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 from 13.12. 2021)
Head of the Academic Council

Mykhailo ILCHENKO

Aviation and Aerospace Technologies

EDUCATIONAL AND SCIENTIFIC PROGRAM

second (master's) level of higher education

Specialty	**134 Aviation and Aerospace Technologies**
Area of expertise	**13 Mechanical engineering**
Qualification	**Master in Aviation and Aerospace Technologies**

Put into effect from 2022/2023 e.y.
by order of the Rector
Igor Sikorsky Kyiv Polytechnic Institute
from 15.02.2022 №НОН/75/2022

Kyiv – 2021

PREAMBLE

DEVELOPED by project group:

The project team chairman:

***Vitalii SUKHOV**, Doctor of Technical Sciences, Professor of Department of Aircraft and Rocket Engineering, guarantor of master's educational and scientific program "Airplanes and helicopters".*

The project team members:

***Volodymyr KABANIACHYI**, Doctor of Technical Sciences, Acting Head of the Department of Aircraft and Rocket Engineering.*

***Olexandr ARKHYPOV**, Doctor of Technical Sciences, Professor of Department of Aircraft and Rocket Engineering.*

***Oleksandr MARYNOSHENKO**, Candidate of Technical Sciences, Associate Professor and Head of Department of Space Engineering.*

***Oleksandr BONDARENKO**, Candidate of Technical Sciences, Associate Professor and Acting Head of the Department of Aircraft and Rocket Engineering.*

***Viktor BORYSOV**, Senior Lecturer of Department of Aircraft and Rocket Engineering.*

***Maxym GLADSKYI**, Candidate of Technical Sciences, Associate Professor, Assistant of Head of Progresstech Ukraine Ltd.*

***Ihor LUCHKO**, postgraduate of Department of Aircraft and Rocket Engineering.*

AGREED:

Scientific and methodological committee of the university in the specialty 134 "Aviation and Aerospace Technologies"

Head of SMCU 134 **Volodymyr KABANIACHYI**

(Protocol №2 from 03.12.2021)

Methodical Council of Igor Sikorsky

Kyiv Polytechnic Institute

Deputy Head of the Methodical Council **Anatolii MELNYCHENKO**

(Protocol №2 from 09.12.2021)

INCLUDED:

Proposals of the heads and leading specialists of specialized enterprises, in particular, ANTONOV COMPANY, Progresstech Ukraine Ltd., State Enterprise State Kyiv Design Bureau "LUCH", AEROPRAKT LLC, the experience of leading higher education institutions of Ukraine, including the Dnipro National University and the National Aerospace University.

The project of the Standard of higher education in specialty 134 Aviation and Aerospace Technologies for the second (master's) level of higher education.

Provisions on the development, approval, monitoring and revision of educational programs at Igor Sikorsky Kyiv Polytechnic Institute: https://osvita.kpi.ua/node/137

The results of the self analysis of educational program in 2021.

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

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

The educational program was discussed after receiving all the wishes and suggestions and approved at an extended meeting of the Department of Aviation and Rocketry (Protocol №4 of October 29, 2021) and at the extended meeting of the Department of Space Engineering (Protocol №14/21 of November 24, 2021).

CONTENT

1. Profile of educational program

1 – Total information	
Full name of the university and institute/faculty	National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute", Educational and scientific Institute of Aerospace Technologies
Higher education level and qualification in the original language	Level – Master Qualification – Master in Aviation and Aerospace Technologies
Official name of the educational program	Aviation and Aerospace Technologies
Diploma type and scope of educational program	Master's diploma, single, 120 ECTS Credits, term of study 1 year 9 months
Availability of accreditation	Certificate of accreditation of the specialty UD 11007490, valid until 01.07.2024
Cycle/level of HE	NQF of Ukraine – 7 level QF-EHEA – second circle EQF-LLL – 7 level
Prerequisites	Availability of a bachelor's degree
Language(s) of lecturing	Ukrainian/English
The validity of educational program	Until the next accreditation
Internet address of educational program permanent location	https://osvita.kpi.ua/op http://iat.kpi.ua
2 – Purpose of the educational program	
Training of professionals capable of solving complex tasks and problems in professional activities related to the development, production and (or) certification of aviation and rocket-space technology, its engines and power plants, structures and systems or in the process of training, which related to research and/or innovation and characterized by uncertainty of conditions and requirements.	
3 – Characteristics of educational program	
Subject area	**Objects of study** - phenomena and problems related to the life cycle stages of aviation and space rocketry facilities. **The purpose of training** - training of specialists capable of solving complex tasks and problems in professional activities related to the development, production and (or) certification of aviation and rocket-space technology, its engines and power plants, structures and systems or in the process of training, which related to research and/or innovation and characterized by uncertainty of conditions and requirements. **Theoretical content of the subject area** - theoretical foundations of development and production of objects of aviation and rocket and space technology. **Methods, techniques and technologies** - modern analytical, numerical and experimental methods of research of the subject area, methods and technologies for solving complex problems and problems related to the stages of the life cycle of aviation and rocket and space technology.

	Instruments and equipment - laboratory equipment with measuring devices, in particular hydraulic stands, wind tunnels, equipment for researching the properties of materials, the stress-strain state of structures; equipment for the assembly and testing of aviation and space rocketry technology, computers with information and specialized software for the design and production of structures of aviation and space rocketry technology.
The educational program orientation	Educational and scientific
The main focus of educational program	The program is based on well-known scientific principles, taking into account the current state of development of the aerospace industry, focuses on current information and production technologies, in which further professional and scientific career is possible: computer technology modeling systems and processes, object-oriented programming, composite materials, diagnostics and control technical objects. Key words: airplanes, helicopters, rockets, space vehicles, aerodynamics, strength, resource.
The features of education program	Education is conducted with elements of dual education. The implementation of the program involves the involvement of practicing professionals, industry experts, and representatives of employers in classroom classes. Students will acquire the skills of describing design and management algorithms using modern object-oriented information technologies.
4 – Suitability of graduates for employment and further study	
Suitability for employment	ДК 003:2010, Codes: 2145. Professionals in the field of Mechanical Engineering 2145.1 Junior Research Associate (Engineering Mechanics) 2145.2 Mechanical engineers
Further education	Continuation of education at the third (educational and scientific) level of higher education and/or acquisition of additional qualifications in the system of adult education.
5 – Teaching and assessment	
Teaching and learning	The general style of study is problem-oriented. Teaching is carried out in the form of lectures, seminars, practical classes, laboratory classes in small groups (up to 8 people), independent work with the possibility of consultation with the teacher, individual classes with the use of information and communication technologies (Pro/Engineer, CATIA, Nastran, FEMAP, ODBMS Space).
Evaluation	Current and semester control in the form of laboratory reports, calculation and graphic works, abstracts, written and verbal examinations and dissertation defense. The evaluation is carried out in accordance with the defined criteria of the Rating system.
6 – Program competencies	
Integral competence	Ability to solve complex problems and problems in professional and scientific activities in the development, production and (or) certification of aerospace and rocketry, structures and systems or in the learning process, which are related to research and/or innovation and characterized by uncertainty of conditions and requirements.

General competencies	GC 1. Ability to abstract thinking, analysis and synthesis. GC 2. Ability to identify set and solve problems. GC 3. Ability to conduct research on the appropriate level. GC 4. Ability to generate new ideas (creativity). GC 5. Ability to use information and communication technologies. GC 6. Ability to adapt and act in a new situation. GC 7. Determinedness and persistence to the assigned tasks and assumed responsibilities. GC 8. Ability to learn and master modern knowledge. GC 9. Ability to apply knowledge in practical situations. GC 10. The ability to communicate in a foreign language in professional (scientific and technical) activities. GC 11. Ability to make management decisions, assess their possible consequences and take responsibility for the results of their activities and the team. GC 12. Ability to teach academic subjects in institutions of higher education.
Professional competencies	PC 1. Awareness of the history, current state, problems and prospects of the development of aviation and rocket and space technology. PC 2. The ability to critically consider the problems of aviation and/or rocket and space technology, including on the border with related fields, engineering sciences, physics, chemistry, ecology, economics PC 3. Ability to qualitatively choose a class of materials for structural elements of aerospace and rocket technice. PC 4. Ability to evaluate the technical and economic efficiency of design, research, technological processes and innovative developments. PC 5. The ability to create, improve and apply mathematical and numerical methods of modeling properties, phenomena and processes in systems and elements of aviation and rocket and space technology. PC 6. Ability to set and solve professional problems based on basic knowledge in the field of hydraulic, pneumatic, electrical and electronic systems. PC 7. Ability to carry out works on the preparation of production of aerospace and rocket and space technology using the latest technologies. PC 8. The ability to determine the optimal structures of samples of aviation and rocket and space technology, and to optimize the parameters of structural elements and systems. PC 9. The ability to optimize the aerodynamic characteristics of samples of aviation and rocket and space technology. PC 10. The ability to implement physical and mathematical models of systems and processes using methods and tools of modern information technologies. PC 11. Ability to develop aircraft control systems.

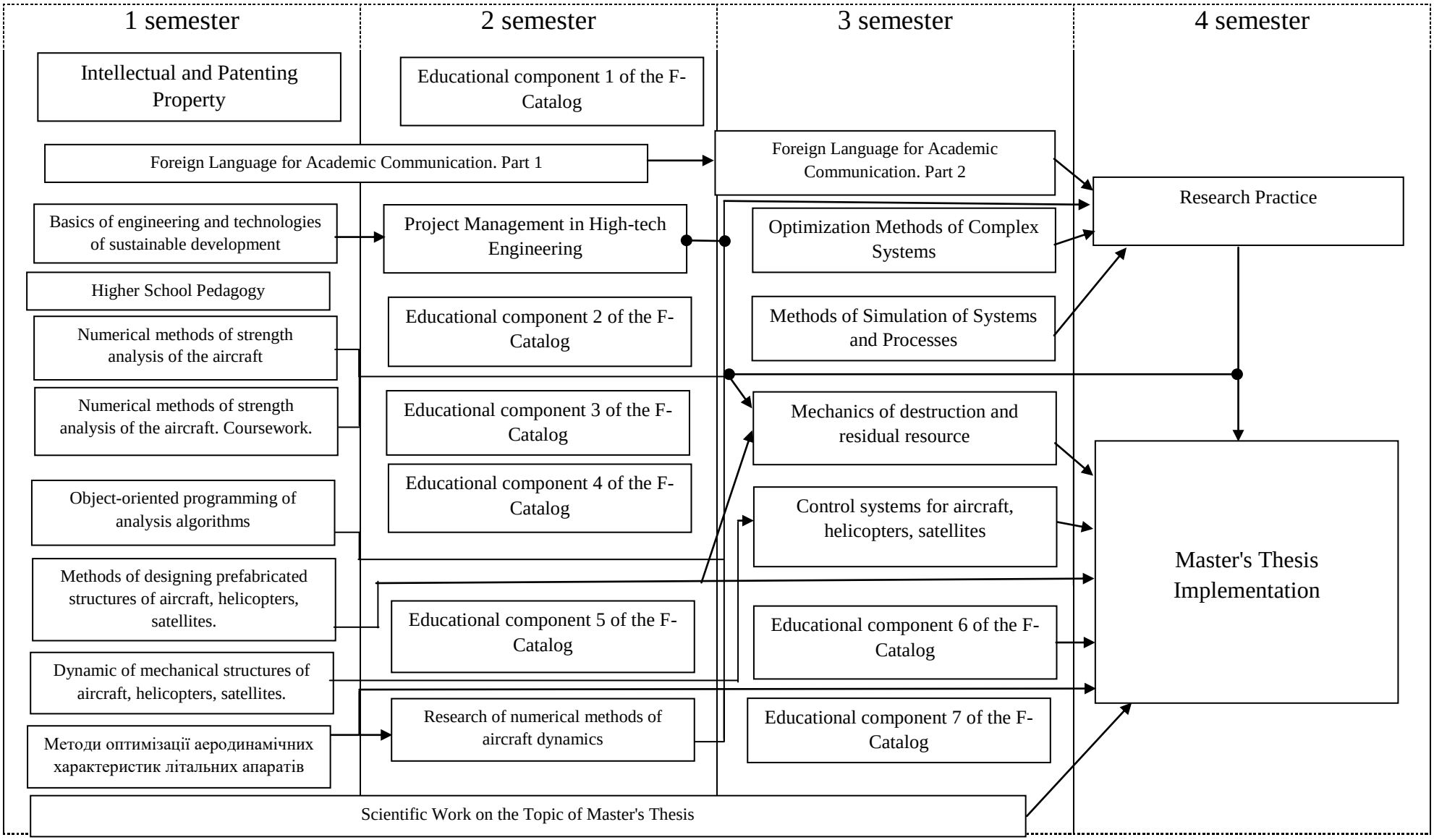
7 – Program learning results
PR 1. Know and understand the fundamentals of fundamental and engineering sciences that are basis of aviation and/or rocket and space technology.
PR 2. Know and understand working processes in systems and elements of aviation and/or rocket and space technology, necessary for understanding, describing, improving and optimizing their parameters.
PR 3. Understand and apply the principles and methods of system analysis when solving complex professional (scientific and technical) problems.
PR 4. Use the modern methods of solving inventive problems, protect intellectual property on technical solutions and other results of professional (scientific and technical) activity.
PR 5. Use the latest specialized software to solve complex problems in professional (scientific and technical) activities in accordance with the educational program.
PR 6. Make the decisions in the event of non-standard complex tasks in professional (scientific and technical) activities in conditions of uncertainty of requirements, the presence of a range of opinions and limited time.
PR 7. Demonstrate the skills of independent and collective work, leadership qualities, organize work under conditions of limited time with an emphasis on professional integrity.
PR 8. Compile report documentation based on the results of solving complex professional (scientific and technical) problems, present the completed research in the form of scientific reports, publications, reports at conferences, etc.
PR 9. It is reasonable to assign a class of materials for elements and systems of aviation and rocket and space technology, to choose and apply effective methods of modifying their properties.
PR 10. Analyses the economic efficiency of the production of elements and systems of aviation rocket and space technology.
PR 11. Reasonable assign quality indicators of objects of aviation and rocket and space technology.
PR 12. Develop and research physical, mathematical and computer models when solving complex professional (scientific and technical) problems related to the stages of the life cycle of aviation and rocket and space technology.
PR 13. Apply the methods of similarity theory, experiment planning, measure and process the results of experimental studies.
PR 14. Prepare applications for competitions for the implementation of scientific research projects and innovative developments.
PR 15. Develop analysis models of objects and systems of aviation and rocket and space technology and optimize their parameters according to various efficiency criteria.
PR 16. Investigate complex internal and external gas (liquid) flows (including flows of compressible, reactive, electrically conductive and other media) using numerical and natural experiment methods of rocket and space technology.
PR 17. Develop and teach academic subjects in institutions of higher education.
PR 18. The ability to communicate in a foreign language at a level that provides the ability to communicate in a professional environment and use scientific and technical documentation in the subject area.
PR 19. Ability to implement mathematical models using modern information technologies.
PR 20. Ability to plan and carry out scientific and applied research in the field of aerospace technologies, choose effective research methods, argue conclusions, present research results.
PR 21. The ability to use theoretical and instrumental support for diagnosing the state of parts of aviation and rocket and space technology based on the latest metrological support.
PR 22. The ability to evaluate the dynamics of aviation and rocket and space technology objects.

8 – Resource support for program implementation	
Staffing	At the graduate department, 9 full-time scientific and pedagogical workers (including internal part-time workers), 7 scientific and pedagogical workers who work part-time (external part-time workers) teach according to the educational program; as part of the scientific and pedagogical staff of the graduation department, 3 doctors of technical sciences, 7 candidates of technical sciences, 2 teachers have a foreign language certificate of level B2. Scientific and pedagogical workers who provide educational components meet the educational and/or professional qualifications, in accordance with the Licensing Terms for conducting educational activities, which were approved by the Resolution of the Government of Ukraine dated 12.30.2015. №1187 in the current version. Scientific and pedagogical workers who ensure the educational process have at least four achievements in professional activity over the last five years, defined in point 38 of the specified Licensing Terms.
Logistics	In accordance with the technological requirements for material and technical support of educational process of the relevant level of HE approved by the Resolution of the Government of Ukraine №1187 from 30 December 2015. Equipment is used for lectures in the form of presentations, network technologies, in particular on the Sikorsky distance learning platform.
Information and the educational and methodical provision	Modern library fund, which is constantly updated, access to professional domestic and foreign periodicals, Scientific and Technical Library of Igor Sikorsky KPI. It accordance's with the technological requirements for educational and methodological and information support of the educational process of the appropriate level of HE approved by the Resolution of the Government of Ukraine №1187 from 30 December 2015.
9 – Academic mobility	
National credit mobility	A double degree agreement has been signed with Dnipro National University.
International credit mobility	An agreement has been concluded about granting the double diploma with the Risen International Culture Exchange Centre (China).
Training of foreign applicants for higher education	It is possible the teaching in English in separate academic groups, while the Ukrainian language is studied as a foreign language or in Ukrainian when studying in joint academic groups with Ukrainian-speaking students.

2. The list of educational components of educational and scientific program

Code	Components of the educational program (subjects, course projects/works, practices, qualification work)	ECTS Credits	Form of final control
1. Normative education components			
General training cycle			
GN 1	Intellectual and Patenting Property	3	Test
GN 2	Basics of engineering and technologies of sustainable development	2	Test
GN 3.1	Foreign Language for Academic Communication. Part 1	3	Test
GN 3.2	Foreign Language for Academic Communication. Part 2	1,5	Test
GN 4	Project Management in High-tech Engineering	3	Test
GN 5	Higher School Pedagogy	2	Test
GN 6	Optimization Methods of Complex Systems	4	Exam
GN 7	Methods of Simulation of Systems and Processes	4	Exam
Vocational training cycle			
VN 1	Numerical methods of strength analysis of the aircraft	4,5	Exam
VN 2	Numerical methods of strength analysis of the aircraft. Coursework.	1	Test
VN 3	Object-oriented programming of analysis algorithms	4	Exam
VN 4	Methods of designing prefabricated structures of aircraft, helicopters, satellites	4	Test
VN 5	Methods for optimizing the aerodynamic characteristics of the aircraft	2	Test
VN 6	Dynamics of mechanical structures of airplanes, helicopters, satellites	4	Exam
VN 7	Mechanics of destruction and residual resource	5	Exam
VN 8	Control systems of airplanes, helicopters, satellites	4	Test
Investigational (scientific) component			
VN 9.1	Scientific work on the topic of the master's thesis. Part 1. Basics of scientific research.	2	Test
VN 9.2	Scientific work on the topic of the master's thesis. Part 2. Research work on the topic of the master's thesis.	5,5	Test
VN 10	Research of numerical methods of aircraft and spacecraft dynamics	3,5	Exam
VN 11	Research practice	10	Test
VN 12	Master's Thesis Implementation	16	Defense
2. Elective education components			
Vocational training cycle			
VE 1	Educational component 1 of the F-Catalog	4	Test
VE 2	Educational component 2 of the F-Catalog	4	Test
VE 3	Educational component 3 of the F-Catalog	6	Exam
VE 4	Educational component 4 of the F-Catalog	4	Test
VE 5	Educational component 5 of the F-Catalog	6	Exam
VE 6	Educational component 6 of the F-Catalog	4	Test
VE 7	Educational component 7 of the F-Catalog	4	Test
Total in Normative components:		**88**	
Total in Optional components:		**32**	
TOTAL		**120**	

3. Structural and logical scheme of educational program



4. The certification form of applicants for higher education

Certification of applicants for higher education under the educational and scientific program "Aviation and Aerospace Technologies" specialty 134 "Aviation and Aerospace Technologies" is carried out in the form of defense of qualifying work and ends with the issuance of a standard document on awarding him a master's degree with a qualification: Master in Aviation and Aerospace Technologies. Qualification work is checked for plagiarism and after defense is placed in the repository of NTB University for free access. Certification is carried out openly and publicly.

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

	GN 1	GN 2	GN 3	GN 4	GN 5	GN 6	GN 7	VN 1	VN 2	VN 3	VN 4	VN 5	VN 6	VN 7	VN 8	VN 9	VN 10	VN 11	VN 12
GC 1		+				+	+												
GC 2		+		+												+		+	+
GC 3				+												+	+		
GC 4	+	+		+															+
GC 5						+	+	+	+	+									
GC 6									+							+		+	
GC 7									+									+	+
GC 8	+	+														+			
GC 9									+									+	+
GC 10			+																
GC 11				+														+	
GC 12					+														
PC 1	+			+												+			
PC 2	+	+		+												+			
PC 3											+			+					
PC 4				+															+
PC 5							+				+	+	+	+		+	+		+
PC 6													+	+			+	+	+
PC 7											+			+		+			+
PC 8						+		+	+		+		+		+			+	+
PC 9						+						+							+
PC 10							+	+	+	+					+		+	+	+
PC 11															+				+

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

	GN 1	GN 2	GN 3	GN 4	GN 5	GN 6	GN 7	VN 1	VN 2	VN 3	VN 4	VN 5	VN 6	VN 7	VN 8	VN 9	VN 10	VN 11	VN 12
PR 1		+		+							+					+			
PR 2						+	+				+		+	+	+				
PR 3			+																
PR 4	+															+			
PR 5							+	+	+	+									
PR 6		+		+					+							+		+	+
PR 7									+							+		+	+
PR 8	+										+					+		+	+
PR 9											+		+	+				+	+
PR 10				+												+		+	+
PR 11				+										+				+	+
PR 12							+	+	+		+	+	+	+	+	+		+	+
PR 13												+					+		+
PR 14	+			+												+			
PR 15						+	+	+	+	+		+	+		+		+		+
PR 16												+				+	+		+
PR 17					+														
PR 18			+														+		
PR 19							+	+	+	+					+				+
PR 20											+					+			
PR 21											+			+					
PR 22													+		+				