application of theories and methods of physics, mathematics and engineering sciences and characterized by the complexity and uncertainty of conditions.										
Assessmen Integral co	nt mpetence Ability to use I	work, course projects and works, practice and excursions, diploind project are the main forms of study. For evaluation, a rating system, oral and written exams, testing, etc. are used in accordance with the Regulation on the system of evaluation of study results at KPI named after Ihor Sikorsky for all types of classroom and extracurricular work. The final certification is carried out in the form of a diploma project. 6 – Program competences Ability to solve complex specialized and practical problems dealing with the development, manufacturing and certification of aerospace and rocket- space technology, which implies the application of theories and methods of physics, mathematics and engineering sciences and characterized by the complexity and uncertainty of conditions. General competences (GC) Krainian language for written and oral communication										
Assessmen Integral co GC 1 GC 2	nt mpetence Ability to use U Ability to use fo	work, course projects and works, practice and excursions, diproma project are the main forms of study. For evaluation, a rating system, oral and written exams, testing, etc. are used in accordance with the Regulation on the system of evaluation of study results at KPI named after Ihor Sikorsky for all types of classroom and extracurricular work. The final certification is carried out in the form of a diploma project. 6 – Program competences Ability to solve complex specialized and practical problems dealing with the development, manufacturing and certification of aerospace and rocket- space technology, which implies the application of theories and methods of physics, mathematics and engineering sciences and characterized by the complexity and uncertainty of conditions. General competences (GC) Krainian language for written and oral communication										

GC3	Ability to carry out safe activity and aspiration to save environment.
GC 4	Ability to use information and communicative technology
GC 5	Ability to work in team
GC 6	Ability to generate new ideas (creativity)
GC 7	Ability to make reasonable decisions.
GC 8	Ability to study and master modern knowledge.
GC 9	Ability to realize duties and responsibilities as a member of society, values of free democratic society and the necessity of its sustainable development, supremacy of law, rights and freedoms of human and citizen of Ukraine.
GC 10	Ability to save and enrich moral, cultural, scientific values and achievements based on the knowledge of history and trends of subject area development, its place in the common system of knowledge about nature and society and society development, technics and technologies, apply different kinds and forms of physical activity for leisure and healthy life style.
GC 11	Ability to work autonomously.
GC 12	Ability to organize and use collaborative discussions of methods for solving unusual design problems.
GC 13	Ability to interpersonal relation.
	Professional competences (PC)
PC 1	Ability to use the theory of flight dynamics and control at designing of aerospace and rocket-space technology
PC 2	Ability to use knowledge of hydraulics, air and gas dynamics to describe the interaction of bodies with gas and hydraulic environment
PC 3	Ability to choose the optimal materials for the construction components of aircraft and rocket and space technology.
PC 4	Ability to calculate the strength of components of aircraft and rocket and space technology
PC 5	Ability to design and test the components of aircraft and rocket and space technology, its equipment, systems and subsystems
PC 6	Ability to develop and implement technological processes of aircraft and rocket and space technology manufacturing
PC 7	Skills to use information and communicative technologies and specialized software in studying and professional activity
PC 8	Ability to consider economic and managerial aspects of aircraft and rocket and space technology manufacturing in professional activity
PC 9	Ability to develop general construction of aircraft and rocket and space technology
PC 10	Ability to carry out diagnostics and testing of aircraft and rocket and space technology and its vibrational protection
PC 11	Ability to determine the optimal type and parameters of rocket and space vehicle power plant
PC 12	Ability to plan wind tunnel experiments and to control their implementation
PC 13	Ability to provide metrological support, standardization and certification of structural elements of rocket and space vehicles by means of calculation methods and considering technological and functional interchangeability
PC 14	Skills to use integral technologies of computer design and modeling of aircraft and rocket
	and space systems and elements
	/ - Program results of learning
PRL 1	professional activity
PRL 2	Explain solutions and give arguments in their favor in reasonable and clear form
PRL 3	Knowledge of development methods of modern applied software for conducting quick nonstandard calculation or analyzing huge amounts of data

PRL 4	Develop the structure of rocket and space vehicles
PRL 5	Conduct diagnostics and nondestructive control of flying vehicles elements.
PRL 6	Describe experimental research methods of structural, physical and mechanical technological properties of materials and structures.
PRL 7	Apply modern methods of modeling, design and manufacturing of aircraft and rocket and space elements and systems
PRL 8	Acquire skills of determining structural elements stress of aircraft and rocket and space technology at all stages of their life cycle
PRL 9	Calculate stress-strain state, determine carrying capacity of structural elements and reliability of aircraft and rocket and space technology
PRL 10	Skills for self-directed study and autonomous work for increasing professional qualification and solving the problems in new and unknown environment
PRL 11	Formulate the reasonable assessment of governmental organizations activity, political institutions from the point of view of mankind, democratic values, human rights and freedoms priority
PRL 12	Follow the requirements of branch documentation dealing with the design procedures, manufacturing, testing and/or certification of aircraft and rocket and space systems and their elements at all stages of life cycle
PRL 13	Assess economic efficiency of manufacturing of aircraft and rocket and space systems and elements
PRL 14	Understand environmentally dangerous and harmful factors of professional activity and regulate its content in order to avoid negative effect on environment
PRL 15	Understand the structure and principles of operation of onboard and navigation equipment of aircraft and rocket and space technology
PRL 16	Calculate the power plants of rockets and space vehicles: pulse engines, gas and gas turbine engines, flywheel engines, liquid and solid fuel rocket engines, solar batteries, generators, servo motors.
PRL 17	Master the modern means of information and communicative technologies in the amount sufficient for studying and professional activity.
PRL 18	Acquire logics and methodology of scientific cognition based on understanding of modern state and methodology of subject area
PRL 19	Describe the models and stress-strain state of aircraft mechanical structures and elements by means of modern integral technologies of computer design
PRL 20	Describe metals and nonmetals and know modification methods of their properties. Determine optimal materials for aircraft and rocket and space elements considering their structure, physical, mechanical, chemical and operational properties, as well as, economic factors
PRL 21	Skills to develop technological processes using computer aided design to manufacture the structural components of aircraft and rocket and space technology
PRL 22	Understand the theoretical principles and practical methods of equipment support of components interchangeability of aircraft and rocket and space technology
PRL 23	Ability to know aerodynamic modeling and assess rocket parameters by means of specialized computer means and wind tunnel experiments
PRL 24	Understand the principles of gas and liquid mechanics, as well as, hydraulics, aerodynamics (gas dynamics)
PRL 25	Understand the features of working processes in hydraulic, pneumatic, electric and electronic systems, servo motors used in aircraft and rocket and space technology
PRL 26	Understand and reason the sequence in design, production, testing and/or certification of aircraft and rocket and space objects and elements at all stages of their life cycle.
PRL 27	Understand and reason the features of structure based on main aspects of working processes in aircraft and rocket and space elements and systems
PRL 28	Explain the influence of structural parameters of rocket and space vehicles on their performance. Know methods of stability and controllability of aircraft and rocket and space technology

8 -	Resource support for program implementation
Staffing	Exchange programs of students and lecturers between partner universities, coordination of the content of disciplines with the related disciplines of profile educational institutions are possible. It meets the requirements of staffing of providing education activity for the particular level of higher education adopted by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (as amended by the resolution of the Cabinet of Ministers of Ukraine dated May 10, 2018 No. 347).
Material and technical support	In accordance with the technological requirements for material and technical support of education activities of the particular level of higher education, approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (as amended by the resolution of the Cabinet of Ministers of Ukraine dated May 10, 2018 No. 347). Use of equipment for conducting lectures in the format of presentations, network technologies, in particular on the Sikorsky distance learning platform.
Information and education and methodical support	In accordance with the technological requirements for education and methodological and information support of education activities of the particular level of higher education approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187 (as amended by the resolution of the Cabinet of Ministers of Ukraine dated May 10, 2018 No. 347). Use of the Scientific and Technical Library of KPI named after Igor Sikorsky
	9 – Academic Mobility
National credit mobility	Agreement on academic mobility is signed with Dnipro National University
International credit mobility	Students take part in the programs of academic mobility (Erasmus + KI) with the University of the Basque Country (Spain), Warsaw University of Technology (Poland), ENS Lyon (France).
Training of foreign applicants of higher education	Foreign students have the ability to study in separate groups in English with the studying of Ukrainian as a foreign language. In mixed groups they are trained in Ukrainian language.

Code	Components of education program (academic disciplines,	Number of	Form of final
Couc	course projects / works, practices)	ECTS credits	control
1	2	3	4
	Compulsory (regulatory) components of the	EP	
	General training cycle		
30 1	Ukrainian Language for Professional Purposes	2	Test
3O 2	History of Science and Technology	2	Test
303	Basics of a Healthy Lifestyle	3	Test
3O 4	Foreign Language	6	Test
30 5	Economics and Management of Enterprise	4	Test
30 6	Labor Safety and Civil Defense	4	Test
3O 7	General theory of Development	2	Test
3O 8	Environmental Safety of Engineering Activities	2	Test
30 9	Business Law	2	Test
3O 10	Foreign Language for Professional Purposes	6	Test/Exam
	Professional training cycle		
ПО 1	Higher Mathematics	18	Exam
ПО 2	Physics	10	Exam
ПО 3	Chemistry	3	Test
ПО 4	Theoretical Mechanics	10	Exam
ПО 5	Electrical Engineering and Electronics	3	Test
ПО 6	Descriptive Geometry	3	Test
ПО 7	Engineering and Computer Graphics	4	Test
ПО 8	Theory of Mechanisms and Machines	4	Test
ПО 9	Materials and Constructions Mechanics	7,5	Exam
ПО 10	Machines Details and Basics of Aircraft Designing	5	Exam
ПО 11	Hydrogas Dynamics and Thermodynamics	6,5	Exam
ПО 12	Engineering Basics of Aviation and Astronautics	4	Test
ПО 13	Aircraft Structure	4	Exam
ПО 14	Course Project on Aircraft Structure	1,5	Test
ПО 15	Design of Satellites	5	Exam
ПО 16	Technical Measuring and Certification	4	Exam
ПО 17	Metrology and Standardization	4	Exam
ПО 18	Theory of Automatic Control	5	Exam
ПО 19	Course Work on Theory of Automatic Control	1	Test
ПО 20	Aerodynamics of Aircraft	4,5	Test
ПО 21	Aerospace materials Science	4	Test
ПО 22	Flight Dynamics	3,5	Exa
ПО 23	Technology of Production of Aircraft	4	Exam
ПО 24	Course Work on Technology of Production of Aircraft.	1	Test
ПО 25	Information Technologies and General Methods of Applied	9	Test
ПО 26	Design of Rocket and Spacecraft Power Plants	6,5	Exam
ПО 27	Pre-diploma Practice	6	Test
ПО 28	Diploma Design	6	Defense

2. List of components of education program

Code	Components of education program (academic disciplines, course projects / works, practices)	Number of ECTS credits	Form of final control
1	2	3	4
	Selective components of EP		
	General training cycle		
3B 1	Educational Component of 1 GU-Catalogue	2	Test
3B 2	Educational Component of 2 GU-Catalogue	2	Test
	Professional training cycle		
ПВ 1	Educational Component of 1 F-Catalogue	4	Test
ПВ 2	Educational Component of 2 F-Catalogue	4	Test
ПВ 3	Educational Component of 3 F-Catalogue	4	Test
ПВ 4	Educational Component of 4 F-Catalogue	4	Test
ПВ 5	Educational Component of 5 F-Catalogue	4	Test
ПВ 6	Educational Component of 6 F-Catalogue	4	Test
ПВ 7	Educational Component of 7 F-Catalogue	4	Test
ПВ 8	Educational Component of 8 F-Catalogue	4	Test
ПВ 9	Educational Component of 9 F-Catalogue	4	Test
ПВ 10	Educational Component of 10 F-Catalogue	4	Test
ПВ 11	Educational Component of 11 F-Catalogue	4	Test
ПВ 12	Educational Component of 12 F-Catalogue	4	Test
ПВ 13	Educational Component of 13 F-Catalogue	4	Test
ПВ 14	Educational Component of 14 F-Catalogue	4	Test
To	otal amount of compulsory education components:	1	80
Th	ne total amount of selective education components:	(50
T	OTAL AMOUNT OF EDUCATION PROGRAM COMPONENTS	2	40





4. Form of certification of applicants for higher education

Graduation certification of higher education applicants in the education program "Aerospace and rocket systems engineering" specialty 134 "Aerospace and rocket-space technology" is carried out in the form of defense of the qualification work and ends with the issuance of a standard document conferred Bachelor degree with qualification: Bachelor in Aerospace and rocket-space technology. The qualification work is checked for plagiarism and is placed in the repository of the NTB of the University for free access after the defense.

Graduation certification is open and public.

5. Matrix of program competences correspondence to the components of education program

	301	30 2	303	304	305	306	307	308	30 9	3010	П01	П02	ПО3	П04	1105	1106	1107	8011	60II	ПО10	П011	П012	IIO 13	IIO 14	IIO 15	IIO 16	IIO 17	IIO 18	ПО 19	IIO 20	IIO 21	IIO 22	IIO 23	IIO 24	II 0 25	IIO 26	110 27	IIO 28
																							Ι		[[[
ЗК 1	+																																					1
ЗК 2						+	+																														1	1
ЗК З									+	+													+	+														1
ЗК 4													+																						+		+	+
ЗК 5																					+			+					+					+			+	
ЗК б																				+	+	$^+$	+	+						+								+
ЗК 7													+							+	+	+	+	+						+								+
ЗК 8						+														+										+								+
ЗК 9	+		+	+																																		
ЗК 10		+			+																																	
ЗК 11																								+					+					+				+
ЗК 12							+																	+					+	+				+			+	+
ЗК 13																								+					+					+			+	
ФК 1											+	+		+							+					+	+	+		+		+						+
ФК 2											+	+		+							+									+								+
ФК 3												+	+						+				+	+	+						+							+
ФК 4											+	+		+				+	+																			+
ФК 5												+	+		+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+				+		+
ФК 6									+	+		+				+	+	+		+			+	+		+	+				+		+	+			+	
ФК 7													+				+				+							+	+	+					+			+
ФК 8				+				+	+													+											+	+			+	
ФК 9																+	+	+		+	+	+	+	+	+	+	+				+					+		+
ФК 10												+			+				+						+	+	+											
ФК 11												+			+					+																+		
ФК 12														+							+						+											
ФК 13											+				+					+	+		+	+	+	+	+						+	+				+
ФК 14															+	+	+				+		+	+			+	+	+					+				+

	301	302	303	304	305	306	307	308	309	3010	101	П02	1103	II04	1105	1106	П07	1108	1109	П010	П011	П012	ПО 13	ПО 14	ПО 15	ПО 16	ПО 17	ПО 18	ПО 19	ПО 20	ПО 21	ПО 22	ПО 23	ПО 24	ПО 25	ПО 26	ПО 27	IIO 28
ПРН 1											+	+																		+								+
ПРН 2																																			+	\square		
ПРН 3					+				+	+		+	+																				+	+		\square		
ПРН 4												+		+							+									+						\square		
ПРН 5												+			+			+			+															+		+
ПРН 6															+	+				+				+	+		+		+				+	+			+	
ПРН 7												+		+	+													+	+			+			+			
ПРН 8											+				+		+	+		+		+	+	+						+	+					+		+
ПРН 9											+											-				+	+											
ПРН 10											+						+		+																			
ПРН 11									+	+				+		+	+			+			+	+														+
ПРН 12											+	+						+		+								+	+							+		
ПРН 13												+			+										+											\square		
ПРН 14																																			+	\square		+
ПРН 15	_			+																		+																
ПРН 16	_											+	+																		+							
ПРН 17												+							+						+						+					\square		
ПРН 18	_														+			+										+	+								+	+
ПРН 19	-										+	+							+																	\square		
ПРН 20	-										+			+																						\square		
ПРН 21	_									+							+	+															+	+		\vdash	+	
ПРН 22	-											+		+						+			+	+			+	+	+	+		+				\vdash		+
ПРН 23	+																																			\vdash		
IIPH 24	-					+	+															+		+					+					+		\vdash		+
IIPH 25	-					+	+															+		+					+					+		\vdash		+
IIPH 26	-	+	+	+				-				-																								\vdash	\vdash	
IIPH 27	L					<u> </u>	<u> </u>		<u> </u>		<u> </u>					<u> </u>						+		+	+	+	+		<u> </u>	<u> </u>			+	+		\vdash	+	+
IIPH 28		1	+	1				+				1																								1	+	l

6. Matrix for providing program learning outcomes with relevant components of education program