

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE  
NATIONAL TECHNICAL UNIVERSITY OF UKRAINE  
"IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE"**

APPROVED by the Academic Council of  
Igor Sikorsky KPI  
(protocol No\_\_\_ from \_\_\_\_\_)

Chairman of the Academic Council

\_\_\_\_\_ Mykhailo ILCHENKO

**MANUFACTURING ENGINEERING**

**Manufacturing engineering**

**EDUCATIONAL AND PROFESSIONAL PROGRAM**

**first (bachelor's) level of higher education**

<b>Specialty</b>	<b>131 Applied mechanics</b>
<b>Field of knowledge</b>	<b>13 Mechanical engineering</b>
<b>Qualification</b>	<b>Bachelor in Applied Mechanics</b>

Introduced from 2021/2022 academic year  
by order of the rector  
of Igor Sikorsky KPI  
\_\_\_\_\_ No\_\_\_\_\_

Kyiv – 2021

## Preamble

### DEVELOPED by the project team:

Chairman of the working group

*Yurii Petrakov – Ph.D., Professor, Head of the Manufacturing Engineering Department*

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Team members:

*Volodymyr Korenkov – Ph.D., Associate Professor of the Manufacturing Engineering Department*

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*Yuliia Lashyna – Ph.D., Associate Professor of the Manufacturing Engineering Department*

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*Vadym Medvedev – Ph.D., Associate Professor of the Manufacturing Engineering Department*

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The Manufacturing Engineering Department is responsible for training applicants for higher education according to the educational program

### AGREED:

Scientific and Methodical Commission of the University in specialty 131 Applied Mechanics (protocol No \_\_\_ of "\_\_\_" \_\_\_\_\_ 20\_\_\_)

Chairman of SMCU 131

\_\_\_\_\_ Mykola BOBYR

Methodical Council of Igor Sikorsky KPI

Chairman of the Methodical Council \_\_\_\_\_ Yurii Yakymenko

(protocol No \_\_\_ of \_\_\_\_\_ 20\_\_\_)

### CONSIDERED:

Recommendations on updating educational programs and peculiarities of the development of curricula for bachelors training (order of Igor Sikorsky KPI of November 30, 2020 No. HOH/35/2020 "On improvement of educational programs of the first (bachelor) level of higher education") and, accordingly, the list of mandatory and selective educational components has been changed.

The educational program was discussed after receiving all wishes and proposals. Approved at the extended meeting of the Manufacturing Engineering Department (minutes No. 6 of January 18, 2021).

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# 1. EDUCATIONAL PROGRAM PROFILE

## specialty 131 “Applied mechanics”

1 – General information	
Full name of the HEI and institute / faculty	National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" Institute of Mechanical Engineering
Higher education degree and title of qualification in the original language	Bachelor, Bachelor in Applied Mechanics
The official name of the EP	Manufacturing Engineering
Diploma type and the scope of EP	Bachelor's diploma, 240 credits, term of study: 3 years 10 months
Availability of accreditation	Certificate of accreditation of specialty НД 1192553, valid until 01.07.2023, issued by the Ministry of Education and Science of Ukraine
Cycle/level of HE	NQF of Ukraine – level 6 QF-EHEA – first cycle EQF-LLL – Level 6
Prerequisites	Availability of complete general secondary education
Language(s) of teaching	Ukrainian
Validity period of the EP	To the next accreditation
Internet address of the permanent placement of the educational program	osvita.kpi.ua mmi.kpi.ua, tm-mmi.kpi.ua
2 – The purpose of the educational program	
<p>Training of highly qualified specialists capable of solving basic scientific and technical problems in the field of applied mechanics and mechanical engineering in the conditions of sustainable innovative scientific and technical development of society and the formation of high adaptability of higher education applicants in the context of transformation of the labor market through interaction with employers and other stakeholders. To create conditions for comprehensive professional, intellectual, social and creative development of the individual at the highest levels of excellence in the educational and scientific environment in accordance with the development strategy of Igor Sikorsky KPI for 2020-2025 [<a href="https://kpi.ua/2020-2025-strategy">https://kpi.ua/2020-2025-strategy</a>].</p>	
3 – Characteristics of the educational program	
Subject Area	<ul style="list-style-type: none"> <li>- <b>object of activity:</b> constructions, machines, equipment, mechanical and biomechanical systems and complexes, processes of their design, manufacture, research and operation;</li> <li>- <b>training objectives:</b> professional engineering activities in the field of design, production and operation of technical systems, machines and equipment, robotics and complexes, manufacturing engineering technologies development;</li> <li>- <b>theoretical content of the subject area:</b> general laws of theoretical mechanics and their applications, theoretical principles of design of machines, manufacturing engineering technologies, mechanics of liquids and gases, machine parts and structures, forecasting of operational features of technical systems;</li> <li>- <b>methods, methodologies and technologies:</b></li> </ul>

	<p>physical and mathematical methods of calculating statics, dynamics and stability of elements and structures; analytical, numerical and algorithmic methods of modeling kinematics and dynamics of machines, analysis of stress-strain state of structural elements; methods of design, control, research, development of manufacturing technologies and assembly of machine elements and structures; information technologies in engineering research, design and production; methods and means of numerical software control of technological equipment;</p> <p>- <b>tools and equipment:</b> machine tools, tools, technological and control devices, control and measuring tools, computer numerical control systems, drives of machine and robotic systems.</p>
EP orientation	<p>Educational and professional</p> <p>The structure of the program provides for modern mastery of the methodology of existing methods of solving complex specialized problems and practical problems in mechanical engineering and applied mechanics and related fields, which involves the use of certain theories and methods of relevant sciences.</p>
Primary focus of EP	<p>Special education in the field of applied mechanics and mechanical engineering with the possibility of acquiring competencies for further scientific career.</p> <p>Keywords: applied mechanics, mechanical engineering</p>
Features of EP	<p>The implementation of the program foresees the involvement to the classroom trainings: professionals – practitioners, industry experts, employers. Some special courses of applied mechanics and mechanical engineering can be taught in English</p>
<b>4 – The suitability of graduates for employment and further education</b>	
Employment suitability	According to the classifier of professions ДК 003:2010
Further education	Possibility to continue studying at the second (master's) level of higher education and / or acquisition of additional qualifications in the system of postgraduate education.
<b>5 – Teaching and evaluation</b>	
Teaching and learning	Lectures, practical and seminar classes, computer workshops and laboratory works; term projects and works; mixed learning technology, practices and excursions; attestation work
Evaluation	Assessment of students' knowledge is carried out in accordance with the Regulations on the system of evaluation of the results of study in the Igor Sikorsky KPI for all types of classroom and extracurricular work (current, calendar, semester control); oral and written examinations, tests
<b>6 – Program competencies</b>	
Integral competence	The ability to solve complex specialized problems and practical problems in applied mechanics or in the learning process, which involves the use of certain theories and methods of mechanical engineering and is

	characterized by complexity and uncertainty of conditions.
General Competencies (GC)	<p>GC1. Ability to abstract thinking, analysis and synthesis.</p> <p>GC2. Knowledge and understanding of the subject area and understanding of professional activity.</p> <p>GC3. Ability to identify, set and solve problems.</p> <p>GC4. Ability to apply knowledge in practical situations.</p> <p>GC5. Ability to work in a team.</p> <p>GC6. Certainty and perseverance regarding the tasks and responsibilities taken.</p> <p>GC7. Ability to learn and master modern knowledge.</p> <p>GC8. Ability to communicate in a foreign language.</p> <p>GC9. Skills in using information and communication technologies.</p> <p>GC10. Skills of carrying out safe activities.</p> <p>GC11. Ability to act socially responsibly and consciously.</p> <p>GC12. Ability to search, process and analyze information from different sources.</p> <p>GC13. Ability to evaluate and ensure the quality of work performed.</p> <p>GC14. The ability to realize one's rights and responsibilities as a member of society, to realize the values of a civil (free democratic) society and the need for its sustainable development, the rule of law, human and citizen rights and freedoms in Ukraine.</p> <p>GC15. The ability to preserve and increase the moral, cultural, scientific values and achievements of society on the basis of 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, engineering and technology, to use different types and forms of motor activity for active recreation and healthy lifestyle.</p>
Professional competencies (PC)	<p>PC1. Ability to analyze materials, structures and processes based on laws, theories and methods of mathematics, natural sciences and applied mechanics.</p> <p>PC2. The ability to assess the performance parameters of materials, structures and machines in operational conditions and find appropriate solutions to ensure a given level of reliability of structures and processes, including in the presence of some uncertainty.</p> <p>PC3. The ability to conduct technological, technical, and economic assessment of the effectiveness of using new technologies and technical means.</p> <p>PC4. Ability to make the optimal choice of technological equipment, equipment for technical complexes, have basic ideas about the rules of their operation.</p> <p>PC5. Ability to use analytical and numerical mathematical methods to solve problems of applied mechanics, in particular, to make calculations for strength, endurance, stability, durability, rigidity in the</p>

process of static and dynamic loading in order to assess the reliability of machine parts and structures.

PC6. Ability to perform technical measurements, receive, analyze and critically evaluate the results of measurements.

PC7. Ability to apply computer-aided design (CAD), computer-aided manufacturing (CAM), computer-aided engineering (CAE) systems, and specialized application software to solve engineering problems in applied mechanics.

PC8. Ability to spatial thinking and reproduction of spatial objects, structures and mechanisms in the form of projection drawings and three-dimensional geometric models.

PC9. Ability to present the results of its engineering activities in compliance with generally accepted norms and standards.

PC10. The ability to describe and classify a wide range of technical objects and processes based on deep knowledge and understanding of basic mechanical theories and practices, as well as basic knowledge of related sciences.

PC11 Ability to choose optimal typical technological processes for manufacture of products and structures

PC12 Ability to conduct research of existing technological processes, their system analysis and find on the basis of this analysis new methods of processing and assembly

PC13 Ability to reasonably choose typical components when designing a snap-in for the developed technological process

PC14 Ability to make decisions on the choice of tools for automated production.

PC15 Ability to apply modern mathematical methods for process control, find analogues and adjust existing processing schemes

PC16 Ability to justify the choice, determine the working parameters of the equipment of automated production of machine-building enterprises and design their typical units

PC17 Ability to create new technical objects of mechanical engineering considering the principles of design and ergonomics

PC18 Ability to design functionally oriented technological processes of manufacturing aircraft parts

PC19 Ability to ensure the manufacturability of products and the processes for their manufacture, to control compliance with technological discipline in the

	<p>manufacture of products</p> <p>PC20 Ability to choose typical components of equipment when equipping technological processes</p> <p>PC21 Ability to apply typical methods of quality control of products and objects in the field of professional activity</p> <p>PC22 Ability to design particular technological operations for machining complex profile surfaces and assembly of aircraft and using computer aided design systems</p> <p>PC23 Ability to use robotics in technological systems of automated engineering.</p> <p>PC24 Ability to use professionally profiled knowledge and skills in the field of theoretical foundations of computer science and the practical use of computer technologies and programming basics to solve experimental and practical problems in the field of mechanical engineering.</p> <p>PC25 Ability to conduct technological as well as technical and economic assessment of the effectiveness of using new technologies and technical means.</p>
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**7 – Program learning outcomes**

- LO1) Select and apply suitable mathematical methods for solving problems of applied mechanics;
- LO2) Use knowledge of the theoretical bases of the mechanics of liquids and gases, heat engineering and electrical engineering to solve professional problems;
- LO3) Perform calculations for strength, endurance, stability, durability, rigidity of machine parts;
- LO4) Evaluate the reliability of machine parts and structures in the process of static and dynamic load;
- LO5) Perform geometric modeling of parts, mechanisms and structures in the form of three-dimensional models and projection views and draw up the result in the form of technical and working drawings;
- LO6) Create and theoretically substantiate the design of machines, mechanisms and their elements on the basis of methods of applied mechanics, general principles of design, the theory of interchangeability, standard methods for calculating machine parts;
- LO7) Apply normative and reference data to control compliance of technical documentation, products and technologies with standards, technical specifications and other regulatory documents;
- LO8) Know and understand the basics of information technology, programming, practically use application software to perform engineering calculations, process information and results of experimental research;
- LO9) Know and understand related industries (mechanics of liquids and gases, heat engineering, electrical engineering, electronics) and be able to detect interdisciplinary connections of applied mechanics at the level necessary to fulfill other requirements of the educational program;
- LO10) Know the designs, methods of selection and calculation, the basics of maintenance and operation of machine and robotic equipment drives;
- LO11) Understand the principles of automated control systems of technological equipment, in particular microprocessor, to choose and use optimal means of automation;



- LO12) Skills in the practical use of computer-aided design systems (CAD), computer-aided manufacturing (CAM) and computer-aided engineering (CAE);
- LO13) Evaluate the technical and economic efficiency of production;
- LO14) Make the optimal choice of equipment and complete set of technical complexes;
- LO15) When making decisions consider the main factors of technogenic impact on the environment and basic methods of environmental protection, labor protection and safety of life;
- LO16) Communicate freely on professional issues orally and in writing in the state and foreign languages, including knowledge of special terminology and interpersonal communication skills;
- LO17) Comparing algorithms and computer programs in programming languages using modern information technologies.
- LO18) Prepare the initial data to substantiate technical solutions, apply standard calculation methods when designing or choosing purchased equipment.
- LO19) Use the means of information design technologies in the tasks of technical preparation of production.
- LO20) Perform information and analytical researches of a given topic.
- LO21) Observe, measure, report on the research conducted, analyze the results of research, prepare data for reviews and scientific publications.
- LO22) Conduct experiments according to the specified methods with the processing and analysis of results.
- LO23) Select the necessary equipment for the specified production conditions, perform calculation of structural elements and parameters of setting up metal cutting machines according to the known methods.
- LO24) Perform calculations of designed objects parameters and performance indicators of mechanisms, machines, structures
- LO25) Design individual machining operations and technological processes for machine parts of different classes, including with the use of computer-aided design systems
- LO26) Develop control programs for CNC machines for machining complex surfaces of machine parts and means of mechanization and automation of technological processes
- LO27) Develop working design and technical documentation, to draw up completed design work with verification of compliance of developed projects and technical documentation with standards, technical specifications and other normative documents
- LO28) Provide modeling of technical objects and technological processes using standard packages and means of automation of engineering calculations, conduct experiments according to the specified methods with the processing and analysis of results
- LO29) Use mathematical methods in technology and design of mechanisms, machines, structures; apply standard calculation methods when designing parts and components of aircraft
- LO30) Conduct the feasibility study of project results

### **8 – Resource support of the program implementation**

Personnel support	In accordance with personnel requirements for ensuring the implementation of educational activities for the appropriate level of HE (Annex 2 to the License Terms), approved by the Resolution of the Cabinet of Ministers of Ukraine of December 30, 2015 No. 1187, as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine No. 347 of 10.05.2018.
Logistical support	In accordance with the technological requirements for material and technical support of educational activities of the corresponding level of HE (Annex 4 to the License Terms), approved by the Resolution of the Cabinet of

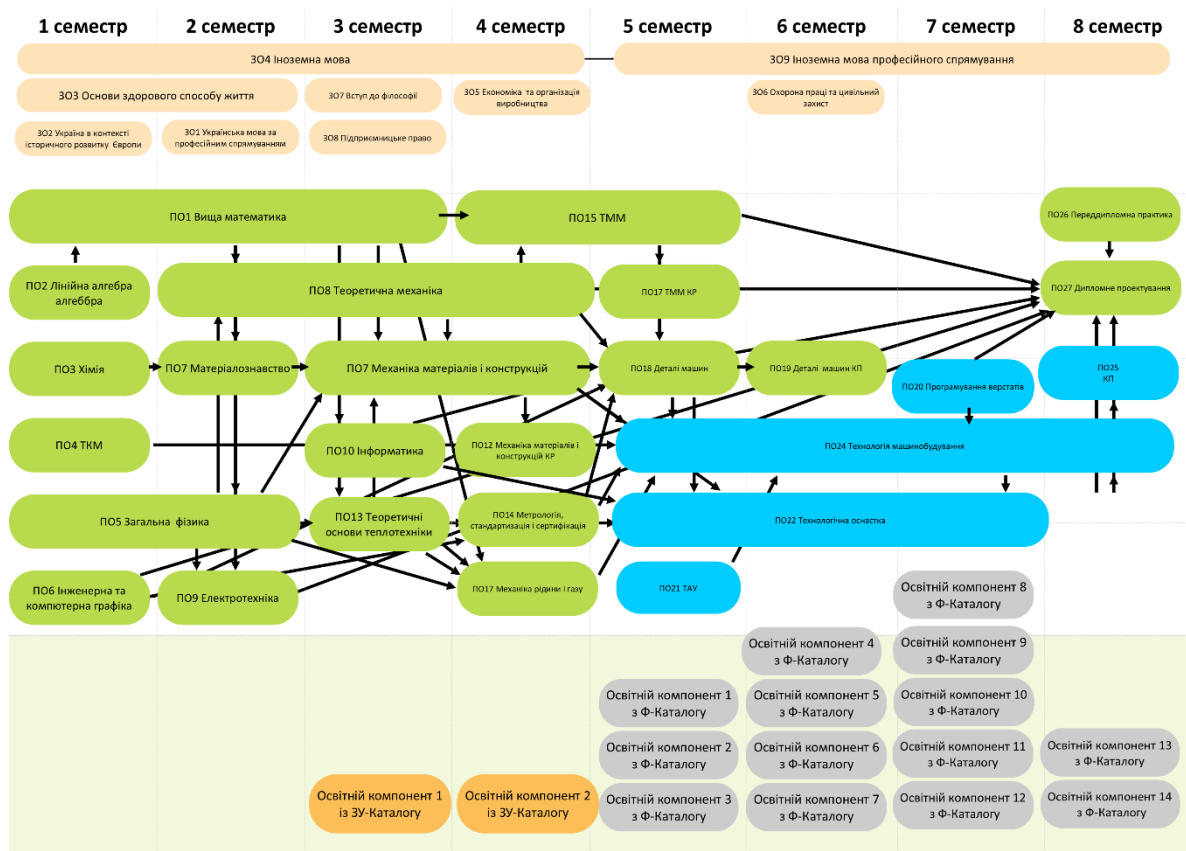
	Ministers of Ukraine of December 30, 2015. No. 1187 as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine No. 347 of May 10, 2018. The use of equipment for lectures in the format of presentations, network technologies, in particular on the Sikorsky distance learning platform.
Information and educational and methodological support	In accordance with the technological requirements for educational, methodological and information support of educational activities of the relevant level of HE (Annex 5 to the License Terms), approved by the Resolution of the Cabinet of Ministers of Ukraine of December 30, 2015 No. 1187, as amended in accordance with the Resolution of the Cabinet of Ministers of Ukraine No. 347 of 10.05.2018. Use of the Scientific and Technical Library of Igor Sikorsky KPI
<b>9 – Academic mobility</b>	
National credit mobility	On the basis of bilateral agreements between the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" and technical universities of Ukraine
International Credit Mobility	On the basis of bilateral agreements between the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" and educational institutions of partner countries, agreements on international academic mobility.
Training of foreign HE applicants	Teaching in English with the provision of Ukrainian language learning as a foreign language or after studying by foreign applicants of the Ukrainian language course in general training groups

## 2. LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM

Code	Components of the educational program (academic disciplines, course projects / works, practices, qualification work)	Number of ECTS credits	Form of Final Control
<b>Mandatory (normative) components of the EP</b>			
<b>General Training Cycle</b>			
301	Ukrainian Language in Professional Direction	2	Credit
302	Ukraine in the Context of Europe's Historical Development	2	Credit
303	Basics of a Healthy Lifestyle	3	Credit
304	Foreign Language	6	Credit
305	Economics and Organization of Production	4	Credit
306	Occupational Safety and Civil Protection	2	Credit
307	Introduction to Philosophy	2	Credit
308	Business Law	2	Credit
309	Foreign Language in Professional Direction	6	Exam
<b>Cycle of vocational training in the educational program</b>			
Π01	Higher Mathematics	17	Exam
Π02	Linear Algebra	3,5	Credit
Π03	Chemistry	3	Credit
Π04	Construction Materials Engineering (CME)	4,5	Exam
Π05	General Physics	10	Credit /Exam

Code	Components of the educational program (academic disciplines, course projects / works, practices, qualification work)	Number of ECTS credits	Form of Final Control
ΠΟ6	Engineering and Computer Graphics	4	Credit
ΠΟ7	Materials Science	4,5	Exam
ΠΟ8	Theoretical Mechanics	13	Credit /exam
ΠΟ9	Electrical Engineering and Electronics	3	Credit
ΠΟ10	Informatics	4	Credit
ΠΟ11	Mechanics of Materials and Structures	13	Exam
ΠΟ12	Mechanics of Materials and Structures Coursework (CW)	1	Credit
ΠΟ13	Theoretical Fundamentals of Heat Engineering	3	Credit
ΠΟ14	Metrology, Standardization and Certification	4,5	Exam
ΠΟ15	Theory of Mechanisms and Machines (TMM)	5	Exam
ΠΟ16	Theory of Mechanisms and Machines Coursework (CW)	1	Credit
ΠΟ17	Mechanics of Fluid and Gas	3,5	Credit
ΠΟ18	Machine Parts	4,5	Exam
ΠΟ19	Machine Parts Course Project (CP)	1,5	Credit
ΠΟ20	Manufacturing Engineering	19,5	Exam
ΠΟ21	Manufacturing Engineering Course Project (CP)	1,5	Credit
ΠΟ22	Theory of Automatic Control of Technological Systems	4,5	Exam
ΠΟ23	Jig and Fixture Design	4	Exam
ΠΟ24	Jig and Fixture Design Course Work (CW)	1	Credit
ΠΟ25	Programming of Machines	5	Exam
ΠΟ26	Pre-Diploma Practice	6	Credit
ΠΟ27	Diploma design	6	Defense
<b>Selective Components of EP</b>			
<b>Selective components of humanitarian training</b>			
3B1	Educational component 1 of the ZU-Catalog	2	Credit
3B2	Educational component 2 of the ZU-Catalog	2	Credit
<b>Selective components of vocational training</b>			
ΠΒ1	Educational component 1 F-Catalog	4	Credit
ΠΒ2	Educational component 2 F-Catalog	4	Credit
ΠΒ3	Educational component 3 F-Catalog	4	Credit
ΠΒ4	Educational component 4 F-Catalog	4	Credit
ΠΒ5	Educational component 5 F-Catalog	4	Credit
ΠΒ6	Educational component 6 F-Catalog	4	Credit
ΠΒ7	Educational component 7 F-Catalog	4	Credit
ΠΒ8	Educational component 8 F-Catalog	4	Credit
ΠΒ9	Educational component 9 F-Catalog	4	Credit
ΠΒ10	Educational component 10 F-Catalog	4	Credit
ΠΒ11	Educational component 11 F-Catalog	4	Credit
ΠΒ12	Educational component 12 F-Catalog	4	Credit
ΠΒ13	Educational component 13 F-Catalog	4	Credit
ΠΒ14	Educational component 14 F-Catalog	4	Credit
Total amount of <b>required components:</b>		180 credits	
Total amount of <b>selective components:</b>		60 credits	
The scope of educational <b>components that ensure the acquisition of competencies defined in SHE</b>		144.5 credits	
<b>THE TOTAL SCOPE OF THE EDUCATIONAL PROGRAM</b>		<b>240 credits</b>	

### 3. STRUCTURAL AND LOGICAL SCHEME OF THE EDUCATIONAL PROGRAM



### 4. FORM OF CERTIFICATION OF HIGHER EDUCATION APPLICANTS

Certification of applicants for higher education under the educational program "Manufacturing Engineering" is carried out in the form of defense of the qualification work and ends with the issuance of a document of the established sample on awarding them a bachelor's degree with the qualification "Bachelor in Applied Mechanics" in the specialty 131 Applied Mechanics.

Certification is carried out openly and publicly. Qualification work is checked for plagiarism and after protection is placed in the repository of University's ST Library for free access.

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

	301	302	303	304	305	306	307	308	309	Π01	Π02	Π03	Π04	Π05	Π06	Π07	Π08	Π09	Π010	Π011	Π012	Π013	Π014	Π015	Π016	Π017	Π018	Π019	Π020	Π021	Π022	Π023	Π024	Π025	Π026	Π027			
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GC2																																				x	x		
GC3																																					x	x	
GC4																																					x	x	
GC5										X																											x	x	
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GC9	x																			x																			
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## 6. MATRIX FOR PROVIDING PROGRAM LEARNING OUTCOMES WITH APPROPRIATE COMPONENTS OF THE EDUCATIONAL PROGRAM

	301	302	303	304	305	306	307	308	309	Π01	Π02	Π03	Π04	Π05	Π06	Π07	Π08	Π09	Π010	Π011	Π012	Π013	Π014	Π015	Π016	Π017	Π018	Π019	Π020	Π021	Π022	Π023	Π024	Π025	Π026	Π027			
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LO2														x			x	x							x	x	x												
LO3																				x	x				x	x		x	x										
LO4																				x	x				x	x		x	x										
LO5														x																									
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