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

APPROVED
Academic Council of KPI. Igor Sikorsky
(Minutes № ___ from "___" _____ 20___)
Secretary of the Academic Council
_____ Mykhailo ILCHENKO

ENGINEERING AND COMPUTER-INTEGRATED TECHNOLOGIES FOR DESIGNING INNOVATIVE INDUSTRY EQUIPMENT

Engineering and computer-integrated technologies for designing innovative industry equipment

EDUCATIONAL AND SCIENTIFIC PROGRAM

second (master's) level of higher education

specialty **133 Industrial engineering**

field of knowledge **13 Mechanical engineering**

qualification **Master of Industrial Engineering**

Put into effect by order of the Rector of KPI. I. Sikorsky
№ ___11___ from "_09_" december_ 2019_)

Kyiv - 2021

PREAMBLE

DEVELOPED project group:

Chairman of the project team

Shcherbina Valeriy Yuriyovych, Doctor of Technical Sciences, Professor, Professor of the Department of Chemical, Polymer and Silicate Mechanical Engineering

Project team members:

Stepanyuk Andriy Romanovych, Candidate of Technical Sciences, Associate Professor, Associate Professor of the Department of Machines and Apparatus for Chemical and Oil Refining

Sidorov Dmitry Eduardovich, Candidate of Technical Sciences, Associate Professor, Associate Professor of the Department of Chemical, Polymer and Silicate Mechanical Engineering

Gondlyakh Oleksandr Volodymyrovych, Doctor of Technical Sciences, Professor, Professor of the Department of Chemical, Polymer and Silicate Mechanical Engineering

Kornienko Yaroslav Mykytovych, Doctor of Technical Sciences, Professor, Head of the Department of Machines and Apparatus for Chemical and Oil Refining

Acting Head of the Department of Chemical, Polymer and Silicate Mechanical Engineering Gondlyakh Oleksandr Volodymyrovych, Doctor of Technical Sciences, Professor, Professor of the Department of Chemical, Polymer and Silicate Mechanical Engineering

Head of the Department of Machines and Apparatus of Chemical and Oil Refining Production Kornienko Yaroslav Mykytovych, Doctor of Technical Sciences, Professor

AGREED:

Scientific and Methodological Commission of KPI. Igor Sikorsky, majoring in 133 Industrial Engineering

Chairman of the NMCU 133_____ Yaroslav KORNIENKO

(Minutes № 3 from "_28_" ___11___ 2019)

Methodical council of KPI named after Igor Sikorsky

Chairman of the Methodical Council _____ Yuriy YAKYMENKO

(Minutes № ___ from "___" _____ 2021)

TAKEN INTO ACCOUNT:

External approbation of the educational program. After receiving all the wishes and suggestions of stakeholders, the educational and scientific program was discussed at a meeting of the Department of Chemical, Polymer and Silicate Engineering (Minutes № from _____ 2021) and at a meeting of the Department of Machines and Apparatus of Chemical and Refining (Minutes № from 2021). .

CONTENT

1. PROFILE OF THE EDUCATIONAL PROGRAM

in specialty 133 Industrial Engineering

1 - General information	
Full name of ZVO and institute / faculty	National Technical University of Ukraine, Kyiv Polytechnic Institute named after Igor Sikorsky Faculty of Chemical Engineering
Degree of higher education and title of qualification in the original language	Degree - Master Qualification - Master of Industrial Engineering
The official name of the educational program	Engineering and computer-integrated technologies for designing innovative industry equipment
Type of diploma and scope of educational program	Master's degree, single, 120 credits, term of study 1 year, 9 months
Availability of accreditation	UD certificate № 11001141 (075763), issued by the Ministry of Education and Science of Ukraine on January 18, 2018, valid until July 1, 2027.
Level with NRC	NRC of Ukraine - level 8 QF-EHEA - second cycle, EQF-LLL - 7 level
Prerequisites	Having a bachelor's degree
Language (s) of instruction	Ukrainian
Term of the educational program	Until the next accreditation
Internet address of the permanent placement of the educational program	http://osvita.kpi.ua/op https://cpsm.kpi.ua/navchannya/osvitni-prohramy.html http://ci.kpi.ua/uk/освітні-програми/#place
2 - The purpose of the educational program	
The purpose of the educational program: training of a specialist capable of solving complex problems and problems in the field of mechanical engineering and carrying out innovative professional activities. Corresponds to the development strategy of KPI. Igor Sikorsky for 2020-2025 (https://data.kpi.ua/sites/default/files/files/2020-2025-strategy.pdf): 1) vision - to promote the formation of the society of the future on the basis of the concept of sustainable development. To be a world-class technical research university. Create all conditions for the training of highly qualified (perfect - perfect) professionals capable of creating modern scientific knowledge and innovative technologies for the benefit of mankind and ensure a worthy place for Ukraine in the world community; 2) mission - to make (to contribute) a significant contribution to ensuring the sustainable development of society through the internationalization and integration of education, the latest research and innovative developments. 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; 3) goals - to ensure the fundamentalization of training according to the physical and technical model, which provides for the synthesis of deep general scientific, natural knowledge and engineering; to strengthen the harmonious, multidimensional education of students as well-developed individuals, capable of the highest achievements in their professional and universal activities, true patriots of Ukraine,able to solve complex specialized practical problems and tasks in the field of industrial engineering to ensure the development of society at a new quality level.	

3 - Characteristics of the educational program	
Subject area	**Objects of study and activity**: System engineering for the creation of innovative technical facilities for industrial engineering and their operation, including: - machines, equipment, complexes, methods and current lines of machine-building production, technologies and means of their design, research, manufacture, operation and utilization; - processes, equipment and organization of machine-building production; - means and methods of testing and quality control of branch engineering products. **Learning objectives:** - training of specialists capable of solving complex problems and problems of branch mechanical engineering. **Theoretical content of the subject area:** - a set of tools and methods of activity aimed at creating, operating and disposing of mechanical engineering products. **Methods, techniques and technologies:** - methods, means and technologies of calculation, design, construction, production, testing, repair and control of objects and processes of branch mechanical engineering. **Tools and equipment:** - main and auxiliary equipment, means of mechanization, automation and control; - means of technological, instrumental, metrological, diagnostic, informational and organizational support of production processes.
Orientation of the educational program	Educational and scientific
The main focus of the educational program	Training of competitive specialists capable of solving complex specialized scientific, technical and practical problems of equipment for chemical, polymer, oil refining, pulp and paper, construction materials and related industries and products characterized by complexity and uncertainty of conditions. Key words: engineering, machines, devices, equipment, process, technology, production, production, research, modeling, design, modernization, operation, product, innovative equipment.
Features of the program	Requires research practice

4 - Suitability of graduates for employment and further study

Suitability for employment	Types of economic activity (according to the Classifier of types of economic activity DK 009: 2010): 17 Manufacture of paper and paper products; 19 Manufacture of coke and refined petroleum products; 20.1 Manufacture of basic chemical products, fertilizers and nitrogen compounds, plastics and synthetic rubber in primary forms; 20.20 Manufacture of pesticides and other agrochemical products; 20.30 Manufacture of paints, varnishes and similar products, printing ink and mastics; 20.4 Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and cosmetics; 20.5 Manufacture of other chemical products; 20.6 Manufacture of man-made fibers; 21.10 Manufacture of basic pharmaceutical products; 21.20 Manufacture of pharmaceutical preparations and materials; 22 Manufacture of rubber and plastic products; 23 Manufacture of other non-metallic mineral products; 28.1 Manufacture of machinery and equipment for general purposes; 28. 21 Manufacture of furnaces and furnace burners; 28.25 Manufacture of industrial refrigeration and ventilation equipment; 28.95 Manufacture of machinery and equipment for paper and paperboard production; 28.96 Manufacture of machinery and equipment for plastics and rubber manufacturing; 33.1 Repair and maintenance of finished metal products, machinery and equipment; 33.11 Repair and maintenance of finished metal products; 33.12 Repair and maintenance of machinery and equipment for industrial use; 33.19 - Repair and maintenance of other machinery and equipment; 33.20 - Installation and assembly of machines and equipment; 71.20 Technical tests and research; 72.19 Research and experimental development on other natural and technical sciences. 28.95 Manufacture of machinery and equipment for paper and paperboard production; 28.96 Manufacture of machinery and equipment for plastics and rubber manufacturing; 33.1 Repair and maintenance of finished metal products, machinery and equipment; 33.11 Repair and maintenance of finished metal products; 33.12 Repair and maintenance of machinery and equipment for industrial use; 33.19 - Repair and maintenance of other machinery and equipment; 33.20 - Installation and assembly of machines and equipment; 71.20 Technical tests and research; 72.19 Research and experimental development on other natural and technical sciences. 28.95 Manufacture of machinery and equipment for paper and paperboard production; 28.96 Manufacture of machinery and equipment for plastics and rubber manufacturing; 33.1 Repair and maintenance of finished metal products, machinery and equipment; 33.11 Repair and maintenance of finished metal products; 33.12 Repair and maintenance of machinery and equipment for industrial use; 33.19 - Repair and maintenance of other machinery and equipment; 33.20 - Installation and assembly of machines and equipment; 71.20 Technical tests and research; 72.19 Research and experimental development on other natural and technical sciences. machines and equipment; 33.11 Repair and maintenance of finished metal products; 33.12 Repair and maintenance of machinery and equipment for industrial use; 33.19 - Repair and maintenance of other machinery and equipment; 33.20 - Installation and assembly of machines and equipment; 71.20 Technical tests and research; 72.19

	Research and experimental development on other natural and technical sciences. machines and equipment; 33.11 Repair and maintenance of finished metal products; 33.12 Repair and maintenance of machinery and equipment for industrial use; 33.19 - Repair and maintenance of other machinery and equipment; 33.20 - Installation and assembly of machines and equipment; 71.20 Technical tests and research; 72.19 Research and experimental development on other natural and technical sciences. The specialist is able to perform these professional works according to the classifier of professions DK 003: 2010: 2145.2 - Design engineer (mechanics) 2145.2 - Engineer - technologist (mechanics) 2149.2 - Engineer - researcher
Further training	Continuation of education at the third (educational and scientific) level of higher education and / or acquisition of additional qualifications in the system of postgraduate education
5 - Teaching and assessment	
Teaching and learning	Lectures, practical and seminar classes, computer workshops, laboratory works, course projects and works, technology of blended learning, practices and excursions, master's thesis
Evaluation	Rating system, assessment, oral and written exams, testing, etc. Qualification work.
6 - Program competencies	
Integral competence	Ability to solve complex problems and problems in the field of mechanical engineering, which involves research of processes, equipment and / or innovation in this field and is characterized by uncertainty of conditions and requirements
General Competences (LC)	
ZK 1	Ability to use information and communication technologies.
ZK 2	Ability to learn and master modern knowledge.
ZK 3	Ability to search, process and analyze information from various sources.
ZK 4	The ability to be critical and self-critical.
ZK 5	Ability to adapt and act in a new situation.
ZK 6	Ability to generate new ideas (creativity).
ZK 7	Ability to identify, pose and solve problems.
ZK 8	Ability to make informed decisions.
ZK 9	Ability to work in a team.
ZK 10	Ability to conduct research at the appropriate level.
	Special (professional) competencies of the specialty (SC)
SC 1	Ability to create, improve and apply quantitative mathematical, scientific and technical methods and computer software, apply a systematic approach to solving engineering problems of industrial engineering, in particular, in conditions of technical uncertainty
SC 2	Critical understanding of advanced scientific facts, concepts, theories, principles and the ability to apply them to solve complex problems of industrial engineering and sustainable development
SC 3	Ability to create new equipment and technologies in the field of mechanical engineering
SC 4	Awareness of promising tasks of modern production aimed at meeting the needs of consumers, ownership of trends in innovative development of industry technologies
SC 5	Ability to develop and implement plans and projects in the field of industrial engineering and related activities, to carry out relevant business activities

SC 6	Ability to scientific and pedagogical activity in institutions of higher and professional higher education
SC 7	Ability to perform scientific, practical and applied research in the engineering industry
SC 8	The ability to create intellectual property objects to protect them
SC 9	Ability to develop equipment taking into account the problems of sustainable development
SC 10	Ability to search, analyze scientific and technical information and professional communication in a foreign language
SC 11	Ability to analyze and develop technologies for automation of technological processes
SC 12	Ability to search for optimal solutions in solving problems of research, design, maintenance and modernization of equipment using computer technology, CAD-systems and other applications
SC 13	Ability to perform mathematical modeling in solving problems of research, design, maintenance and modernization of equipment
SC 14	Ability to carry out innovative, design, engineering and operational activities in the fieldbranch engineering
SC 15	Ability to engineer innovative technological processes and have the ability to upgrade, develop and ensure its efficiency
SC 16	Ability to use computer-integrated technologies for designing industry equipment
SC 17	Ability to model processes and regulations of industrial equipment
SC 18	Ability to develop and implement plans and projects in the field of industrial engineering and related activities, to carry out relevant business activities
7 - Program learning outcomes	
PH 1	Knowledge and understanding of the principles of technological, basic and engineering sciences that underlie the branch engineering of the relevant industry
PH 2	Knowledge and understanding mechanics and mechanical engineering and prospects for their development
PH 3	Know and understand the processes of industrial engineering, have the skills of their practical use
PH 4	Carry out engineering calculations to solve complex problems and practical problems in the field of mechanical engineering
PH 5	Analyze engineering objects, processes and methods
PH 6	Find the necessary scientific and technical information in available sources, in particular, in a foreign language, analyze and evaluate it
PH 7	Prepare production and operate equipment and products of branch mechanical engineering during the life cycle
PH 8	To plan and carry out scientific researches in the field of branch mechanical engineering, to analyze their results, to substantiate conclusions
PH 9	Develop and teach special disciplines in institutions of the higher world
PH 10	Using databases of intellectual property, to conduct patent research in a particular field of technology
PH 11	Knowledge of basic methods of collecting, processing, analyzing and systematizing scientific and technical information about existing equipment and creating new facilities
PH 12	Knowledge of modern problems of sustainable development in terms of approaches to the development of technologies and equipment for industrial engineering
PH 13	Knowledge of a foreign language for search, analysis of scientific and technical information, publication of research results and communication with specialists
PH 14	Knowledge of modern approaches to the development of management solutions, startup projects and innovation management in the development of equipment for industrial engineering
PH 15	Based on the methods of mathematical modeling and using computer technology, CAD-systems and other applications to solve problems of research, design, operation, modernization of industrial engineering equipment
PH 16	Using the fundamental laws of conservation and transfer, choose / develop / analyze / implement software or environments mathematical models and regulations of processes occurring in the workspace and / or in the construction of technological equipment, taking into account the initial and boundary conditions

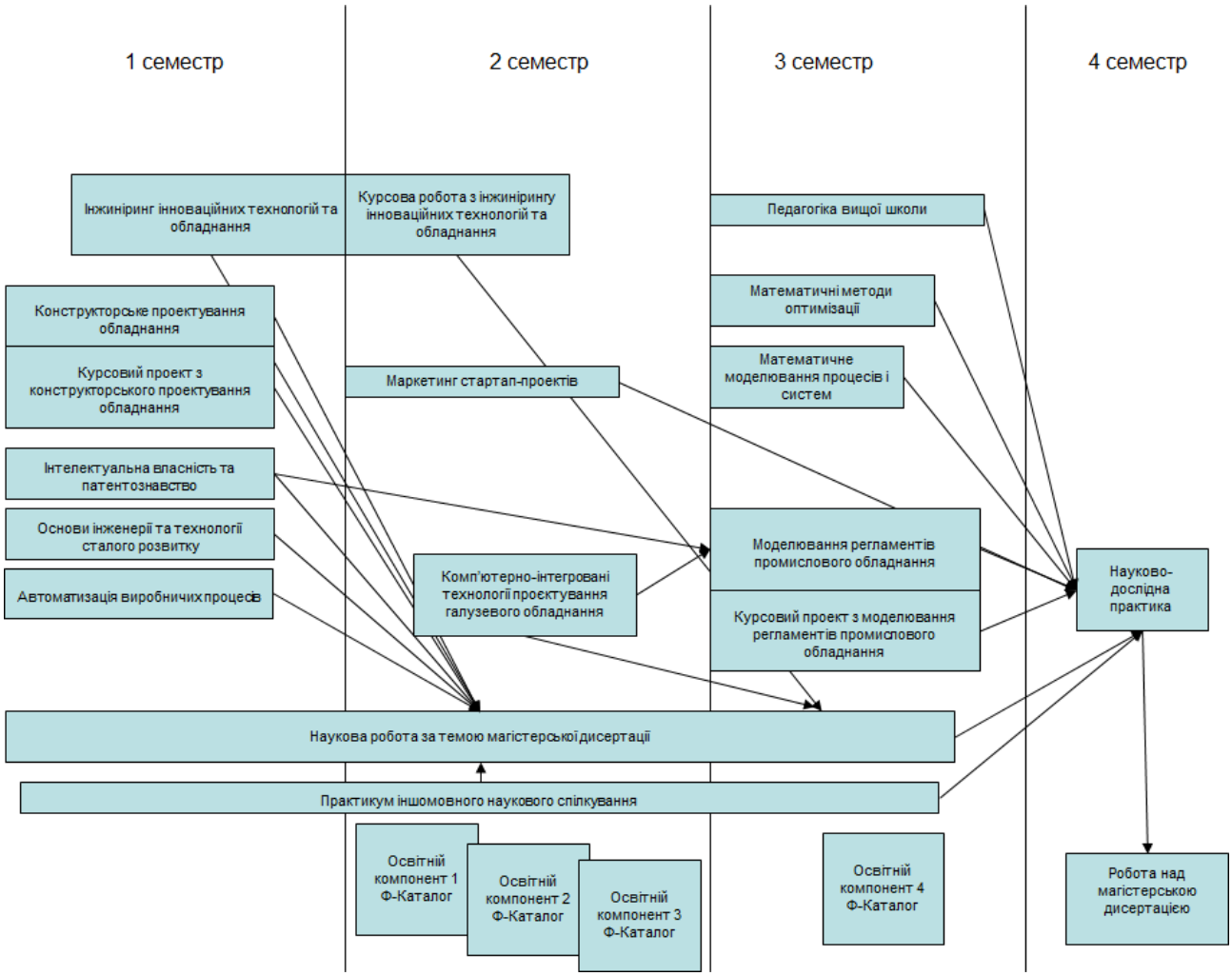
PH 17	Knowledge of modern methods of problem statement, analysis and development of technologies for automation and process control
PH 18	Perform engineering of innovative technological processes and possession of modernization, development and ensuring its efficiency
8 - Resource support for program implementation	
Staffing	In accordance with the personnel requirements for ensuring the implementation of educational activities for the relevant level of HE (Annex 12 to the License Conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187
Logistics	In accordance with the technological requirements for material and technical support of educational activities of the appropriate level of HE (Annex 13 to the License Conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187
Information and educational and methodical support	In accordance with the technological requirements for educational and methodological and informational support of educational activities of the relevant level of HE (Annexes 14 and 15 to the Licensing Conditions), approved by the Resolution of the Cabinet of Ministers of Ukraine dated 30.12.2015 № 1187
9 - Academic mobility	
National credit mobility	Opportunity to participate in academic mobility programs, double graduation
International credit mobility	Opportunity to participate in the Erasmus + program, international credit mobility projects
Training of foreign applicants for higher education	Occurs in academic groups on general grounds, or in separate groups of international students

2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Code n / a	Components of the educational program (academic disciplines, practices, qualification work)	Number of credits	Form final control
1. REGULATORY educational components			
1.1. General training cycle			
3O1	Intellectual property and patent science	3	Test
3O2	Fundamentals of engineering and technology of sustainable development	2	Test
30	Practical course of foreign language scientific communication	4.5	Test
3O4	Marketing of startup projects	3	Test
3O5	Pedagogy of high school	2	Test
3O6	Mathematical methods of optimization	4	Exam
3O7	Mathematical modeling of processes and systems	4	Exam
1.2. Cycle of professional training			
PO1	Design design of equipment	6.5	Exam
PO2	Course project on design design of equipment	1.5	Test
PO3	Automation of production processes	5.5	Exam
PO4	Engineering of innovative technologies and equipment	8	Exam
PO5	Course work on engineering of innovative technologies and equipment	1	Test
PO6	Computer-integrated technologies of technological equipment design	3	Test
PO7	Modeling of processes and regulations of industrial equipment	5	Test
PO8	Course work on modeling regulations of industrial equipment	1	Test
Research (scientific) component			
PO9	Scientific work on the topic of master's dissertation	9	Test
PO10	Research practice	10	Test
PO11	Completion of a master's thesis	17	Protection
2. SELECTIVE educational components			
2.1. Cycle of professional training (Selective educational components with faculty / department catalogs)			
PV1	Educational component 1 of the F-Catalog	7.5	Exam
PV2	Educational component 2 of the F-Catalog	7.5	Exam
PV3	Educational component 3 of the F-Catalog	7.5	Exam
PV4	Educational component 4 of the F-Catalog	7.5	Exam
The total volume of the general training cycle		**22.5**	
The total volume of the training cycle		**67.5**	
The total amount of mandatory components		**90**	
The total amount of elective components chosen by students		**30**	

Code n / a	Components of the educational program (academic disciplines, practices, qualification work)	Number of credits	Form final control
TOTAL VOLUME OF THE EDUCATIONAL PROGRAM		**120**	

3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



4. FORM OF FINAL CERTIFICATION OF HIGHER EDUCATION APPLICANTS

Graduation certification of applicants for higher education according to the educational program "Engineering and computer-integrated technologies for designing innovative industry equipment"Specialty" 133 - Industrial Engineering "is carried out in the form of protection master's thesis and ends with the issuance of a standard document on the award of a master's degree with the qualification "Master of Industrial Engineering" in the specialty "133 Industrial Engineering", according to the educational and scientific programEngineering and computer-integrated technologies for designing innovative industry equipment».

Graduation certification is open and public.

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

	ЗО1	ЗО2	30	ЗО4	ЗО5	ЗО6	ЗО7	РО1	РО2	РО3	РО4	РО5	РО6	РО7	РО8	РО9	РО10	РО11
ZK 1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
ZK 2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
ZK 3	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
ZK 4		+		+	+											+	+	+
ZK 5		+	+	+	+											+	+	+
ZK 6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
ZK 7	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
ZK 8	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+		+
ZK 9	+	+	+	+	+												+	
ZK 10	+	+		+		+	+	+	+	+	+	+	+	+	+	+	+	+
SC 1	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
SC 2	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
SC 3	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+
SC 4	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
SC 5		+		+	+	+		+	+	+	+	+	+	+	+	+	+	+
SC 6					+													
SC 7		+				+	+	+	+		+	+	+	+	+	+	+	+
SC 8	+															+	+	+
SC 9		+	+					+	+		+	+	+	+	+	+	+	+
SC 10	+				+											+	+	+
SC 11										+						+	+	+
SC 12						+		+	+	+	+	+	+	+	+	+	+	+
SC 13					+		+				+	+	+	+	+	+	+	+
SC 14	+			+				+	+	+	+	+	+	+	+	+	+	+
SC 15				+				+	+	+	+	+				+	+	+
SC 16					+	+	+	+	+	+	+	+	+	+	+	+	+	+
SC 17														+	+	+	+	+
SC 18				+				+	+							+	+	+

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

	ЗО1	ЗО2	30	ЗО4	ЗО5	ЗО6	ЗО7	РО1	РО2	РО3	РО4	РО5	РО6	РО7	РО8	РО9	РО10	РО11
РН 1	+	+		+		+	+			+						+		
РН 2	+	+						+	+		+	+	+	+	+			
РН 3					+	+	+	+	+	+	+	+	+	+	+			
РН 4					+			+	+		+	+	+	+	+	+		
РН 5	+	+		+		+	+	+	+	+	+	+	+	+	+	+		
РН 6	+		+	+												+		
РН 7								+	+	+	+	+	+	+	+			
РН 8																+	+	+
РН 9					+													
РН 10	+																	
РН 11	+			+		+	+											
РН 12		+																
РН 13			+													+		
РН 14				+														
РН 15						+	+	+	+		+	+	+	+	+	+	+	+
РН 16							+	+	+		+	+	+	+	+	+	+	+
РН 17										+								
РН 18														+	+		+	+